Ecological Evaluation of Shifting Habitat History for Riverbed Management

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Table of Contents

1 Introduction and overall objectives 1
1.1 Background 1
1.2 Overall objectives 2
1.3 Outline of this research 3
1.4 References 5

2 Habitat diversity hypothesis 6
2.1 Introduction and objectives 6
2.2 Ecological restoration: channel widening and creation of secondary channels 6
2.3 Habitat diversity hypothesis 18
2.4 An attempt to analyze spatiotemporal patterns in the Tenryu River 19
2.5 Conclusions 20
2.6 References 20

3 Spatiotemporal patterns determining riverine habitat heterogeneity 23
3.1 Introduction and objectives 23
3.2 Methods 23
3.3 Results and discussions 29
3.4 Conclusions 35
3.5 References 36

4 Development processes of spawning redds for Ayufish (*Plecoglossus altivelis altivelis*) under shifting habitat history 38
4.1 Introduction and objectives 38
4.2 Methods 41
4.3 Results 45
4.4 Discussions 53
4.5 Conclusions 59
4.6 References 60

5 Habitat age effects on biodiversity of macro-invertebrates 63
5.1 Introduction and objectives 63
5.2 Methods 64
5.3 Results 74
5.4 Discussions 165
5.5 Conclusions 176
5.6 References 177

6 Application to riverbed management 179
6.1 Introduction and objectives 179
6.2 Methods 179
6.3 Results and discussions 186
6.4 Conclusions 200
6.5 References 201

7 Conclusions 203

Acknowledgements 205

Appendixes 206

1 Introduction and overall objectives

1.1 Background

Various habitat evaluation tools have been adopted in decision-making processes in flood and water resources management. For example, Habitat Evaluation Procedures (HEP) quantifies the overall suitability through time by integrating the areal extent-suitability product function over time via habitat suitability indices and thus can quantitatively compare two or more alternative management practices of an area with regards to those practices affecting species (US Fish and Wildlife Service (US FWS), 1981). Physical Habitat Simulation Model (PHABSIM) predicts physical microhabitat changes associated with flow alternations such as microhabitat, physical habitat and life stage changes (US FWS, 1986). Australian River Assessment Sys-tem (AUSRIVAS) makes an assessment of physical stream condition using the protocol, which requires a large number of reference sites sampled (Parsons et al, 2001). River Invertebrate Prediction And Classification System (RIVPACS) assesses the biological quality of rivers offering site-specific predictions of the macroinvertebrate fauna to be expected in the absence of major environmental stress (Wright et al, 2000). Index of Biotic Integrity (IBI) quantifies changes in ecosystem health as a result of habitat degradation or flow alteration, in addition to chronically poor chemical water quality (Karr, 1981 & Karr & Dudley, 1981). Most of these tools can evaluate current habitat suitability based on physical characteristics or habitat spatial distributions. These tools are useful when comparing several options to determine most appropriate one (s) that can avoid negative consequences to the river ecology and thus often used in decision-making processes, e.g., exploring mitigation measures.

Ecological researches in rivers have been proposing for recent decades several hypotheses such as the habitat templet concept, which focuses on the premise that the habitat under spatial and temporal heterogeneity conditions provides the templet on which evolution forges species characteristics (Southwood, 1977 and 1988, Townsend, 1994) and the patch dynamics concept, which explains streams conform reasonably and closely to the patch dynamics explanation of community organization that emphasizes temporal phenomena (e.g., disturbances) and focuses on the importance of history and chance (Townsend, 1989). These concepts are different approaches to the river ecology from those traditionally discussed, which have emphasized that competition is overwhelmingly the most important in shaping stream communities (Yodzis, 1986) and several researches have appeared that address the importance of spatial and temporal heterogeneity (Ward et al, 2002 and Tockner et al, 2010). Recently, the shifting habitat mosaic steady state concept appeared and it was known as: “Location of aquatic habitats in floodplains changed considerably (turnover), whereas habitat configuration and composition remained relatively stable. These results support the applicability of the shifting mosaic steady-state model to riverine floodplains environments (Arscott et al, 2002 and van der Nat et al, 2003)”. Further, it is shown that there is a need to address habitat diversity in relation to biological diversity (i.e., species abundance and richness) and there is implication that habitat diversity maximizes biological diversity (Takemon, 1997). Further, importance of temporal patterns, e.g., habitat age, was also highlighted (Arscott et al, 2002).

From a different perspective, other studies on analyzing material cycle efficiency showed that habitat structure is considered important for particulate organic material (OCK et al, 2010 and OCK & Takemon, 2011), and habitat conditions change in spatial and temporal distributions and thus implicated that temporal patterns are also the key to addressing habitat structure (Takemon et al, 2008). These results explain the importance of considering dynamic state of changing habitat. Nevertheless, existing habitat evaluation tools lack this perspective: changing habitat in its habitat age: intensity and turnover rate of spatiotemporal patterns that determine biodiversity.

1.2 Overall objectives

Various habitat evaluation tools have been adopted in decision-making processes in flood and water resources management. However these tools have not addressed spatiotemporal pattern of habitats, even though the riverbed and habitats thereon change due to disturbances induced under sediment and flow regimes. Recent studies implicated that, in order to optimize biodiversity, it requires presence of various habitat types with different habitat age. For example, there are previous studies looking at spatiotemporal patterns of riverine habitats, e.g., shifting habitat steady state and habitat age in the Tagliamento River, North Italy. However, they have neither shown temporal variables of habitats based on data nor tracked changing patterns of each habitat to quantitatively analyze shifting habitat history. In ecological evaluation in the river environment, therefore there is a need to evaluate shifting habitat history. Objectives of this study are i) to analyze relations between habitat suitability to sediment transport and flood intensity and frequency, ii) to develop a tool for evaluating ecological functions, and iii) to proposes basic approaches for applying this tool to riverbed management at a practical level.

1.3 Outline of this research

Chapter 1 Introduction and overall objectives: We conducted a review on evaluation tools and previous studies, and discussed importance of addressing temporal changes of habitats for ecological evaluations.

Chapter 2 Habitat diversity hypothesis: This chapter reviewed case studies on ecological evaluations of habitats in the riverine habitats in Japan and other countries, identified key challenges to ecological evaluations, and proposed "habitat diversity hypothesis" as a new approach to ecological evaluation of shifting habitats history.

Chapter 3 Spatiotemporal patterns determining riverine habitat heterogeneity: Shifting habitat history has been recorded at 16.4 k-point of the Tenryu River in Japan, where dynamic riverbed changes have been occurring, through interval-recording cameras installed at an electric transmission tower located in the middle of the river channel. This chapter analyzed these photo data, quantitatively showed shifting habitat history in the form of deposition and erosion areas, and evaluate characteristics of spatiotemporal patterns of the riverbed due to small, middle, and large floods.

Chapter 4 Development processes of spawning redds for Ayufish (*Plecoglossus altivelis altivelis*) under shifting habitat history: Through a field survey, we found two locations of spawning redds and eggs of Ayufish (*Plocoglossus altivelis altivelis*), where were located with a photo frame of interval-recording cameras installed. We analyzed these spawning redds and showed shifting habitat history and spatial distribution patterns, which have contributed to developing spawning redds, and its environmental physical conditions, thus having successfully conducted ecological evaluation of shifting habitat history prerequisite for developing and sustaining spawning redds for Ayufish.

Chapter 5 Habitat age effects on biodiversity of macro-invertebrates: We analyzed relations between shifting habitat history and its responses to macro-invertebrates, and showed habitat age effects on biodiversity. The analysis showed the importance of habitats having different ages within a reach in order to sustain biodiversity and how small, middle, and large floods play a role in supporting it.

Chapter 6 Application to riverbed management: This chapter discusses approaches and methodologies on ecological evaluations of shifting habitat history in order to apply to riverbed management at a practical level.

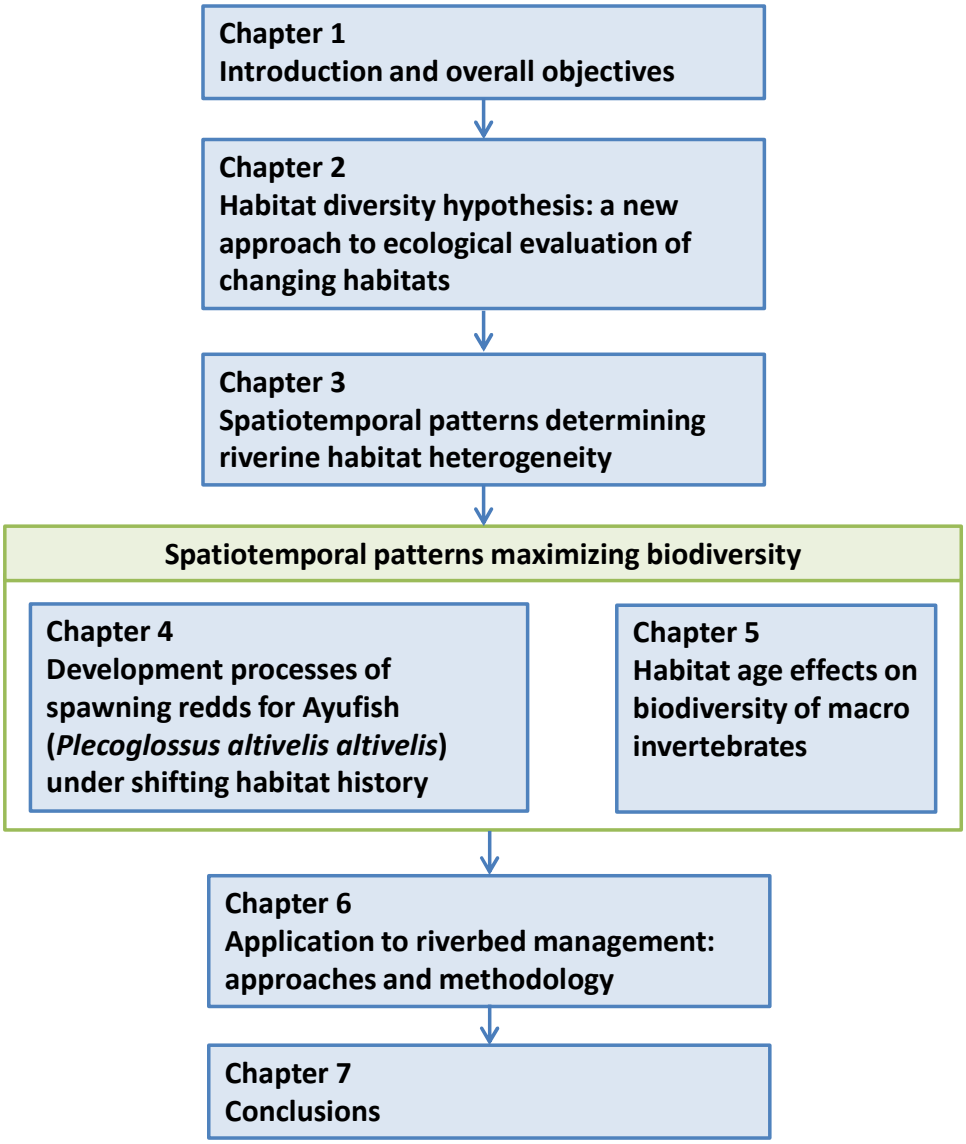


Figure 1.3.1 Constitution of this overall research.

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2 Habitat diversity hypothesis

2.1 Introduction and objectives

Spatiotemporal patterns are determined by flow regimes and morphological regimes, e.g., deposition and erosion, and sediment transport from upstream. Therefore, they should be integrated in the ecological evaluation. When spatiotemporal patterns are addressed, flow and morphological regimes should be considered as explanatory variables. In this context, firstly we conducted a review on ecological restoration of river corridor habitats, particularly through channel widening and creating secondary channels. We selected well-known restoration projects, which have been implemented in U.S.A., Europe, and Japan. Our particular attention was placed on whether or how flow and morphological regimes are considered to restore fundamental ecological and fluvial processes through particular management options, i.e., reservoir operation and managed flows, and sediment augmentation. Secondly, based on the review, we identify key challenges and propose a habitat diversity hypothesis in order to evaluate spatiotemporal patterns, which is a different approach from the intermediate disturbance hypothesis. Thirdly, in order to prove our hypothesis, we introduce our case study, which started in July 2012 in a middle reach of the Tenyu River in Japan, where several interval recording cameras (hourly) were placed at 60 m high from the riverbed in the center of the river corridor. Through several camera-recording, the photo data can be transformed into 2D and 3D data, enabling to monitor dynamic changing habitat and quantify its spatiotemporal patterns including erosion and deposition processes.

2.2 Ecological restoration: channel widening and creation of secondary channels

2.2.1 A review on case studies

In this context, firstly we conducted a review on ecological restoration of river corridor habitat, particularly through channel widening and creating secondary channels. We selected well-known restoration projects, which have been implemented in U.S.A., Europe, and Japan (see Table 2.2.1).

Table 2.2.1 A review of river restoration projects through channel widening & creating secondary channels for ecological restoration. Particular attention was placed on substantial factors determining the fluvial processes: the river shape, morphological regime, and flow regime. Some projects from U.S.A., Europe, and Japan were selected for the review.

River	Year	Country	Restoration option	Target habitat restored	TP[*1]	SA[*2]	FR[*3]
Drau River	1999	Austria	Secondary channel rehabilitation	River islands and gravel banks	No	No	No
Chikuma River	2006	Japan	Channel widening	Gravel banks	No	No	No
Waar River	1996	Netherlands	Secondary channel creation	Secondary channels	No	No	No
Thur River	2003	Switzerland	Channel widening	Shorelines and gravel banks	No	No	No
Tama River	1996	Japan	Channel widening	Gravel banks	No	Yes	No
Mana River	2003	Japan	Secondary channel creation	Pools, gravel banks, & vegetation	No	Yes	Yes
Trinity River	1991	U.S.A.	Channel widening	Riffles & pools and point bars	No	Yes	Yes

[*1] TP: Temporal patterns of habitat structure were considered.

[*2] SA: Sediment augmentation was implemented.

[*3] FR: Flow regimes were modified, e.g., through reservoir operation and managed flows.

1) Drau River in Austria

The upper Drau in Carinthia had been a highly braided river with many side arms and gravel banks. In the 20th, the riverbed was canalized, bends were straightened out, branches were cut off from the main stream, dams were built, and farming in the floodplain area was intensified. These interventions have brought an enormous loss and degradation of the natural freshwater habitats including alluvial forests and a decline of species populations including the Danube salmon (*Hucho hucho*) and the crayfish (*Austropotamobius pallipes*). Major problems occurred include the deterioration of natural flood retention capacity leading to great risk of flooding. Deepening of the riverbed, e.g., 2 cm per year, caused a fall in groundwater tables (Mohl, 2012).

The restoration measures were implemented in from 1999 to 2003 for a river length of 7.6 km as part of the LIFE Nature project “Auenverbund Obere Drau”, which became culminated in one of the largest river restoration projects in Europe (Formann et al, 2007). The restoration project aimed to prevent from further riverbed degradation, to reconnect the river with its floodplain area and to initiate the development of typical habitats of the riverine landscape (see Figure 1). Bank stabilization structures

were removed and the riverbed was widened. Lateral erosion increased the sediment input and initialized the development of gravel / sand bars and islands. One of the former side arms was reconnected to the river for annual flooding. The second side arm was widened to a width of 30 m creating diverse instream structures and thus increasing habitat diversity of the aquatic environment (Mohl, 2012). The monitoring of the measures has shown positive results including: better flood prevention; reduced flow velocity; decrease in riverbed deepening even rose; created 50 to 70 ha more natural river habitats as river islands, gravel banks, steep banks for engendered species such as Danube Salmon, Common Sandpiper and Kingfisher created; and fish population doubled such as the grayling (Mohl, 2012).



Figure 2.2.1 Drau River before and after rehabilitation 2003. (Mohl, 2012)

2) Chikuma River in Japan

The Chikuma River, which is called in the Nagano prefecture, is part of and located a middle reach of the Shinano River that is the longest river in Japan. The Chikuma River has been covered by gravel riverbed and plenty of native plants and animals. However, as same situations as the Tama River (see Section 2.5 for details), intensive gravel miming caused degradation of average riverbed; inundation frequency of floodplains got lost due to development for human use; and embankments and straightening of rivers fixed river morphology, resulting in loss of habitat diversity and native plants. These interventions as a consequence caused increased local sedimentation and nonnative plants, e.g., Ambrosia trifida and Sicyos angulatus, and woods, e.g., Robinia pseudocacia (Chikuma River Ecological Research Group et al, 2010 and Ishikawa et al, 2010). The Cikumagawa River Works Office of MLIT and Chikuma River Ecological Research Group conducted a river restoration project since 2004 through channel widening with a view to restoring native plants as well as impeding invasion and growth of nonnative plants, as part of riparian forest and river management. The two study sites were selected: the Awasa district conducted in 2006 is located a 81km point of the Chikuma River, average riverbed slope is 1/510, mean particle size is 40mm; on one hand, the Nezumi district conducted as the reference site in 2009 is steeper than the Awasa reach located a 98km point, average riverbed slope is 1/220, mean particle size is 53mm. were selected in the Chikuma River (see Figure 2).

The Awasa district restoration showed that channel widening enabled to restore native plants within a short term. A large flood event occurred in July 2006, 3 months after the channel widening, showed that reinvaded nonnative plants were flushed away from the study site and gravel riverbed and aquatic native plants were sustained. This explained the potential to maintain gravel riverbed if widened channel keeps one year frequency of inundation by a certain flood event (annual flood discharge). Small flood events occurred in the Nezumi district also contributed to increasing native plants instead of allowing for nonnative plants to grow. In addition, at both sites, benthic communities temporarily lost due to channel widening, e.g., Chironomidae, Trichoptera, and Ephemeroptera, were recovered within a few months, implicating further potentials to the outreach of restoration activities.



Before restoration

Just after restoration. Different types of elevation in channel widening were adopted for the research

Four years after restoration

One year after restoration

(a) Awasa district

(b) Nezumi district

Figure 2. Channel widening of the Chimuma River, illustrating before, just after, and some period after the restoration. (Ishikawa et al, 2010, English words added) Some plants are vegetated in Awasa district (a) the left column, but nonnative plants are not identified even after 4 years after the restoration. Even though a period one year is not long enough after the restoration in Nezumi district (b) a right column, native species are dominant instead of being invaded by nonnative plants.

3) Waar River in The Netherlands

Garmerensche floodpains are located in the Waar River, a lower reach of the Rhine River in The Netherlands. After a flood event 1995, large amount of clay and sand were excavated and secondary channels were created as part of flood management project including dyke improvement (Baptist and Mosselman, 2002). This project also aimed at creating through secondary channels the nature development of flora and fauna as shown in Figure 3 & 4. Characteristics of the three secondary channels of west, east, and large ones differ: the west and east channels have a sill at the entrance opening that determines the flow frequency; and the larger channel does not have a sill but permanently flows (Baptist and Mosselman, 2002).

The geomorphological processes were monitored by the Institute for Inland Water Management and Wastewater Treatment (RIZA) and revealed that the east and west channel flow more often than the design frequency. Total sedimentation in the east and west channels since 1996 to 1999 reached to about 5 cm in three years at the entire channels (Baptist and Mosselman, 2002). At the same time, secondary channels also caused erosion, where it is not allowed, for example near winter dikes, infrastructure or heavily polluted areas. It may require defense of the banks with stones. Since limits are usually put on the permissible rate of erosion and sedimentation in secondary channels, maintenance measures such as dredging or defending banks can be necessary. It is practically impossible to design stable secondary channels while taking all preconditions into account. Therefore, maintenance activities and monitoring are then needed (RIZA, 2001).

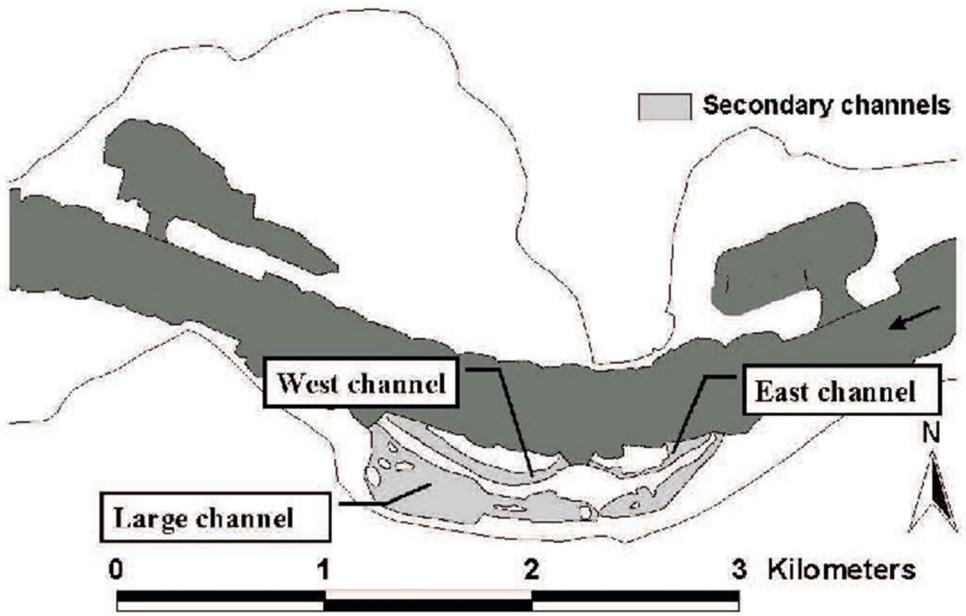


Figure 3. Locations of secondary channels in the Gamerensche floodplains in the Waar River (Baptist and Mosselman, 2002).



(a) sedimentation of sand in an intermittently discharging secondary channel



(b) bank erosion near the intake sill of one of secondary channels

Figure 4. Sedimentation and bank erosion occurred at the secondary channels in the Gamerensche floodplains in the Waar River. (RIZA, 2001, photos taken by Jans L.)

4) Thur River in Switzerland

The Thur River is located in north east of Switzerland, flowing along the Swiss north east Limestone Alps. Switzerland's watercourses have been severely degraded by flood control measures and other engineering operations. This is also true of the Rhone and Thur Rivers, which have largely lost their ecological diversity and characteristic landscape features (Peter, 2006). For this reason, increasing efforts have been made to rehabilitate watercourses by the Rhone-Thur research project. The aim of this project is to remedy deficiencies in the existing flood control system and, at the same time, to enhance the Rhone ecologically. Figure 5 shows the Thur River at Altikon-Niederneunforn before and after the channel widening (Peter, 2006). This channel widening involved a stretch of 1.5 km of the river, which was the most extensive local widening project in Switzerland. Particularly increase in shoreline length resulting from the development of gravel banks can be highlighted. The new habitat types that emerged were rapidly colonized by plants and wildlife (REFORM, 2012).

In this Rhone-Thur research projects, ecological success by channel widening of five river stretches were assessed in detail before and after widening: the Emme at Aefligen, the Thur at Gütighausen, the Rhone at Chippis, and the Moesa at Grono and Lostallo. The indicators chosen for this purpose were parameters that describe landscape structure, e.g., habitat type, diversity, size and shape, distance between two areas of a given habitat type, and habitat boundary length (Rhode 2004 & 2006). For the assessment, values were determined for the indicators and were transferred to a unitless index, with a scale from 0 to 1. The value "0" represents the initial channelized state, and "1" the desired near-natural target state. Through the assessment, the channel widening achieved a relatively high degree of naturalness (Rhode, 2004 and 2006).

The assessment indicated that the remaining deficiencies in comparison with near-natural reference sites are due to the lower habitat diversity and patchy structure arising from the limited spatial extent of the

widening. The Thur stretch was found to be less successful as compared to other sites. This is partly due to the fact that the gravel bars at this site are less substantial and thus more frequently flooded (Rhode, 2004 and 2006). It is important to identify stretches of rivers that are particularly suitable for channel widening on account of favorable ecological conditions and thus appear to offer good prospects of success (Rhode, 2006).



(a) Before rehabilitation June 2001

(b) 2 years after rehabilitation September 2005

Figure 2.2.2 Thur River at Altikon-Niederneunforn before and after the channel widening. (Peter, 2006 including photos)

5) Tama River in Japan

The Tma River has been most consisted of gravel riverbed in Japan and is under management of Ministry of Land, Infrastructure, Transport and Tourism (MLIT), of which: catchment area is 1240 km2; river length is 138 km including major tributaries; average bed slope is 1/218; and river width is approximately 300 m in mean annual flood discharge (almost bankfull) of 1300 m3/s. The Tama River has formed gravel bars mostly braided and has provided habitat for native plants and animals requiring gravel riverbed, e.g., Aster kantoensis, in 1950s (Nakamura et al, 2006). However, intensive human interventions made in 1960s to 1990s altered fluvial processes by: e.g., gravel bed mining prohibited in 1965 (most severely affected); construction of the Okouchi dam in 1957; and fixing of river shapes by embankments, straightening, and creation of less frequently inundated area for human use such as parks, camping area, and baseball and football fields. Such human interventions caused: reduced sediment supply from upstream (particularly coarse sediment but not fine one), leading to degradation of average riverbed elevation; reduced inundation and disturbance on floodplains, resulting in intensive fine sediment deposition on relatively higher floodplains where are less frequently inundated; increased

nonnative woods (e.g., *Robinia pseudocacia*) thereon replaced with native plants; and thus loss of habitat and species diversity of rivers (see Figure 6).

The gravel-bar restoration project was conducted in the Nagata district of the Tama River, with a view to increasing frequency of floodplain inundation by channel widening and thereby restoring gravel-bars, native plants, and species dependent on such gravel-bars (Shimatani, 2003 and Unno et al, 2006). The restoration projects have started since 1996 by the Keihin River Works Office of MLIT and Tama River Ecological Research Group. Characteristics of the project are composed of two parts: (i) channel widening was made at 52 to 53 km points in which different five types of bed elevation (i.e., different inundation frequency) were selected and (ii) sediment augmentation was installed at 3 km upstream of the restored reach of a 56 km point (see Figure 7).

The results showed positive consequences. Gravel-bed restoration through channel widening increased native plants and species, e.g. Aster kantoensis and Charadrius placidus. The widened channel shape became stable and slightly deposited. Sediment augmentation of 5000m3 per year upstream has the potential to stabilize the riverbed elevation (Unno et al, 2006).

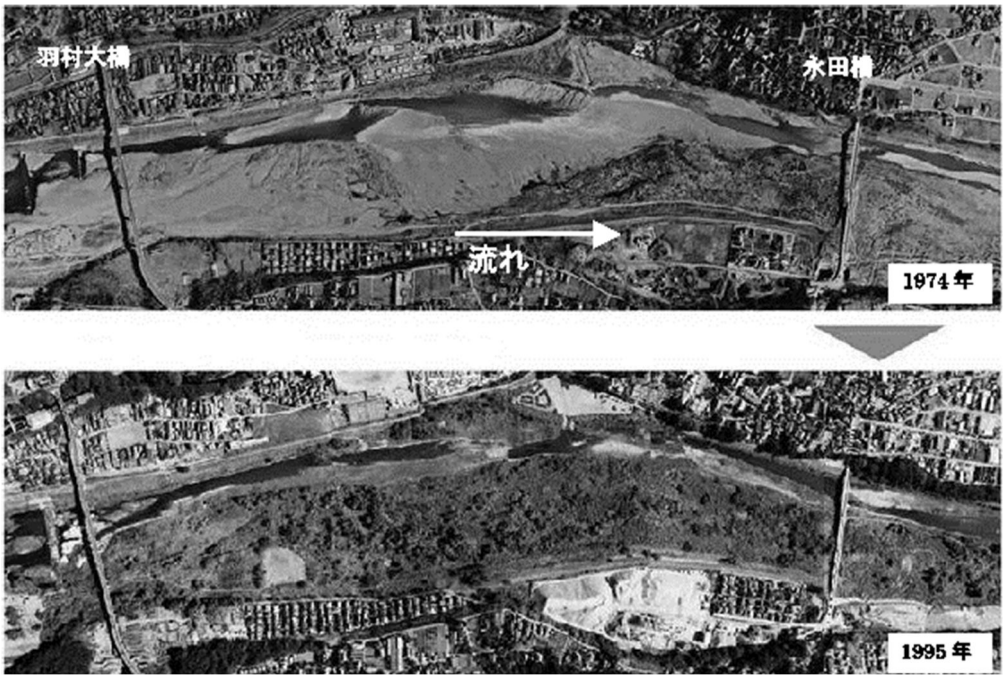


Figure 2.2.3　Aerial photos of Nagata district in 1974 and 1995 (Unno et al, 2006). The gravel bed on the right floodplains 1974 was replaced with vegetation and tree covers 1995. Fine sediment was severely deposited on the right side and frequency of inundation was drastically reduced.

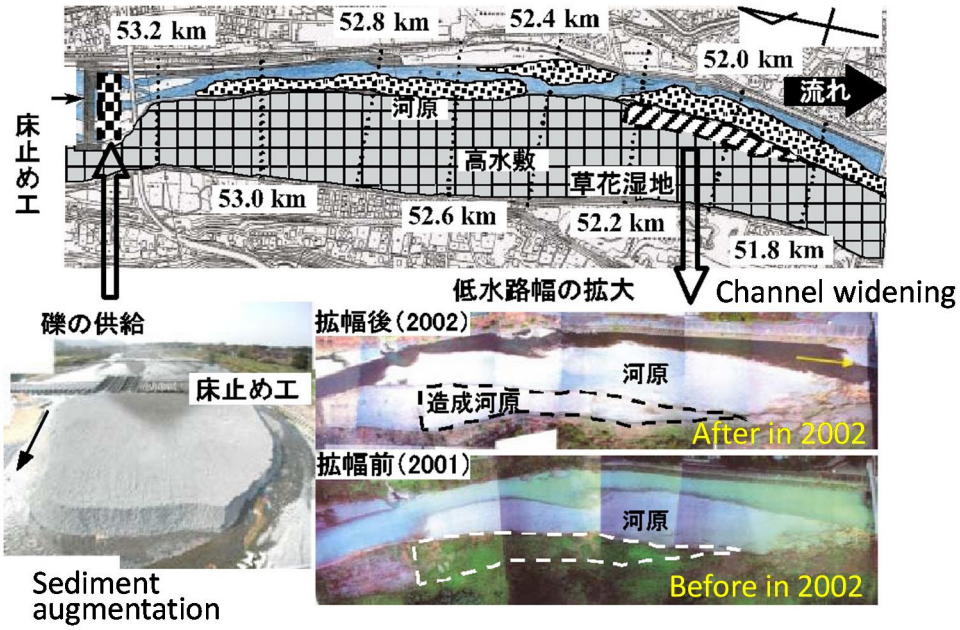


Figure 2.2.4 Channel widening and sediment augmentation in 2001 (Unno et al, 2006, English words added). Sediment augmentation (see the photo of the left bottom) was carried out 3 km upstream of the study reach at the amount of 1800m3 in Feb. 2001, 4000 m3 in Feb. 2002, 400 m3 in May 2002, and 4300 m3 in Feb. 2003.

6) Mana River in Japan

The Mana River is located in the Fukui prefecture, flowing to the Kuzuryu River. In the upstream of the Mana River, several dams are constructed: from the upper reach, the Kumokawa dam in 1956, Sasogawa dam in 1965, and Managawa dam in 1979 at the downstream reach, 14 km from the Kuzuryu River. These dams play important roles in flood mitigation and electric supply for the Fukui city. Since the Mana River does not have relevant tributaries below the Managawa dam until it meets the Kuzuryu River, it causes negative impacts such as fixing of river shape, processing riverbed armoring, resulting in coarse sediment not allowing for fluvial processes, and intense vegetation and wooden floodplains (Kumagai, 2009).

The Kuzuryu Dam River Office of MLIT has started a restoration project. Artificial floods via reservoir operation have been carried out since 2003 and maximum 45 m3/s flood discharge for 2.5 hours was installed since 2006. This flood discharge was adopted based on a result of previous studies that attached algae to sediment can be flushed and thus effective for restoring morphological regimes of the Mana River (Sakamoto et al, 2006).

In 2007, rehabilitation of a secondary channel and sediment augmentation were integrated into artificial floods with a view to restoring gravel riverbed, instead of intensive invasion of woods onto floodplains, habitat diversity, and habitat preferred to fish communities (see Figure 8). A secondary channel created at the middle reach of the Mana River upstream of the Kimigayo bridge has the channel width of 20 m,

length of 100 m, riverbed slope of 1/82 as the same slope as the main channel, and deepened down to a elevation that does not allow for flowing less than mean flow discharge. The sediment augmentation of 330 m3, consisted of excavated sediment for the secondary channel and deposited sediment of the Managawa dam, was placed with the width of 10 m (i.e., one third width of the main channel), its length of 10 m at the main channel, and inundated at peak discharge of artificial floods (Kumagai, 2009).

The results showed, for example in 2007, that: a deep pool was created at the entrance of the secondary channel; gravel bars were created at its outlet; and 115 m3 of sediment placed were flushed downstream. The monitoring results identified increased vegetation, and increased habitat diversity in the form of a pool and gravel bars, and species diversity in response to benthic communities between the main and secondary channel. This restoration project through integration of channel rehabilitation, artificial floods, and sediment augmentation implicates its potential to become a trigger for restoring morphological regimes and creating habitat diversity suitable for fish and benthic communities (Kumagai, 2009).

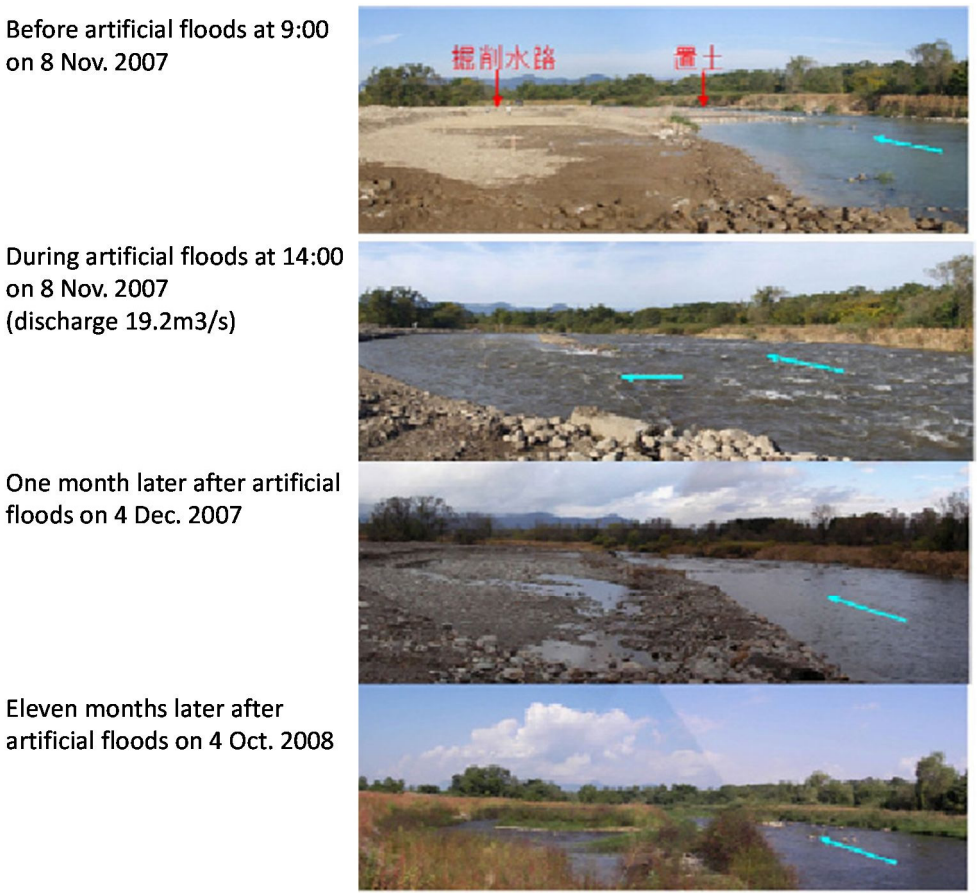


Figure 2.2.5 Monitoring results of rehabilitated the secondary channel and sediment augmentation. (Kumagai, 2009)

7) Trinity River in California, U.S.A.

The Trinity River begins in the rugged Trinity Alps in northwestern California. It tumbles through steep canyons and meanders through broad valleys until it joins with the Klamath River to flow into the Pacific Ocean. In 1958, a plan was executed to increase water supplies in California's Central Valley in part by transferring water from the Trinity River into the Sacramento River known as Trinity River Division (TRD). This diverts 90 % of the river's flow exported from the river each year. Trinity and Lewiston dams were also completed in 1964. The impacts of land use and dams combined to push the river past its regenerative capacity. After the dams were completed, the extent of habitat alteration and decline in salmon and steelhead populations became obvious by 1970.

The plan is to implement recovery of the Trinity River and its fish and wildlife populations. Restoring the Trinity River requires a combination of actions that: reestablishes the natural physical processes that creates and maintains high quality aquatic habitat; and creates spawning and rearing conditions downstream of the dams that best compensate for lost habitat upstream, including adequate water temperatures (McBain & Trush, Inc., 2000). This strategy does not strive to recreate pre-dam conditions, but rather to create a dynamic alluvial channel, exhibiting all the characteristics of the pre-dam river but at a smaller scale. Particular attention was placed in the project to, but not limited to: channel rehabilitation, flow management, and sediment augmentation. Channel rehabilitation removed riparian berms that confine the river, and relocated sand contained in the berm outside of the floodway (Figure 9 & 10).

Floodplains will be constructed to be periodically inundated by flows 170 m3/s and larger. Then it is expected to create riffles, pools, and gravel/cobble point bars, improve channel dynamics, and increase salmon spawning and rearing habitat. Observations at rehabilitation sites constructed between 1991 and 1993 have shown that once the riparian berm is removed and new bars have formed, flow and coarse sediment management is capable of maintaining the desirable channel morphology (McBain & Trush, Inc., 2000).

For flow management, in order to recreate inter-annual, or "between-year" flow variability, five water year types with a minimum volume of water to be released into the Trinity River were designed as shown in Figure 11. The quantity and quality of spawning and rearing habitat for salmon and steelhead varies with flow levels. The relationship between streamflows and habitat, developed during years of the field study, was used to determine the preferred flow releases for riverine life stages of chinook salmon, coho salmon, and steelhead. Habitat is maximized at 4.2 m3/s for some life stages and at higher flows for others. Within the existing channel, 8.5 m3/s provides the best balance for juvenile rearing and adult spawning habitat (McBain & Trush, Inc., 2000).

Coarse sediment management is to increase coarse sediment storage in the river (gravel/cobble bars), improve coarse sediment transport, and restore a balance between coarse sediment supply and coarse

sediment transport using high flows and mechanical gravel introduction. If the river were considered a conveyor belt periodically transporting and depositing coarse sediment, the proposed restoration strategy would add coarse sediment at the upstream end of the conveyor belt at a rate equal to what the conveyor is moving, such that accumulations (at tributary deltas) or deficits (channel incision and armoring) are minimized (McBain & Trush, Inc., 2000).



Figure 2.2.6 Sheridan Creek Bank rehabilitation site with newly formed gravel bars. (McBain & Trush, Inc., 2000)

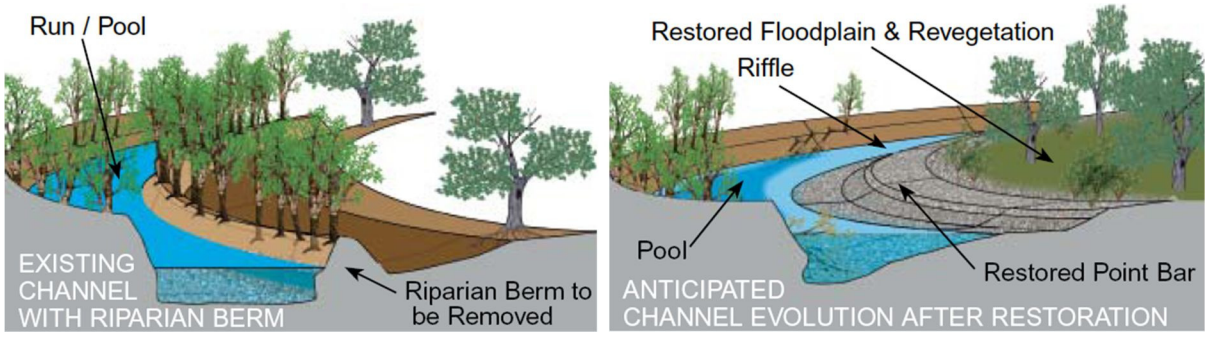


Figure 2.2.7 Sketch of channel rehabilitation. (McBain & Trush, Inc., 2000)

2.2.2 The analysis of the review

All the seven case studies on ecological restoration in U.S.A., Europe, and Japan have been addressing restoration of some parts of spatial habitat structure, depending on their project scale and goals such as: gravel banks (e.g., Drau River, Chikuma River, Thur River, Tama River, and Mana River) and riffles and pools (e.g., Mana River and Trinity River). However, approaches to achieving their goals are different. While some projects addressed only modifying river shapes locally (e.g., Thur River, Drau River, Waar River, and Chikuma River), but the other projects addressed operation of flow or morphological regimes in an integrated manner (e.g., Trinity River, Tama River and Mana River). Only two case studies of the Trinity River and Mana River integrated restoration of both flow and sediment regimes into their restoration projects (see Table 1). From a perspective of temporal patterns, little case studies addressed temporal change of habitat structure, except for some local deposition and erosion processes. Through the review, we found that flow and morphological regimes, which can be considered as explanatory variables for spatiotemporal patterns of habitat structure, have been addressed by only a few case studies. In the review however, it should be noted that: case studies are in the ongoing processes of determining desirable spatiotemporal patterns of river corridor habitat and how they are evaluated; and that options for ecological restoration should be adopted based on appropriate combination of flow and morphological regimes (Kantoush et al 2011, and Sumi & Kantoush, 2012). Importantly, for some case studies, flood management objectives are at center of their restoration projects (e.g., Drau River and Chikuma River) based on a concept that restoring some part of fluvial processes can contribute to, for example, lowering of water stages during flooding, instead of constraining flood water in channelized embankments.

Various existing ecological evaluation tools, as discussed in Section 1.1 address spatial distributions of habitat structure but do not address spatiotemporal patterns of changing habitat. There is, therefore, a need for analyzing spatiotemporal patterns of habitat structure. However, questions may be raised: how dynamic state of changing habitat can be evaluated and integrated into restoration projects; and how goals for successful restoration can be set.

2.3 Habitat diversity hypothesis

Intermediate disturbance hypothesis is one of keys to discussing evaluation of species richness, originally developed for marine intertidal communities (Connel, 1978). This hypothesis explains that disturbance of intermediate intensity and frequency will maximize species richness by reducing density of dominant species and create habitat for more fugitive species in interspecific competition. However, since some communities of species can exist in intermediate disturbances, another approach to evaluating biological diversity may be needed rather than a concept of interspecific competition. Other studies showed that there is a need to address habitat diversity in relation to biological diversity (i.e., species abundance and richness) and there is implication that habitat diversity can maximize species diversity (Takemon, 1997). A study conducted in rivers in New Zealand showed that ratio of surface sediment in its relation to species richness had similar results with the habitat disturbance hypothesis

(Townsend et al, 1997 and Matthaei et al, 1999). Even though this result does not analyze relations between habitat diversity and species diversity, it implicates the possibilities. Therefore, spatial heterogeneity should be addressed.

On one hand, temporal patterns are also highlighted. The shifting habitat mosaic steady state concept, addressing some parts of temporal patterns, explains that habitat changes in shifting mosaic and assembles of spatial distributions of habitat structure get almost stable and this steady state supports riverine environment (Arscott et al, 2002). Habitat age is another approach that analyzes continuity of habitat structure in a reach and understands that existence of diversity of habitat age in a reach supports species diversity (Arscott et al, 2002). An attempt to address temporal patterns in form of habitat age is important, however, this neither tracks processes of temporarily changing patterns of each habitat unit, e.g., riffles, pools, side pools, and back waters, nor addresses quality of changing habitat, i.e., changing patterns of microhabitat in each habitat unit (macro habitat). The discussions above highlighted a need for analyzing spatiotemporal patterns of river corridor habitat structure, in which flow and morphological regimes can be explanatory variables.

We propose the "habitat diversity hypothesis" to analyze spatiotemporal patterns of habitat structure. We define the habitat diversity hypothesis as: Spatiotemporal patterns of habitat structure determine biological diversity (i.e., species abundance and richness), which can be characterized by a function of intensity and frequency of disturbances and age of each habitat unit from its disturbances. Then if intermediate disturbances enhance habitat diversity, it is prerequisite for proving the following two aspects:

- ✓ Biological diversity is maximized by spatial heterogeneity, defined as "spatial heterogeneity hypothesis"; and
- ✓ There are disturbance regimes, which maximize biological diversity in temporal heterogeneity of habitat conditions, i.e., disturbance intensity and frequency and age of each habitat unit, defined as "temporal heterogeneity hypothesis".

Our approaches to prove these hypotheses can be explained. Spatial heterogeneity hypothesis can be proved by analyzing whether resultant habitat diversity, which maximizes biological diversity, is characterized by intermediate disturbances. Temporal heterogeneity hypothesis can be proved by developing a series of special distributions of each habitat unit and its age and analyzing conditions that maximize biological diversity. We identify spatial heterogeneity hypothesis and temporal heterogeneity hypothesis are substantial components of habitat diversity hypothesis.

2.4 An attempt to analyze spatiotemporal patterns in the Tenryu River

In order to prove the habitat diversity hypothesis discussed above, we started a case study in July 2012 in a middle reach of the Tenryu River Japan, of which the riverbed is likely to move by a certain discharge. There is a similar case study, which analyzes spatiotemporal patterns using interval-recording cameras in the Tagliamento River Italy (for example, Arscott, 2002). This study is effective to gain plenty of

qualitative data through photos but cannot quantify quantitative data, e.g., area of changing habitat and deposition and erosion processes. In the Tenryu River, in respect to the Tagliamento study, photogrametric mthods are used as a challenge to solve the problems. Data has been collected on spatiotemporal patterns by several interval recording cameras (hourly) placed at 60 m high from the riverbed in the center of the river corridor. Several camera-recording can transform photos into 2 D, i.e., ortho data, enabling to quantify the spatiotemporal patterns including erosion and deposition processes, using photogrametoric methods. This chapter is kept up to introduce our attempt to be made, methodologies and results of which will be discussed in Chapter 3.

2.5 Conclusions

The review revealed that spatiotemporal patterns, determined by flow and morphological regimes, should be integrated into restoration projects depending on its scales and objectives. We propose the habitat diversity hypothesis as a different approach from the intermediate disturbance hypothesis, which explains biological diversity composed of two aspects: spatial heterogeneity hypothesis and temporal heterogeneity hypothesis. We started a case study in the Tenryu River via interval-recording cameras. This study can be a new approach to analyzing spatiotemporal patters of habitat structure quantitatively, through which spatial and temporal patterns are expected to be interwoven.

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3 Spatiotemporal patterns determining riverine habitat heterogeneity

3.1 Introduction and objectives

Riverine habitat is structured with various habitat types, e.g., riffles and pools, back waters, and side pools, and these habitat structures are formed by erosion and deposition processes. Such geomorphological processes are determined by flood intensity and frequency, and sediment volumes with various grain sizes (Poff et al, 1997, and Sumi & Kantoush,2010), thereby characterizing habitat diversity and heterogeneity. Depending on flow and sediment regimes, habitats are recurrently created and eliminated and they are structured as a result of spatiotemporal patterns of geomorphological processes (Hyodo et al, 2013a). Habitat structures include nutrients and vegetation and they are influenced by flow and sediment regimes as well (OCK et al, 2010, OCK and Takemon, 2011). In order to restore the riverine ecosystem, it is important that spatiotemporal patterns be appropriately evaluated. However, current ecological evaluation tools, e.g., HEP (US FWS 1981), PHABSIM (US FWS 1989), AUSRIVAS (Parsons et al. 2001), RIVPACKS (Wright et al, 2000), IBI (Karr, 1981, Karr and Dudley, 1981), etc., have not addressed this perspective. Recent researches implicated that, in order to optimize biodiversity, it requires presence of various habitat types with different habitat age (Takemon, 1997, Ward et al, 2002). For example, there are several researches looking at spatiotemporal patterns of riverine habitats, e.g., shifting habitat steady state (Arscott et al, 2002) and habitat age (Tockner et,. 2010) in the Tagliamento River in Italy. However, only a few researches have tracked changing patterns of each habitat and quantitatively analyzed geomorphological changes and resultant spatial distributions of habitats. The objective of this study is to analyze spatiotemporal patterns of geomorphological processes that determine characteristics of riverine habitat heterogeneity. We analyzed shifting habitat history based on data taken through interval-recording cameras from a perspective of flood inundation, riverbed hardening and softening, and erosion and deposition processes.

3.2 Methods

We conducted a case study in a middle reach of the Tenryu River in Japan. The Tenryu River has the catchment area of 5090 km2 and river length of 213 m in the Nagano, Shizuoka, and Aichi prefecture. The study area is at 16.4 k-point from its river mouth, the slope is 1/520 to 1/650, 60 % representative grain diameter is 60 to 73 mm, riverbed configuration is co-exiting of alternate and braided bars, and channel width is 1000 km. The lowest dam at the downstream reach is called Funagira Dam located at 30 k-point for hydropower. A discharge gauging station has been set at Kashima at 25 k-point. There is an electric supply tower located in the middle of the river corridor. We have installed on the tower a set of interval-recording cameras at 60 m above the riverbed since 8 August 2012, after we conducted camera testing on 17 May 2012 (Figure 3.2.1 and Figure 3.2.2). The study are and camera-recording sites, which are directed to upstream and downstream, are shown in Figure 3.2.1, and the photo data are shown in Figure 3.2.3. A number of habitat types were identified within the camera-recording sites at the beginning on 8 August 2012, summarized as: three riffles (2 in upstream and 1 in downstream sites, also referred to as Rfs), six side pools (4 in upstream and 2 in downstream sites, also referred to as SPs), and

three back waters (3 in upstream and 4 in downstream sites, also referred to as BWs). SPs and BWs are classified by defining that SPs are disconnected to main or secondary channels by surface water under low flow conditions, and on the other hand BWs are connected. Exceptionally, in case when surface waters are connected but flow direction of pools goes to main or secondary channels rather than influenced by backwater, these habitats are classified as SPs in this article, i.e., Up-SP-2 and Up-SP-3 in Figure 3.2.3. This classification was made by photo data and field surveys.

This case study was conducted to analyze how geomorphological processes determine characteristics of riverine habitat heterogeneity: by analyzing inundation processes during floods with different intensity via interval-recording cameras; by quantitatively analyzing changing patterns of riverbed softness at a micro habitat scale; and by quantitatively analyzing erosion and deposition patterns at a macro habitat and reach scale.

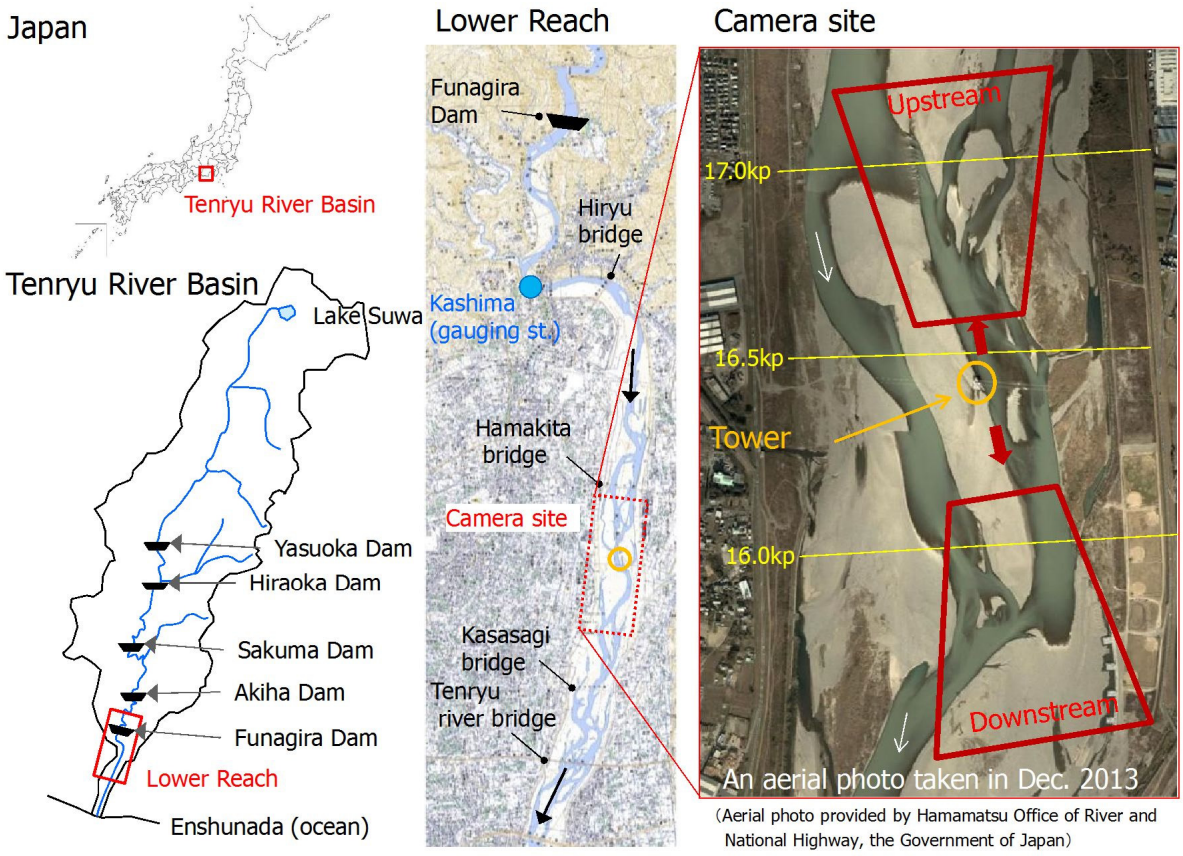


Figure 3.2.1 Study area and camera-recording sites, Tenryu River. The study site selected is located at 16.3km from the river mouth, which is a downstream reach of the Funagira dam (located the most downstream at 30 km). Several interval-recording cameras have been installed to monitor spatiotemporal patterns of riverine habitat at upstream and downstream reaches of the study site.

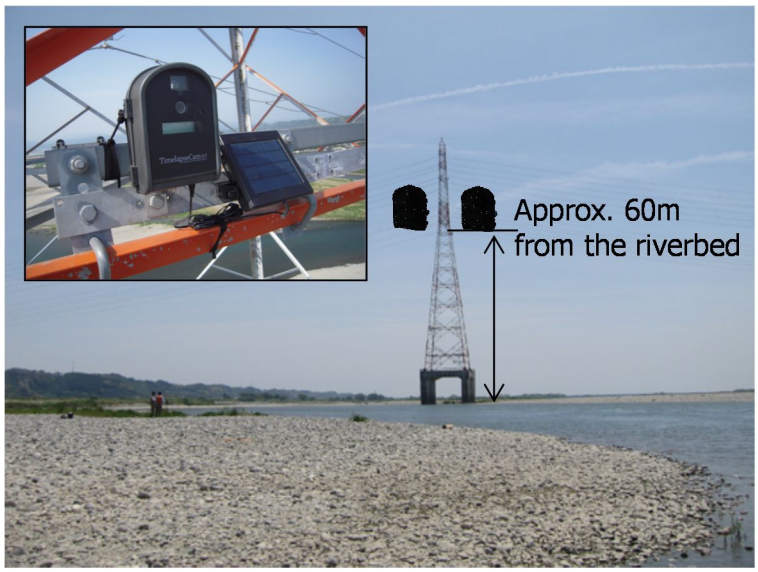


Figure 3.2.2　A camera monitoring location at the Tenryu River. Interval recording of camera photo data has started since 8 August 2012 to date. Photos were also taken on 17 May 2012 as a field test of the interval recording prior to its implementation, and therefore were used in this article to analyze spatiotemporal patterns of riverine habitat. Interval-recording cameras were located in a middle of the river channel, approximately 60 m high from the riverbed. These cameras have been equipped with solar panels, enabling data accumulation of a longer period.

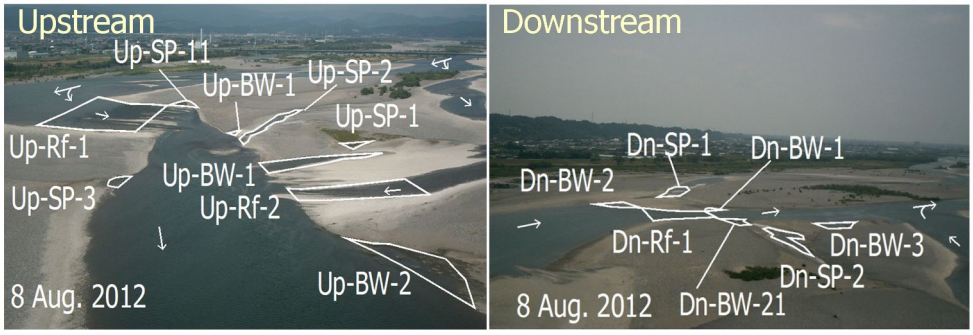


Figure 3.2.3　Habitat distributions within the camera-recording sites at the beginning, as of 8 August 2012. Habitat units of upstream and downstream reaches were identified. At the beginning of this camera photo monitoring, in total 3 riffles, 7 back waters, 6 side pools were identified. Spatiotemporal patterns of these habitat units identified were monitored via these cameras set.

3.2.1　Inundation processes during floods

Two flood events with different intensity were selected for the inundation analysis. Figure 3.2.4 shows hourly discharge of recent years in relation to surveys conducted. It is noted that hourly discharge at the Kashima gauging station is used throughout this article, when providing information relating to discharge. As maximum annual discharge since 1939 to 2013 is 4500 m3/s, one is a small flood occurred

on 23 October 2012 with the discharge of 510 m3/s, and another is a middle flood occurred on 16 September 2013 with the discharge of 4900 m3/s. Reasons for selecting these two floods were because not only they have different flood intensity, but also a riverbed softness survey was conducted around these periods to analyze their relations. Sequence photos taken via interval-recording cameras were used to analyze inundation processes including flow directions according to water level rise.

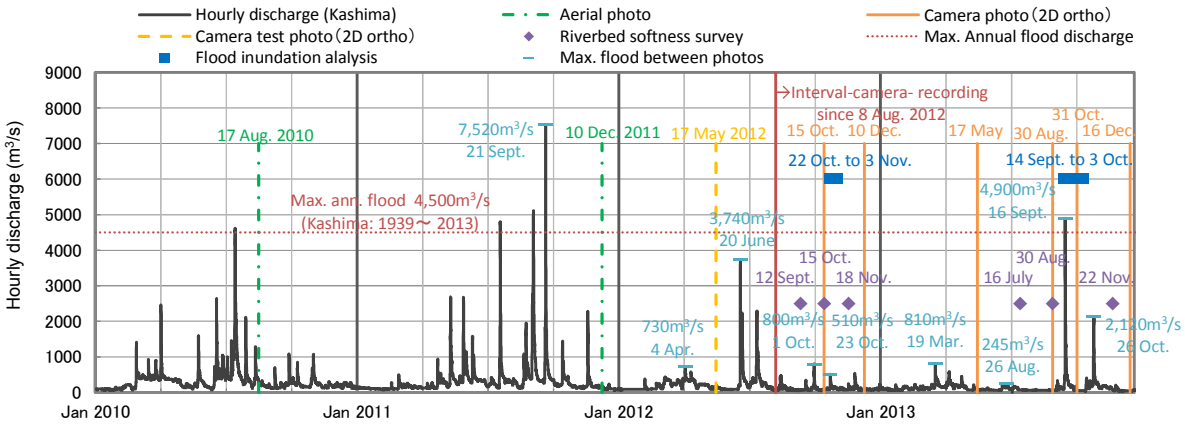


Figure 3.2.4 Hourly discharge at the Kashima gauging station located at 25 k-point, in relation to surveys conducted.

3.2.2 Changing patterns of riverbed softness at a micro habitat scale

In order to analyze changing patterns of hardening and softening processes of the riverbed, a riverbed softness survey was conducted six times in total, i.e., three times in 2012 (12 September, 15 October, and 18 November) and three times in 2013 (16 July, 30 August, and 22 November 2013) as shown in Figure 3.2.5. A small flood occurred during the former three times in 2012, while a middle flood occurred during latter three times in 2013. Methodologies for this survey are that firstly a matrix was developed for each habitat, ranging from 3 to 12 longitudinally along and 3 to 16 laterally against flow direction respectively, depending on the habitat size. The riverbed softness was measured at lattice points in matrixes. The measurement is called “shino” and was made with a small steel pipe, of which one edge is sharp. The sharp side edge is penetrated into the riverbed with a certain load by hand, and the depths under the riverbed surface were measured and recorded. For each lattice point of the matrix, the penetrated depth below the riverbed was recorded five times and their average values were used as the riverbed softness. When the riverbed is soft, a value of the riverbed softness shows a high number and vice versa. In order to measure the riverbed softness, there is a tool called “Hasegawa riverbed cone penetration testing”. Since numerous lattice points need to be continuously measured, easy-to-use shino was adopted to effectively measure them in this study.

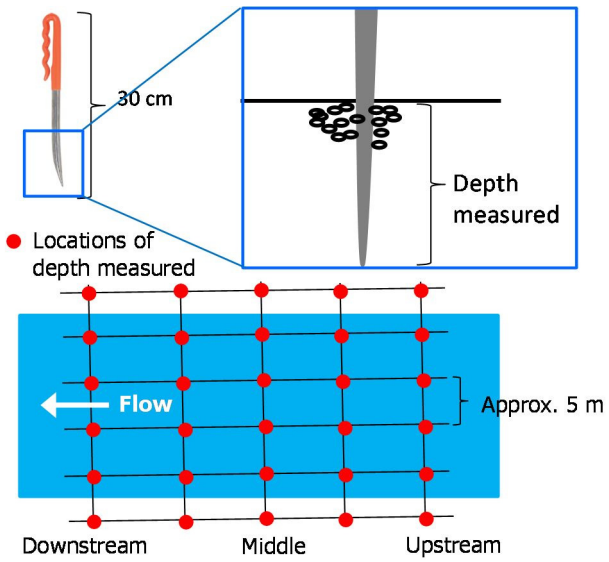


Figure 3.2.5 Survey on riverbed softness by "*shino*". As shown in this figure, *shino* was used to measure riverbed softness by sticking it with certain weights into riverbed and measuring the depth of being stuck. A matrix was organized at each habitat unit, in which grids were locations of depth measured. Depths measured five times at each grid were averaged and adopted as the riverbed softness.

3.2.3 Erosion and deposition patterns at a macro habitat scale

Firstly, we developed a 2-D model applying a photogrammetric method, i.e., transforming photo data to 2-D images with the orthogonal coordinate system, in order to quantitatively analyze erosion and deposition processes (see Figure 3.2.6 and also Hyodo et al, 2013b for details). Secondly, erosion and deposition areas were measured by orthogonal 2-D images developed, which were superposed to identify geomorphological changes of surface-terrestrial boundaries. Then relations between flood intensity and erosion and deposition processes were analyzed.

A basic theory of the photogrammetric methods is formed by an equation (1).

$$X = \frac{b_1 x + b_2 y + b_3}{b_7 x + b_8 y + 1}, \quad Y = \frac{b_4 x + b_5 y + b_6}{b_7 x + b_8 y + 1} \tag{1}$$

This equation is obtained from objectives to be transformed, which need to be a plane geometry, but they do not necessarily be a non-plane geometry, e.g., vertical and slope planes. 8 unknown quantities from b_1 to b_8 in equations of (2) and (3) can be obtained based on the least squares method by transforming more than 4 pairs of coordinate target bench marks as (X_i, Y_i, x_i, y_i) (y_i=1, 2$\cdots$,n: $n \geq 4$) to liner equations.

$$x_i b_1 + y_i b_2 + b_3 - x_i X_i b_7 - y_i X_i b_8 = X_i \tag{2}$$

$$x_i b_4 + y_i b_5 + b_6 - x_i Y_i b_7 - y_i Y_i b_8 = Y_i \tag{3}$$

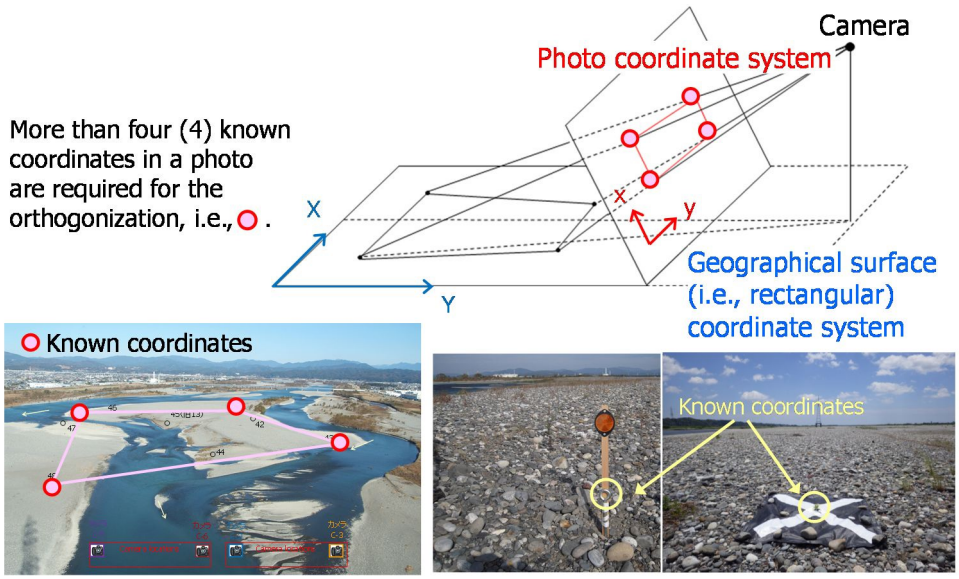


Figure 3.2.6 A 2D model for the orthogonization developed, using a photogrammetric method.

In this case study, we have installed 8 target bench marks having coordinate values within camera recording sites, of which 4 were used for developing a 2-D model, i.e., a set of orthogonal images. Figure 3.2.7 shows an image of superposing an orthogonal image developed and aerial photo taken both in December 2012. This result describes well the accuracy of the 2-D model and showed approximately the 1 m accuracy. Considering a fact that a river width of this study area is about 800 m, this accuracy is appropriate enough to quantitatively measure erosion and deposition areas. However, it is noted that modeling of around photo edges used extrapolation and reduced its accuracy. This fact does not discuss in this article, but will be treated as a future challenge to enhance accuracy of this model.

A period for the quantitative analysis was from 17 August 2010 to 16 December 2013 (see Fig. 3). Even though interval-recording cameras have been installed since 8 August 2012, camera testing was conducted prior to its installation on 17 May 2012. This photo data enables to obtain geomorphological change by a middle flood on 20 June 2012 with the peak discharge of 3740 m3/s. In addition, orthogonal aerial photo data on 10 December 2011 and 17 August 2010 were used to obtain changes due to a large flood occurred on 21 September 2010 with the peak discharge of 7520 m3/s. These orthogonal aerial photo data were taken and developed by the Hamamatsu Office of Rivers and National Highways, Ministry of Land, Infrastructure, Transport and Tourism. Based on these data, geomorphological changes by a set of small, middle, and large floods could be used for the quantitative analysis on erosion and deposition processes.

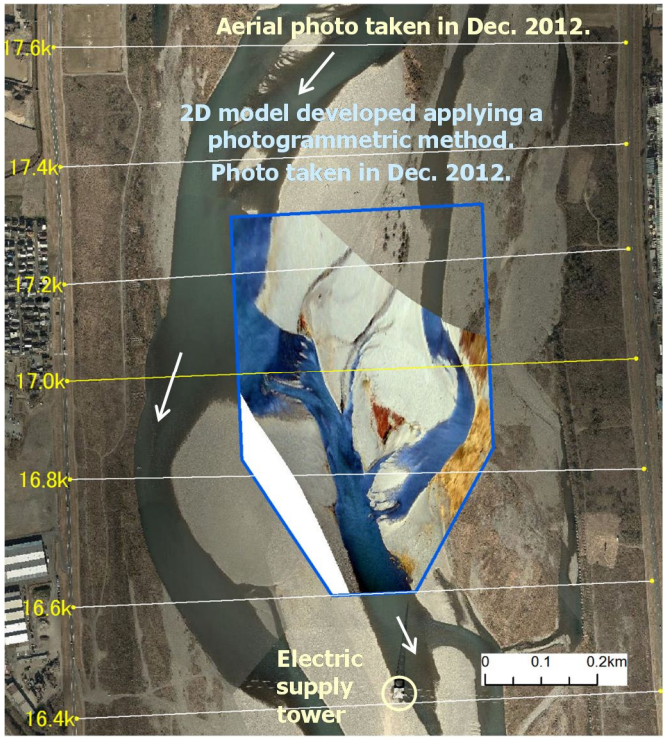


Figure 3.2.7 An image of superposing an orthogonal image developed and aerial photo taken both in December 2012.

3.3 Results and discussions

3.3.1 Inundation processes during small and middle floods

Figure 3.3.1 shows upstream photo sequences of a small flood from 22 October to 2 November 2012, taken by upstream interval-recording cameras. As for Up-BW-1 and Up-SP-2, flood water passed through old channels followed by its water level rise. This old channel played a role as an active channel during a small flood, referred to as a "lotic system". On the other hand, as for Up-SP-1, it got inundated by backwater followed by its water level rise around Up-Rf-1, referred to as a "lentic system". In simplification, habitats have different inundation processes during small floods, which can be categorized as two types of lotic and lentic systems. Only Small geomorphological change has occurred by the small flood, such as integrating Up-BW-1 and Up-SP-2 into Up-BW-11.

Figure 3.3.2 shows upstream photo sequences of a middle flood from 14 September to 3 October 2013. At an earlier stage of the middle flood, inundation processes are similar with small floods. When the water level reached to the flood peak at 13:00, 16 September 2013, a part of woody canopies is above the water level except of which were totally inundated. In the recession stage of floods, river geomorphology appeared to have changed. Habitats were newly created such as Up-Rf-21, 22 and 23, Up-BW-22, Up-SP-21, etc. This implicates that middle floods have the potential to create new habitats, while small floods cause only geomorphological changes at a very small scale.



Figure 3.3.1 Upstream photo sequences of a small flood from 22 October to 2 November 2012.

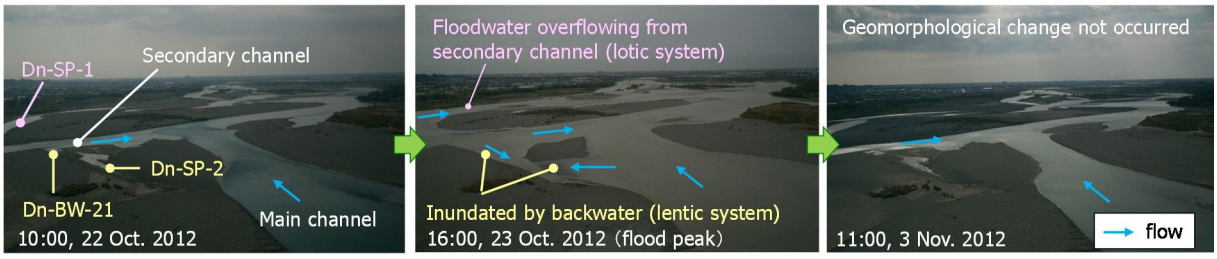


Figure 3.3.2 Upstream photo sequences of a middle flood from 14 September to 3 October 2013.

3.3.2 Changing patterns of riverbed softness at a micro habitat scale in relation to floods

This section analyzes changing patterns of micro habitat structures, focusing on the riverbed softness, and how their hardening and softening processes are related to geomorphological and inundation processes, which can be represented by lotic and lentic systems. Figure 3.3.3 shows results of a riverbed softness survey conducted in September, October, and November 2012 and July, August, and November 2013. A middle flood occurred between August and November 2013. Higher the numbers indicate the riverbed is soft and vice versa.

As for Rfs, the riverbed softness is averaged longitudinally, i.e., riffle head, middle, and tail. The result shows that the riverbed has got continuously hardened especially at riffle heads. The riverbed of Up-Rf-2 once got softened, but it again started to get hardened. At Dn-Rf-1, unique change has occurred. While the riffle head got harder, the tail became softer until November 2012 and then again got harder. This process may be explained that small floods can transport a small portion of sediment to limited distance downstream, since small floods erode sediment at riffle heads and deposit it on their tails. For middle floods, we expected that they can deposit sediment on existing Rfs and its riverbed gets renewed and softened, according our assumptions (Hyodo et al, 2013b). However, relevant results explaining this assumption could not be obtained from this survey. One reason for this is that since we could not conduct the survey between a middle flood in September 2013 and a relatively small flood in October 2013, but could conduct only after the small flood. As of November 2013, renewing processes of habitats by the middle flood may be completed and hardening processes by the small flood may have already started. These processes are discusses in Section 3.3.

As for SPs and BWs, the riverbed softness is averaged for each habitat. As shown in Figure 3.3.3, lotic and lentic systems correspond to the riverbed softness. Habitats with lotic systems showed lower values of the riverbed softness mostly below 10 cm, while those with lentic systems showed higher mostly above 10 cm. Lentic systems of SPs and BWs are inundated by backwater, assuming that in flood recession stages fine sediment is likely to be deposited on their habitats. This explains why lentic systems showed the riverbed is softer than lotic systems. On the other hand, even if habitat types are SPs and BWs, those of lotic systems have the harder riverbed than those of lentic systems. This result also leads to an assumption that small floods induce a sediment move of the riverbed of such habitats at a micro habitat scale, causing erosion as same as Rfs. Giving a detailed look at Up-SP-1 of lentic systems, the riverbed softness got higher over the period from 2012 to 2013, experiencing both small and middle floods. Figure 3.3.4 shows softening processes of Up-SP-1, representing well how lentic systems deposit fine sediment and form the softened riverbed.

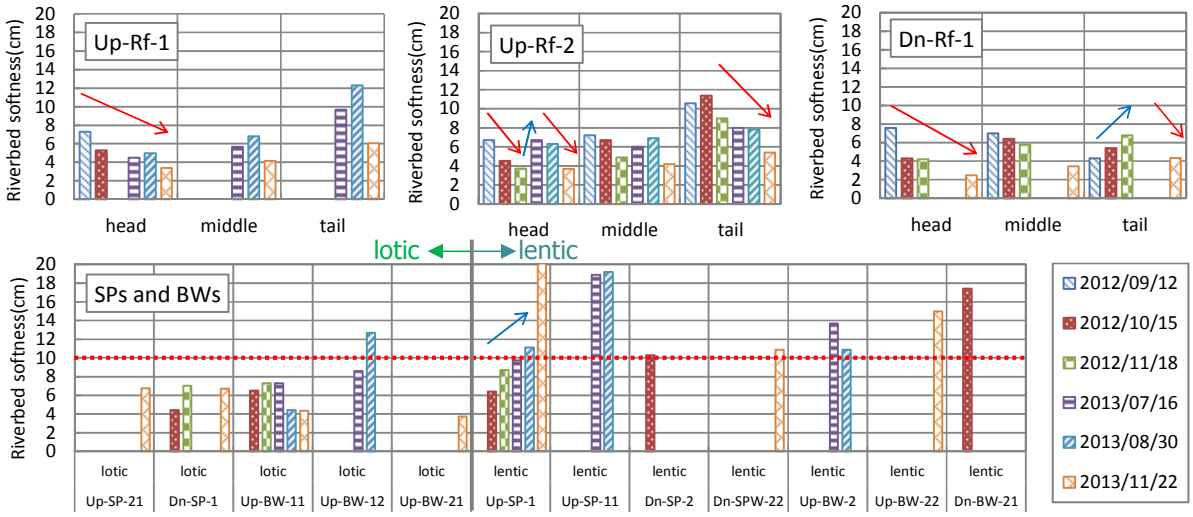


Figure 3.3.3 Results of the riverbed softness survey. Higher the numbers indicate the riverbed is soft and vice versa.

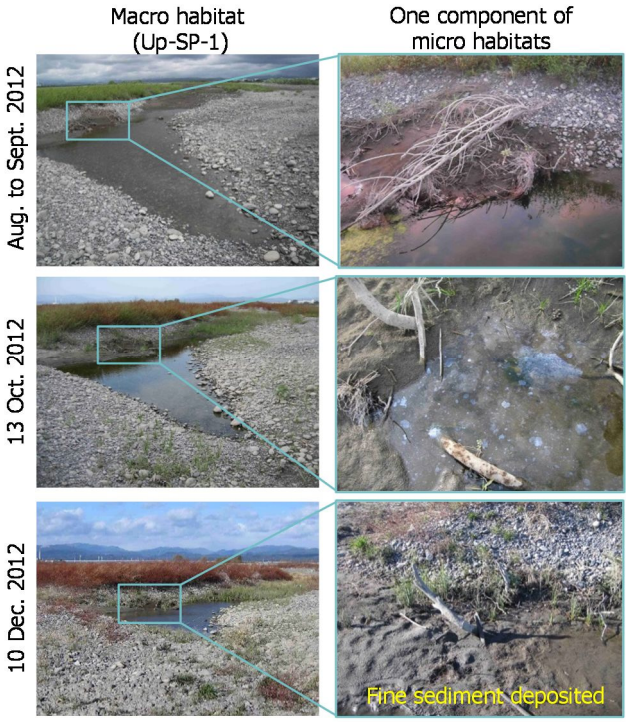


Figure 3.3.4 Micro habitat photos of Up-SP-1. These photos represent well how fine sediment is deposited by a backwater effect, leading to softened riverbed.

3.3.3 Flood intensity and erosion and deposition processes at a macro habitat scale

Figure 3.3.5 shows a temporal series of spatial distributions of erosion and deposition areas within camera photo frames upstream. 2-D models for the orthogonalization of photo data were developed under conditions of low-enough flows. Area of erosion and deposition means changes of terrestrial and surface water boundaries in plane shapes above low-enough water levels. A period between August 2010 and December 2011 experienced a large flood with the discharge of 7520 m3/s. Large area of erosion and deposition were identified. Up-Rf-1 was developed by deposition of up- and down- stream sides on the right bars created. A new secondary channel was created on the left bars due to deposition and neighbor erosion. As a result of significant geomorphological changes, bar waterfront was formed by the large flood. A period between May 2012 and September 2012 experienced a middle flood with the discharge of 3740 m3/s. relatively large geomorphological changes occurred. Right bars were deposited and extended to downstream, thus renewing Up-Rf-1. Secondary channels on the left bars were deposited and eroded further downstream, thus creating Up-Rf-2. A period between August and October 2013 experienced a middle flood with the discharge of 4900 m3/s. On the right bars, a large ratio Up-Rf-1 was replaced by deposition with a new habitat of Up-BW-22. A period between October and December 2013 experienced a relatively small flood with the discharge of 2120 m3/s. A tail of the bar waterfront was eroded and shifted further downstream. A set of these results explains that creation, elimination, renew of habitats can occur through erosion and deposition processes, and these changing patterns can be characterized by flood intensity.

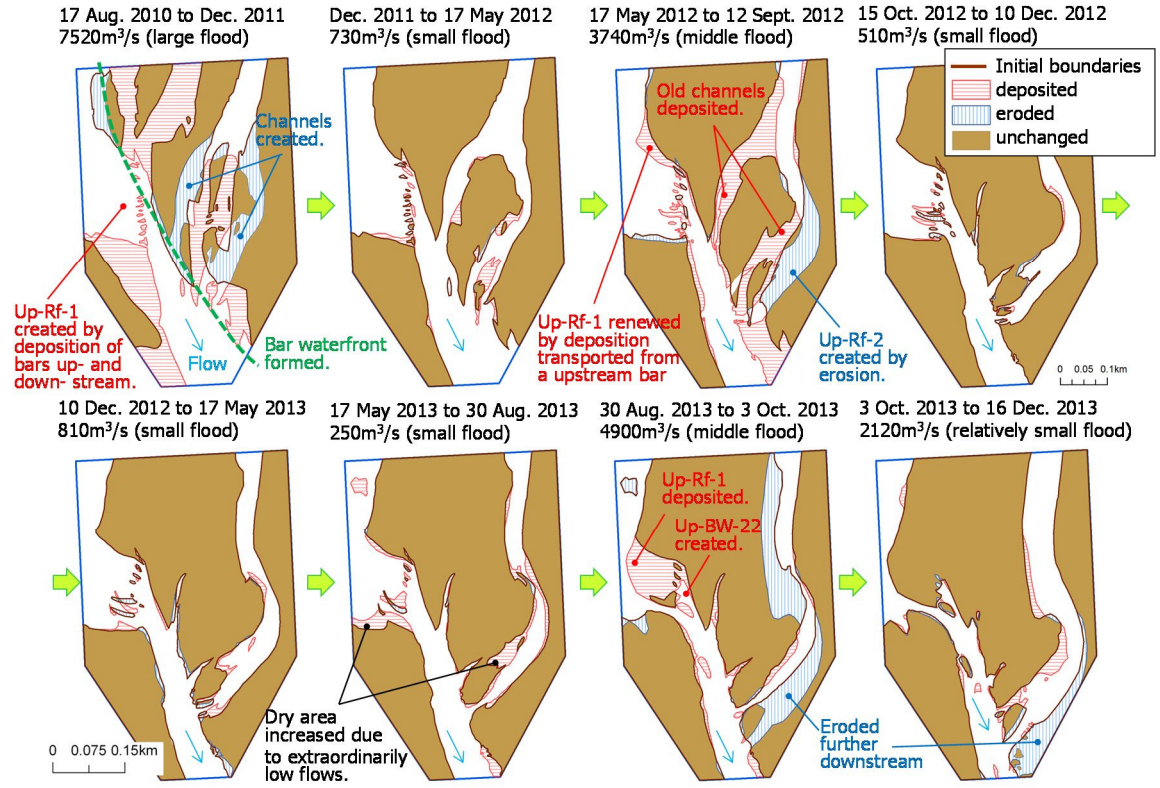


Figure 3.3.5 Results of orthogonalization of photo data, showing a temporal series of erosion and deposition areas, since 17 August 2010 to 16 September 2013.

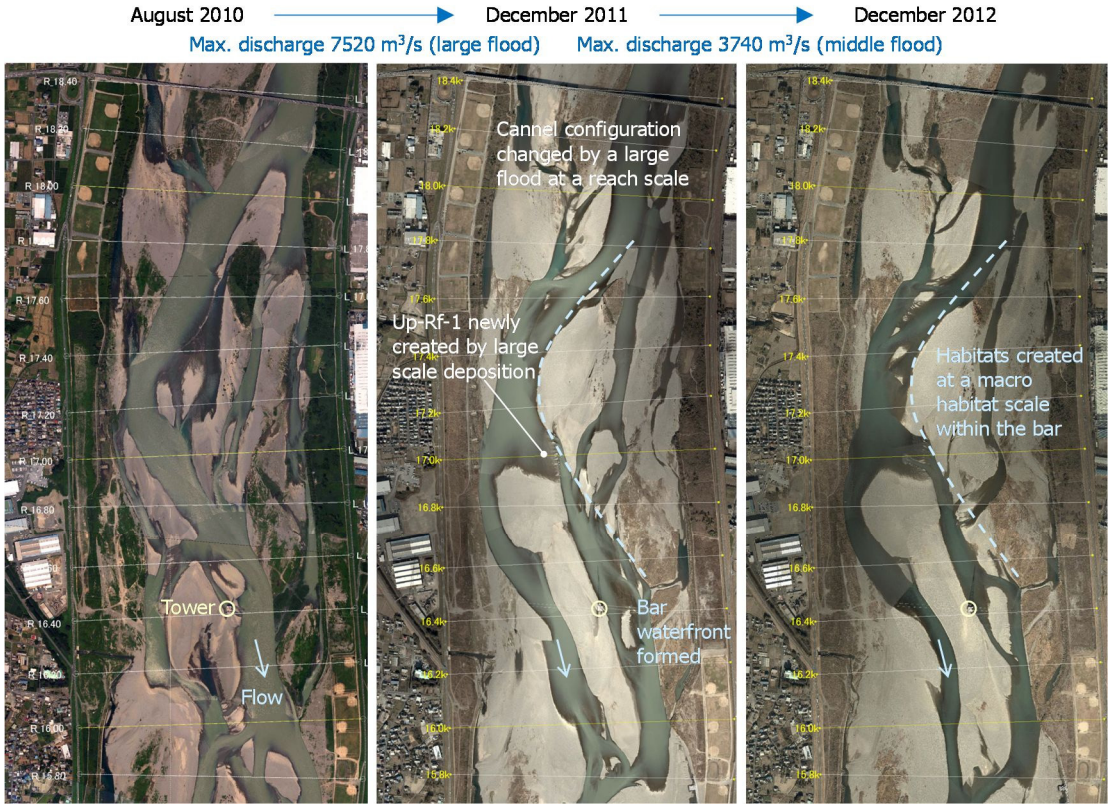


Figure 3.3.6 Aerial photos at a reach scale in August 2010, December 2011, and December 2012.

3.3.4 Erosion and deposition processes extended to a reach scale and discussions

Figure 3.3.6 shows geomorphological changes at a reach scale in August 2010, December 2011, and December 2012. After experiencing a large flood, this reach has significantly changed the channel configuration, Up-Rf-1 was newly created as a result of such significant change, and the bar waterfront was formed as of December 2011. After experiencing a middle flood, the channel configuration has not changed, but changes to creating and renewing habitats have occurred at a macro habitat scale within the bar as of December 2012. When experiencing only small floods, habitat changes at a micro habitat scale, for example Rfs get continuously hardened (see Figure 3.3.3). This result shows that geomorphological processes and resultant habitat heterogeneity are characterized more or less by flood intensity.

Using the results of 2-D models developed (see Figure 3.3.5), relations between flood intensity and erosion and deposition processes were analyzed. We measured area of being eroded, deposited, unchanged, and surface water for each result. Figure 3.3.7 shows relations between flood intensity and the area measured. In comparison with the total area of 272,000 m2 for the analysis, in relatively small and middle to large floods (larger than 2000 m3/s), active area for geomorphological changes, where erosion and deposition are subject to occurring, is 19,000 to 89,000 m2 (17 % to 33 % against the total area). On the other hand, in small foods (lower than 1000 m3/s), active area is 4100 to 14,200 m2 (2 % to 5 %), explaining that small floods less contribute to geomorphological changes.

In comparison with a ratio between erosion and deposition area in small floods lower than 1000 m3/s (see Figure 3.3.7), erosion is dominant in most of cases. During small floods, sediment adjacent to bar waterfront did not change. Based on this fact and hardening processes of the riverbed at riffle heads (as discussed in Figure 3.3.3), it is assumed that sediment is not supplied from upstream bars onto the riffle heads, and within a riffle unit sediment is transported by eroding its heads and depositing it on its tails. This process created the erosion dominant and hardening of the riverbed at Rfs during small floods.

Taking an example of spawning redds for Ayufish fish species (Plecoglossus altivelis), it is known that Rfs are important and they should be composed of relatively small gravels. Our recent studies showed that especially riffle heads are more frequently used for spawning redds and soft riverbed is one of important components creating suitable redds (Sumi et al. 2011). Our case study showed that absence of middle and large floods reduces the suitability by eroding riffle heads and showed quantitatively processes of how the riverbed gets hardened. It also showed that presence of middle floods create new Rfs and induce deposition onto existing Rfs by a mass movement around bar waterfront located upstream of riffles. Large floods change significantly the channel configuration, creating new Rfs as summarized in Figure 3.3.7.

As for Rfs, it is assumed that the Rf suitability can be classified by flood intensity (see Figure 3.3.7). Small floods have a deterioration effect (-) by changing habitats limited to a micro scale, middle floods have a relatively positive effect (+) by renewing riffle heads by deposition of sediment within a macro habitat scale, and large flood have a recovery effect (++) by significantly changing channel configuration

and thus creating soften riverbed suitable for spawning redds of Ayufish species. As for SPs and BWs, small and middle floods enhance habitat heterogeneity over inundation processes of lentic and lotic systems, while large floods may reduce habitat heterogeneity by changing significantly the channel configuration. Although we need to accumulate data and another effect influencing suitability and heterogeneity, e.g., timing and frequency of floods, vegetation effects, etc., it is revealed that they can be explained by a spatial hierarchy at reach, macro habitat, and micro habitat scales, and its temporal changing patters caused by floods with different intensity.

Flood intensity	Small	Middle	Large
Geomorphological changing patterns	Changes limited to a micro habitat scale	Creating new habitats & renewing existing habitats at a macro scale	Changing channel configuration at a reach scale
SPs & BWs heterogeneity	Plus (+)	Plus (+)	Minus (-)
Rf Suitability	Minus (-)	Plus (+)	Double Plus (++)

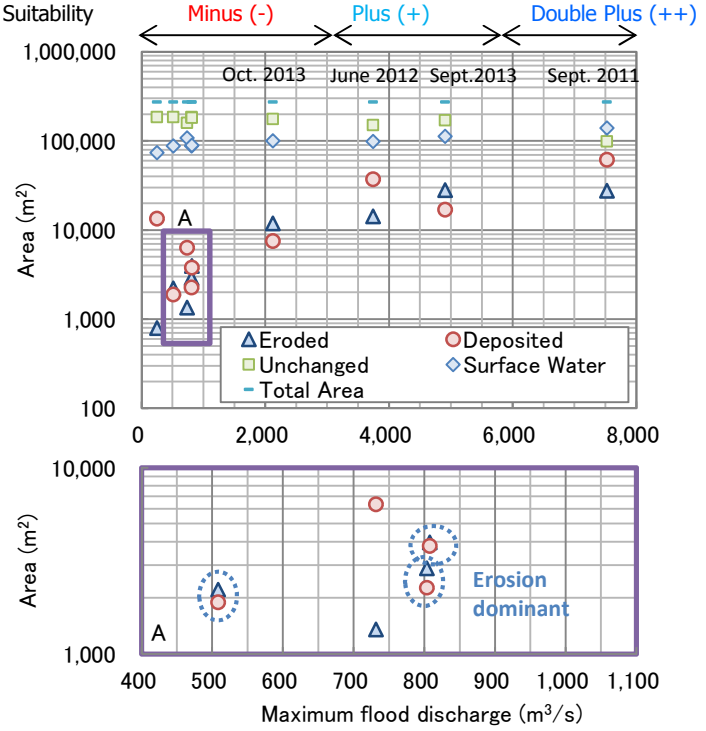


Figure 3.3.7 Relations between flood intensity and riverbed erosion and deposition areas. This figure also depicts geomorphological changing patterns and resultant SPs & BWs heterogeneity and Rf suitability.

3.4 Conclusions

Monitoring by a set of interval-recording cameras revealed that during small floods inundation processes of SPs and BWs are classified with two types of lentic and lotic systems and these systems determine the riverbed softness at a micro habitat scale. Riverbed softness is high in lentic systems and low in lotic systems. We developed a 2-D model applying a photogrammetric method. This model showed effectiveness to quantitatively analyze erosion and deposition processes with certain accuracy, by

transforming photo data to 2-D images with the orthogonal coordinate system. This result showed large floods significantly change channel configuration, as a result of which new habitats are created. Middle floods do not have the potential to change the channel configuration, but change can occur at a macro habitat scale and renew existing habitats such as Rfs by deposition within a bar formed after large floods. Small floods can change at a micro habitat scale, for example Rfs get continuously hardened. These results showed that geomorphological processes and resultant habitat suitability and heterogeneity are characterized more or less by flood intensity. Even though we need to accumulate data and another effect influencing suitability and heterogeneity, e.g., timing and frequency of floods, vegetation effects, etc., it is revealed that they can be explained by a spatial hierarchy at reach, macro habitat, and micro habitat scales, and its temporal changing patters due to floods with different intensity.

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4 Development processes of spawning redds for Ayufish (*Plecoglossus altivelis altivelis*) under shifting habitat history

4.1 Introduction and objectives

4.1.1 Background

The river geology is composed of various habitat types such as riffles and pools, side pools, back waters, etc., and has spatiotemporal patterns by creating and eliminating these habitats due to deposition and erosion processes induced by flood events. In order to evaluate the river ecology, a perspective of spatiotemporal patters of habitats is of particular importance (Hyodo et al, 2013 and 2014a). Ayufish (Scorpaeniformes, Plecoglossidae, *Plecoglossus altivelis altivelis*) is amphidromous fish, born in the upstream of a freshwater river, and migrated to estuaries and ocean as larvae to grow up and spawn. Ayufish are considered to be one of the most important resources in many Japanese rivers of freshwater. Various studies on Ayufish have been conducted in Japan. Among others, spawning redds for Ayufish have been one of study agenda for many researchers, since suitable spawning habitats for Ayufish have been deteriorated due to human interventions for flood and water resources management. Previous studies emphasized that suitable spawning habitats for Ayufish are riffles (e.g., Ishida, 1961 and Hyodo et al, 2014b), loose gravel riverbed (Ishida, 1962 and 1964), representing particle size of spawning redds is composed of sand and gravel materials less than 30 mm (Ishida, 1961), etc. There have been also previous studies addressing importance of velocity and water depth under ordinal conditions (Ishida, 1962, and Chibana & Tamai, 2002), Froude number (Nogami, 2001), friction velocity during flood events (Oniduka, 2007), etc. These previous studies have generally evaluated spawning redds for Ayufish by static indicators, but have not evaluated spatiotemporal patterns of spawning habitats. On one hand, looking into dynamic indicators, there is a research, addressing spatial and temporal continuity in the life cycle of freshwater fish and evaluating habitats of riffles by a ratio of surface riverbed area between gravels and other riverbed materials (Tashiro, 2002). Ishida (1964) showed that suitable spawning redds for Ayufish could be developed at riffles where plural tributaries are merged or bending reaches, since these channels around riffles are complex and dynamic equilibrium of flow and sediment is sustained. However, there are least studies that analyze physical conditions of dynamic flow and sediment regimes and spatial distribution characteristics, from a perspective of channel configuration or sandbar transport at a reach scale. Hyodo et al (2014) showed softening and hardening processes of riffle structure, i.e., riverbed of a riffle head gets hard receiving small floods, while it gets soft just after around mean annual maximum (middle) flood. It also showed that in order to obtain soft riverbed at a riffle head, deposition is required due to middle flood that can transported sediment from upstream and sandbar front has the potential to create such soft riverbed. This previous study, however, neither showed the riverbed conditions, spatial hierarchal structures (i.e., micro, macro, and reach scale hierarchy), nor development processes of spawning redds for Ayufish, which have been verified by observed data on the redds where actually Ayufish spawned.

From a broader perspective, similar characteristics of spawning habitats are used by Salmon and Trout,

among others in U.S.A. and Europe, for example, in the Columbia River (Geist and Dauble, 1998, and Geist, 2000), Merced River (Utz et al, 2013) and Trinity River (Brown and Pasternack, 2007) in California, Salmon River in central Idaho (Isaak and Thurow, 2006), and Moosach River of the Danube River basin in Germany (Pulg et al, 2013). Requirements for spawning habitats for Salmon and Trout have been considered to be shallow water depth in lotic systems (Louhi, 2008), high dissolved oxygen (Geist, 2000), loose gravels (e.g., sediment porosity) (Louhi, 2008 and Utz et al, 2013). In addition, the importance of interstitial flows in the hyporheic zone has been emphasized for suitable spawning habitats (Geist and Dauble, 1998, Geist, 2000, and Utz, 2013). In these rivers, river restoration projects have been carried out and some of these projects addressed the importance of sediment dynamics by sediment augmentation in the Trinity River (Brown and Pasternack, 2007), Merced River (Utz et al, 2013), and Columbia River (Geist, 2000). However, there is still a need for analyzing development processes of spawning habitats in relation to flow and sediment regimes for such restoration projects to be effective and further enhanced.

4.1.2 Current trend of Ayufish in the Tenryu River in Japan

The Tenryu River is well known in Japan as production area for Ayufish (*Plecoglossus altivelis altivelis*). Catch amount of Ayufish has been currently reducing. Confirmed amount of juvenile fish migrating downstream estuary and ocean have been 2 billion in 1980s, but reduced to some thousand million in 1990s and 2000s at maximum (Tenryu river fishermen's corporative, 2012). Since it is realized that there is a correlation between amount of juvenile fish migrating downstream and amount of adult fish migrating upstream, reduced catch amount of fish implicates reduced amount of juvenile fish. The current riverbed of a downstream reach of the Tenryu River has been covered with gravels. However, increased transport of fine sediment due to dam operation and resultant in particle size distributions of sediment can lead to reduced loose gravel riverbed suitable for spawning redds and reduced gravels covered by algae suitable feeding, degrading ecological requirements for Ayufish.

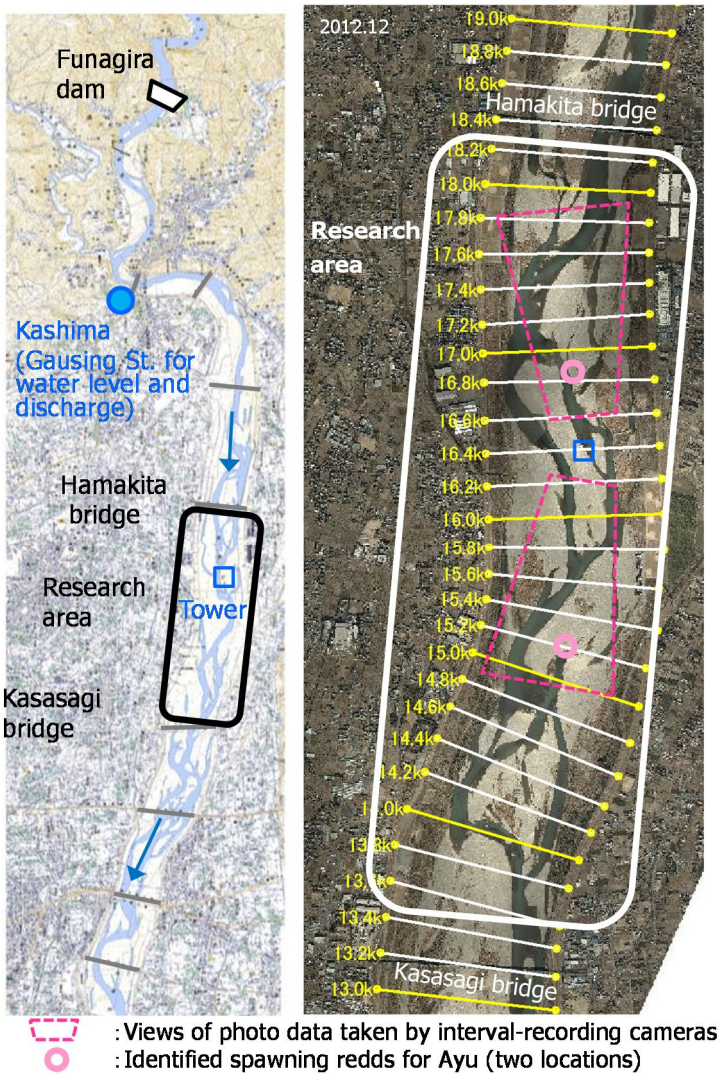


Figure 4.1.1 The study area in the Tenryu River Japan.

4.1.3 Objectives

Objectives of this chapter are to analyze formation and conditioning processes of spawning redds in relation to shifting habitat history in the Tenryu River, using interval-recording cameras and field measurements of the riverbed conditions. The study area is around 16.4 k-point from its river mouth (from 13.2 to 18.2 k-point, see Figure 4.1.1), which is the downstream reach of the Tenryu River and is assumed to have the potential for developing spawning redds according to a report published by Tenryu River fishermen's corporative (2012). Even through this study area is located at a downstream reach of a Funagira dam (lowest dam in the Tnryu River), the riverbed frequently changes due to floods. The river slope is 1/520 to 1/650 and representative grain diameter (60%) is 60 to 73mm. Channel configuration of the study area is composed of coexisting of braided and alternating bars according to classification of Muramoto et al (1977), which is characterized by relations with channel width, slope, and grain size.

4.2 Methods

We selected 16.4 k-point of the Tenryu River for the study area where have been assumed to have a number of spawning redds for Ayufish (Tenryu River fishermen's corporative, 2012) and conducted the surveys depicted below in section 4.2.1to 4.2.5.

4.2.1 Surveys on exploring spawning redds for Ayufish

A survey on spawning redds for Ayufish was conducted in November and December 2013 at a reach from 13.2 to 18.2 k-point of the Tenryu River (see Figure 4.1.1) in corporation with the Tenryu River fishermen's corporative. This survey was conducted by visiting irregularly to this field and exploring spawning redds for Ayufish. According to the report of Tenryu River fishermen's corporative (2012), this reach has been considered one of principal area for spawning redds as of 2006. However, number of spawning redds have been gradually reduced and have finally been no more considered as the principal area as of 2010. Currently, some amount of downstream migration of lavae has been confirmed through surveys conducted by Tenryu River fishermen's corporative (2012). Nevertheless, despite numerous efforts that have been made to explore spawning redds, they have not been confirmed in shallow riffles, where have been considered popular in general for suitable spawning redds.



Figure 4.2.1 Surveys on exploring spawning redds for Ayufish (*Plecoglossus altivelis altivelis*).

4.2.2 Water quality surveys

In order to understand physical conditions of spawning redds, we measured both surface water quality and interstitial water quality (20 cm below ground level, see Figure 4.2.2) at the spawning redds and other habitats such as riffles, back waters, and side pools during the field surveys to analyze these results for comparison. Water quality surveys were conducted on 22 November 2013. Water temperature, water depth, dissolved oxygen (DO), turbidity were measured through these surveys. Here in this chapter 4, we only discuss DO of surface and interstitial water, since DO only showed certain differences between spawning redds and other habitats.



Figure 4.2.2　Sampling of interstitial water flowing 20 cm below the riverbed. A pile together with a long tube is penetrated into soils until they reached to 20 cm below the riverbed. A suction syringe is connected to upper side (above riverbed) of the tube and used to get interstitial water for measuring water quality.

4.2.3 Surveys on riverbed softness

Surveys on riverbed softness were conducted at spawning redds and other habitats, i.e., riffles, back waters, and side pools, as well as those by water quality surveys. There are several ways to measure riverbed softness such as by Hasegawa Soil Penetration Tester (developed by Ohshima Landscape Construction Co., Ltd.) and "*shino*" used by authors (Hyodo et al, 2013), and stepping (Onitsuka, 2007). Hasegawa Soil Penetration Tester uses a drop weight with 2 kg fallen by 50 cm. Gravitational potential energy, which are obtained by 50 cm-fallen is transmitted to energy to penetrate the bottom edge into soil (Figure 4.2.3). Number of drops penetrating into soils reached to 100cm depth is continuously measured and recorded. Accuracy of Hasegawa Soil Penetration Tester is objectively sustained, but numerous times are required to measure a number of points. On the other hand, "S*hino* (Japanese name) is made with a small steel pipe, of which one edge is sharp (Figure 4.2.4). The sharp side edge is penetrated into the riverbed with a certain load by hand, and the depths under the riverbed surface is measured and recorded. Measurement of riverbed softness by *Shino* is simple and easy to use, enabling to measure numerous points effectively. However it is needed that accuracy of this measurement is verified when used for comparative analysis, since values (i.e., depth) obtained through this measurement depends on the certain load by hand. Therefore, we measured riverbed softness both by Hasegawa Soil Penetration Tester and *Shino* at same points. The correlation between results of these two measurements is shown in Figure 4.2.5. As for Hasegawa Soil Penetration Tester, we adopted the average penetration depth (cm/number of drops) reached to 15 cm for the correlation with *Shino*, which could be likely physical conditions for suitable spawning redds for Ayufish. Sample data for this correlation include results obtained for three years by Murai (2012), Awazu (2013) and Izumi (2014). This result showed high correlation meaning that the accuracy is verified by adopting *Shino* for measuring riverbed softness.



Figure 4.2.3　Riverbed softness measured by Hasegawa Soil Penetration Tester



Figure 4.2.4　Riverbed softness measured by "S*hino*"

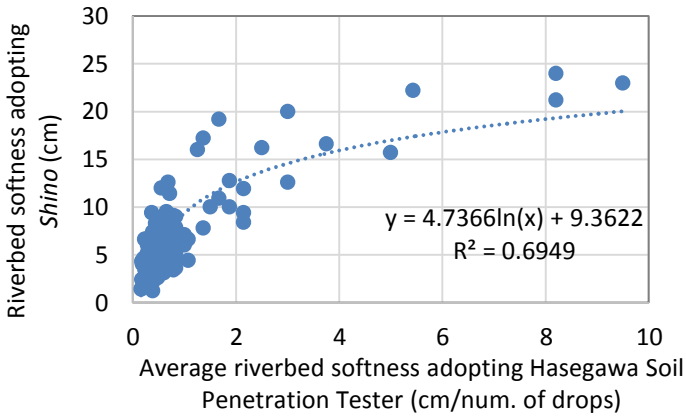


Figure 4.2.5　Correlation of riverbed softness between Shino and Hasegawa Soil Penetration Tester.

4.2.4　Sediment sampling and image analysis

A quadrat with 25 cm length and 25 cm width was placed on the riverbed of spawning redds and other riffles, which are generally known as suitable spawning redds for Ayufish. We took photos of a quadrat at 50 cm above the riverbed and analyzed grain size distributions by image processing. In the process of image processing, the quadrat was divided longitudinally and laterally by four grids each, at just below which length of major and minor axes of gravels were measured. Grain size just blow each grid was averaged by major and minor lengths, and was classified by three groups: 20 mm $<$ d, 20 $\leq$ d $\leq$50 mm, 50 mm $\leq$ d. Here d is diameter (mm) representing grain size image-processed. 20 cm to 50 cm of d are considered desirable for spawning redds for Ayufish in general. This analysis will not be able to measure smaller sediment such as fine sediment and sand. However, since this study address gravels as suitable spawning redds for Ayufish, we decided to adopt this image processing for measuring grain size of the riverbed.

4.2.5 Analysis on Riverbed changes in the riverbed through interval-recording digital cameras

Interval-recording digital cameras (hereafter referred to as interval cameras) have been installed at an electronic supply towers at 16.4 k-point of the Tenryu River since August 2012 and these interval cameras have been taking photos hourly to upstream and downstream reaches of the river (Figure 4.1.1). We used these photo data taken before a spawning period for Ayufish on 16 September and after a middle flood occurred on 26 October 2013 in order to analyze riverbed changes due to the middle flood. An hourly hydrograph of discharge at Kashima (a nearest gauging station for discharge, see Figure 4.1.1 for reference) is shown in Figure 4.2.6. Prior to our surveys on spawning redds conducted in November and December 2013, the study area received a middle flood at which hourly peak discharge is 4,900 m3/s on 16 September and a small-to-middle flood at which hourly peak discharge is 2,120 m3/s on 26 October. Particularly, photo data taken before and after a middle flood were orthogonized through a photogrammetric method for developing a 2 D model. For reference methodology for developing a 2 D model by the photogrammetric method are explained in Chapter 3 in detail. Therefore, here in this study we only showed results obtained by a 2D model.

Furthermore we analyzed geographical changes of the riverbed on which spawning redds for Ayufish exist, from larger spatiotemporal scales such as channel configuration and sandbar movement characteristics. Aerial photos taken in August 2010, December 2011, and December 2012 were used to analyze spatiotemporal patterns of the riverbed and locations of sandbars in relation to spawning redds we found. As shown in Figure 4.2.6, during a period among a set of aerial photos, a reach including the study area has received a large flood of which its peak discharge was 7,520 m3/s and a middle flood of which its peak discharge was 3,740 m3/s. Importantly, geographical changes at reach or larger scales have occurred during this period. We also checked sediment volumes of deposition and erosion, using data on cross section surveys (obtained every 200 m) between 2008 and February 2013 in order to analyze deposition and erosion characteristics at a reach scale (i.e., alternating sand bar scale) and influence of history of geographical changing patterns on spawning redds.

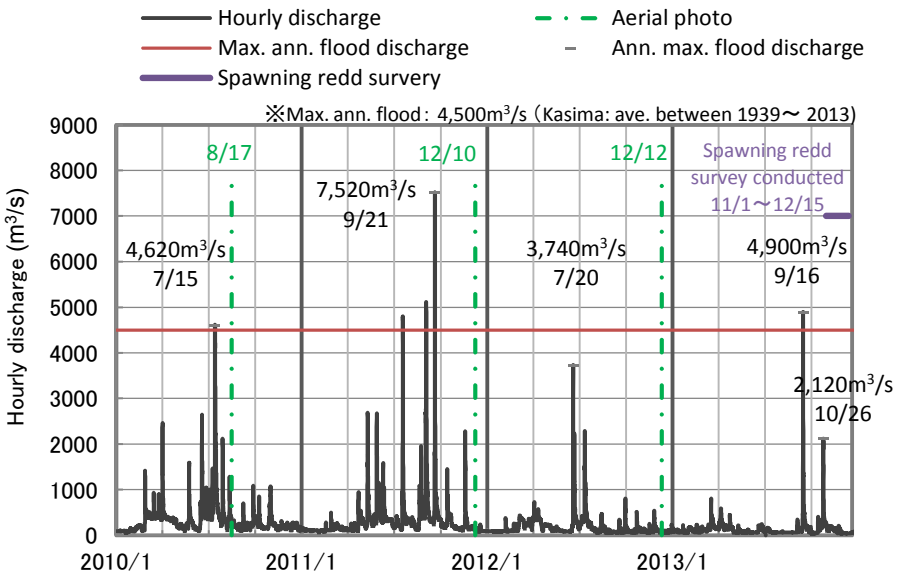


Figure 4.2.6 Hydrograph of the hourly discharge at the Kashima station in the Tenryu River.

4.3 Results

4.3.1 Spawning redds and eggs found

In an effort to explore spawning redds for Ayufish, we found spawning redds and eggs at only two locations, first one at the upstream of the camera site confirmed on 15 November 2013 and second one at the downstream of the camera site confirmed on 15 December 2013 (see Figure 4.3.1). However, we could not find at other locations. Two locations are what we call Up-SP-Riffle-21 and Dn-SP-Riffle-22 and these locations are different from riffles along channels, which have been generally considered suitable for spawning according to previous studies (Ishida, 1961 and Hyodo et al, 2014a). These locations are, however, small riffles neither along nor directly connected to channels, but connected to upstream side pools (SPs) where flows are coming through the spring welling up, referred to as SP-Riffle (or SP-Rf). Eggs we found on 15 December 2013 in the downstream were eyed ones. According to information obtained at the field, these SP-Rfs are composed most of gravels with 20 to 50 mm, and its riverbed were not filled with sand but rather formed loose gravels.



Figure 4.3.1 Spawning redds and eggs found. Downstream and upstream photos at 16.4 k-point were taken via interval-recording cameras hourly over the survey period. Habitat types were identified and two spawning redds were found.

4.3.2 Characteristics of dissolved oxygen at surface and interstitial layers

We compared dissolved oxygen (DO) between SP-Rfs and other habitats such as riffles, back waters, and side pools, where are located within area of photo data taken by interval-recording cameras. A survey on DO for surface and interstitial waters was conducted on 22 November 2013 and results are shown in Figure 4.3.2. At Up-SP-Rf-21 and Dn-SP-Rf-22, where spawning redds were found, average values of DO were 11.8 mg/l in surface water and even 6.9 mg/l in interstitial water. DO in surface water at SP-Rfs were almost same as those at other riffles, and greater than those at back waters and side pools. On the other hand, DO in interstitial water at SP-Rfs were smaller than those in surface water. But it was revealed that a certain amount of Oxygen was indeed supplied to water flows at SP-Rfs through interstitial layers, even though SP-Rfs were not directly connected to lotic flow systems of surface water.

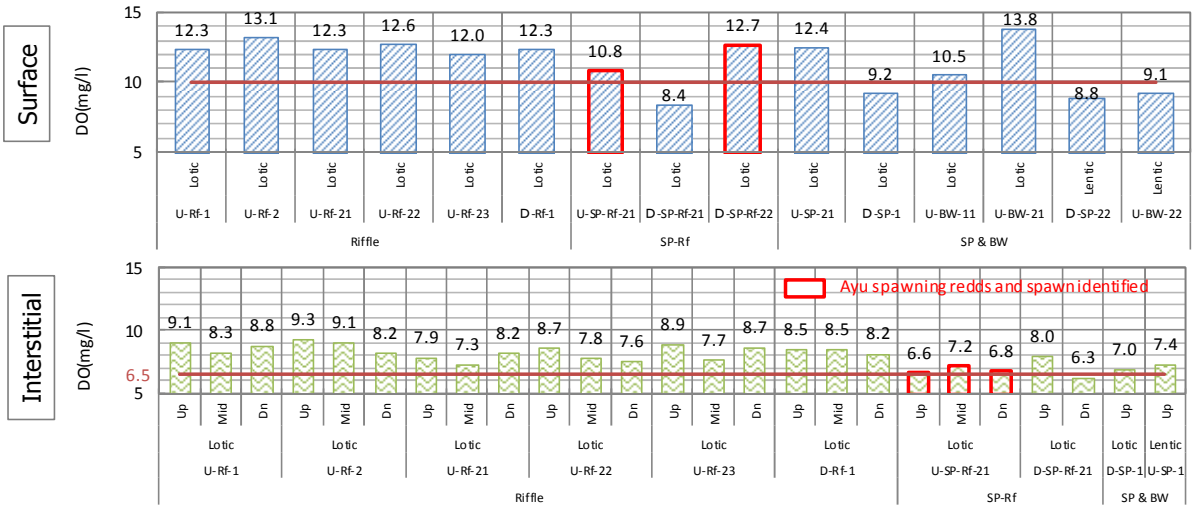


Figure 4.3.2 Comparison of Dissolved Oxygen (DO) at surface and interstitial layers among habitats of different types. Surveys were conducted on 22 November 2013.

4.3.3 Characteristics of riverbed softness

Results of riverbed softness surveys are shown in Figure 4.3.3. Greater values of riverbed softness indicate that the penetration depth by *Shino* is large, explaining the riverbed is soft and vice versa. SP-Rfs, where spawning redds were found, showed average riverbed softness of 12.5 cm, which was greater than that of riffles and back waters. There is a reason why riverbed softness of riffles is low. Riffle riverbed is deposited when more than middle floods occur, leading to soft riverbed. However, subsequent and recurrent smaller floods erode riffle riverbed, gradually leading to hard riverbed and resultant degraded spawning redds (Hyodo et al, 2014a). High riverbed softness identified at side pools could be explained that fine sediment and sand are likely to be deposited during recession stages of recurrent small floods (Hyodo et al, 2014a). Characteristics of riffles, back waters, and side pools are different from those of SP-Rfs. As such, SP-Rfs, where spawning redds and eggs were found, have higher values of both DO and riverbed softness, as compared with other habitats, assuming that flowing and spring water welled up, and soft riverbed are prerequisite for sustaining spawning reds for Ayufish.

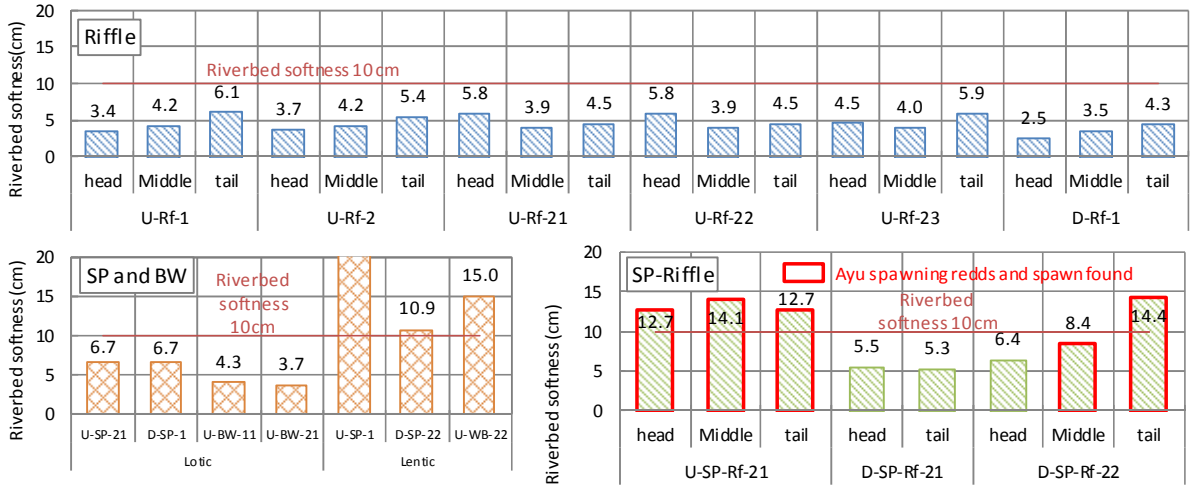


Figure 4.3.3 Comparison of riverbed softness measured by *Shino* among habitats of different types. Surveys were conducted on 22 November 2013.

4.3.4 Grain size characteristics

Figure 4.3.4 shows grain size distributions. A ratio of grain size from 20 to 50 mm in SP-Rfs, where spawning redds and eggs are found, seems to be larger than those in other riffles. A ration greater than 50 mm in SP-Rfs seems to be smaller than those of other riffles. A ratio less than 20 mm does not show relevant differences between SP-Rfs and other riffles. This result and information obtained on the field showed that the riverbed is not composed of grain size larger than 50 mm around spawning redds for Ayufish but composed most of small sand and gravels, of which grain size is smaller than 50 mm.

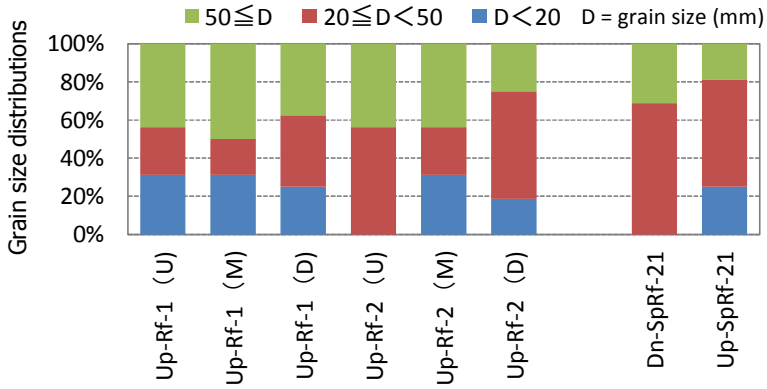


Figure 4.3.4 Comparison of grain size distributions among spawning redds and other riffles. Surveys were conducted on 22 November 2013 and analyzed by image processing. Letters described in ( ) for each riffle refer that U is the riffle head, D is the riffle tale, and M is in the middle location between U and D.

4.3.5 Changing patterns of the riverbed at different spatial scales

1) Habitat-scale changing patterns

Figure 4.3.5 shows results of changing patterns of the riverbed at a habitat scale, which was represented by deposition and erosion area by a middle flood (4,900 m3/s) on 16 September 2013. Two photo data taken by interval-recording cameras were orthogonized using the photogrammetric method, of which two orthogonized figures (before and after the flood) were superposed to exactly identify which area are deposited or eroded against the initial riverbed and surface water boundaries. This middle flood caused changes that reduced riffle area by deposition around a sandbar front as depicted in I of Figure 4.3.5. Along a secondary channel 2, a new riffle, namely Up-Rf-23, was created at II of Figure 4.3.5, leading to increased water level at just upstream of this riffle. Because increased water level just upstream of the Up-Rf-23 has got higher than water level at secondary channel 1, this water level differences developed energy gradient, thereby having created a spring water flow welling up into a side pool (SP) as shown in III of Figure 4.3.5. Further, a back water was located along a sandbar front, and therefore deposited by the middle flood, thus creating this SP upstream and a small channel downstream. This SP was connected with the secondary channel 2 by spring water under interstitial systems, and connected to the secondary channel 1 through the small channel, thus having created Up-SP-Rf-21, as shown in IV of Figure 4.3.5. Processes of creating spawning redds for Ayufish indicated importantly that there was no spawning redds existed before the middle flood occurred on 16 September 2013, but these spawning redds were created by this middle flood as a result of sediment movement and riverbed changes. These processes were explained and supported by a set of photo data taken during surveys before and after the middle flood as shown in Figure 4.3.6. The back water system changed to riffle one by welling-up of a spring water coming from the secondary channel 2 into the side pool, which was then connected to the riffle by the middle flood.

It has been discussed in the previous studies that suitable spawning redds for Ayufish are located in riffles downstream of sandbars (Sumi et al, 2011), they should be deposited before relatively near the spawning period (Suzuki et al, 2011), the riverbed of riffle heads should be soft (loose) (Murai et al, 2012) and deposition over riffles should occur by a middle or larger flood (Hyodo et al, 2014a). However, these previous studies simply assumed potential locations and some of possible conditions, which spawning redds may be created without finding substantial spawning redds and eggs. This study identified exact locations of substantial spawning redds and eggs, which have rarely been found over years, and revealed that spawning redds were created as a results of sandbar movement and geographical changes due to a middle flood, sandbar fronts have the potential to create spawning redds, and assumptions obtained through previous studies have been proved based on substantial and physical data.

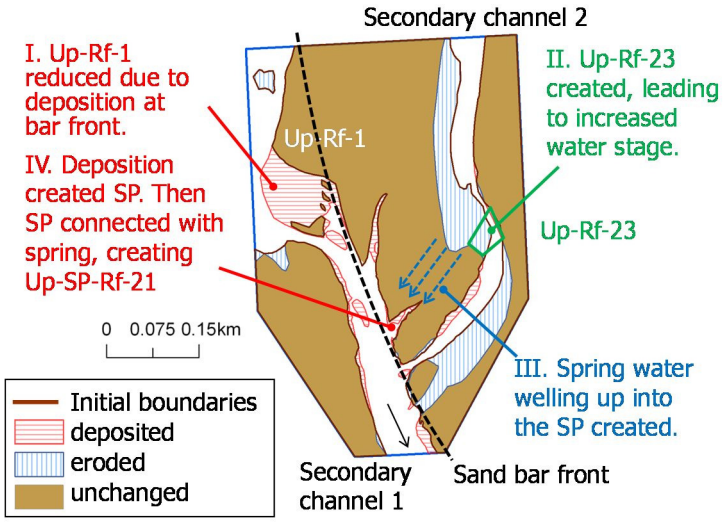


Figure 4.3.5 Riverbed change by erosion and deposition after middle flood in September 2013 with the discharge of 4,900m3/s. The photogrammetric method was used for developing 2 D orthogonal data.

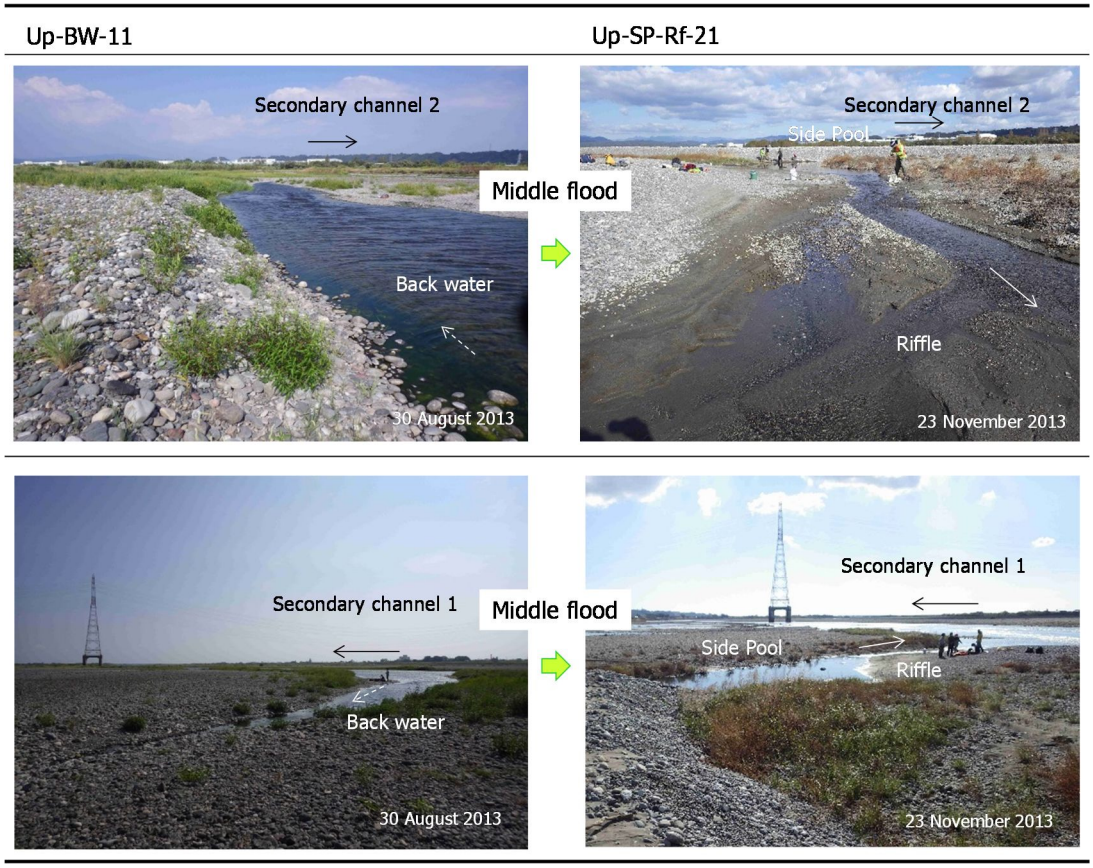


Figure 4.3.6 Development processes of spawning redds for *Plecoglossus altivelis altivelis* at a reach scale.

2) Reach-scale changing patterns

Aerial photo data taken in August 2010, December 2011, and December 2012 were used in order to analyze middle term changing patterns around locations, where two spawning redds were found as shown in Figure 4.3.7. Spawning redds found at the upstream reach of the tower had been a channel until December 2011. This channel was located along a sandbar front and deposited by a middle flood of which its peak discharge was 3,740 m3/s on 20 July 2012. Similarly, spawning redds at the downstream reach of the tower have been a channel until August 2010. This channel was located also along a sandbar front and deposited by a large flood of which its peak discharge was 7,520 m3/s occurred on 21 September 2011. There seems to be coexisting of alternating bars and braided bars (relatively smaller than alternating ones) and a mass movement downstream at a scale of the channel configuration (see Figure 4.3.7), and both of which are likely to contributing to spatial distributions of spawning redds for Ayufish. It is assumed that: locations of spawning redds used to be channels; these channels were deposited due to mass movement of sandbars along a sandbar front; riverbed layers of sandbar front were composed of small loose gravels on the surface layers, which could be one of important physical conditions determining suitable for spawning redds, and composed on the other hand of course gravels on the interstitial layers, which could have the potential to create spring water providing important inputs of oxygen into water flows.

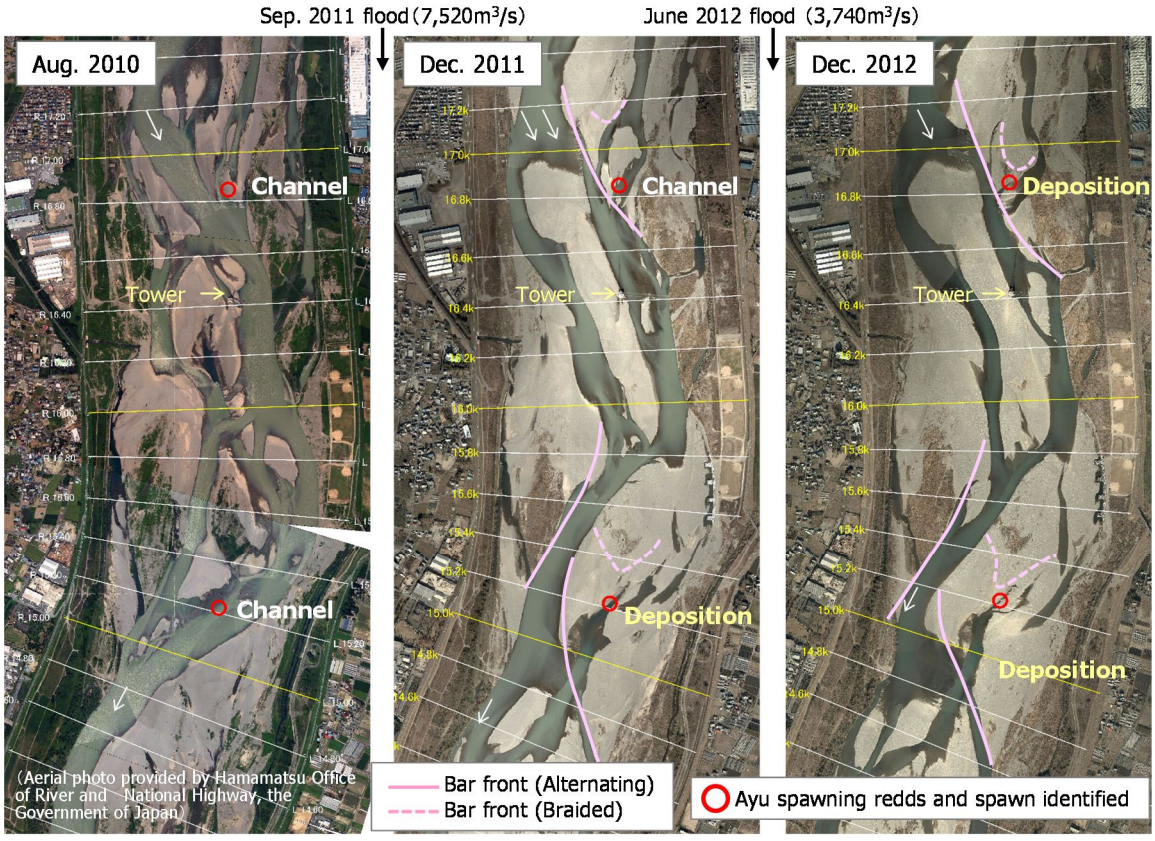


Figure 4.3.7 Riverbed changing patterns at a reach scale by aerial photos from 2010 to 2012 in relation to configuration of sandbar front and spawning redds.

Figure 4.3.8 shows a longitudinal profile of riverbed variations represented by sediment volumes of deposition and erosion, using data on cross section surveys (obtained every 200 m) between 2008 and February 2013. This figure shows deposition and erosion volumes respectively and its differences to analyze relations between locations of spawning redds, and a scale of sediment movement and its characteristics of whether deposition or erosion are dominant. Previous studies assumed that suitable spawning redds are deposition dominant reaches (Takemon et al, 1995, and Hyodo et al, 2014a). This study proved this assumption by comparing with substantial phenomenon this study observed. This result shows that longitudinally there are several reaches, where are deposit and erosion dominant, and these deposition and erosion reaches alternately appear approximately at a scale of alternating sandbars (i.e., a reach scale). This result almost corresponds to locations of alternating sandbars identified at aerial photos shown in Figure 4.3.7. We also confirmed that locations of spawning redds found at 16.9 k-point and 15.2 k-point were both deposit dominant reaches. Thus, results obtained by analysis using aerial photos and riverbed variations showed that spawning redds found used to be channels and were created by deposition along a sandbar front due to a middle flood.

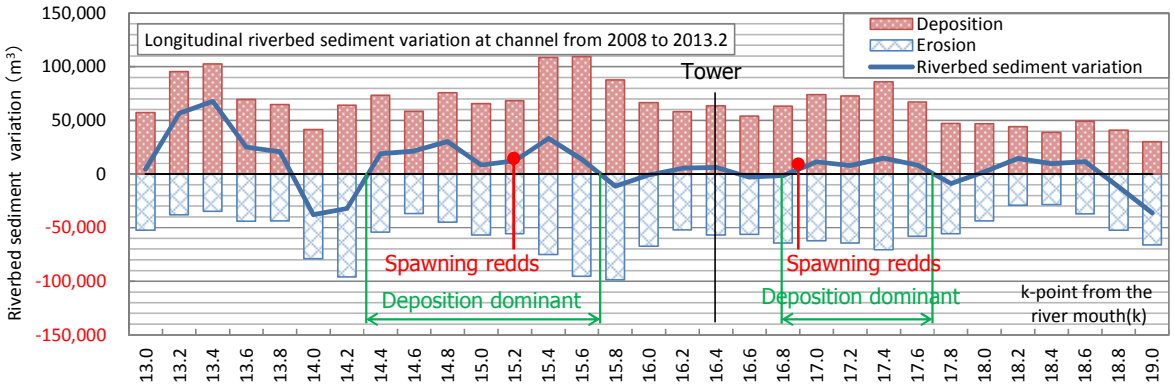


Figure 4.3.8 Longitudinal profile of riverbed change volumes by erosion and deposition between 2008 and 2013.

4.4 Discussions

4.4.1 Temporal variables of suitable spawning redds

Previous section 4.3.5 analyzed how spawning redds for *Plecoglossus altivelis altivelis* were developed in relation to riverbed changing patterns induced by a middle flood. This section discusses how long suitable spawning redds could be sustained, addressing the deteriorating processes. Figure 4.4.1 showed photos of spawning redds at Up-SP-Rf-21 during and post the spawning season. The riffle system (i.e., lotic shallow flows) found during the spawning season had turned into dry area and had been composed as part of a sandbar front. The same processes were also seen at Dn-RSP-Rf-22 (see Figure 4.4.2).



Figure 4.4.1 Degrading processes of suitable spawning redds at Up-SP-Rf-21.

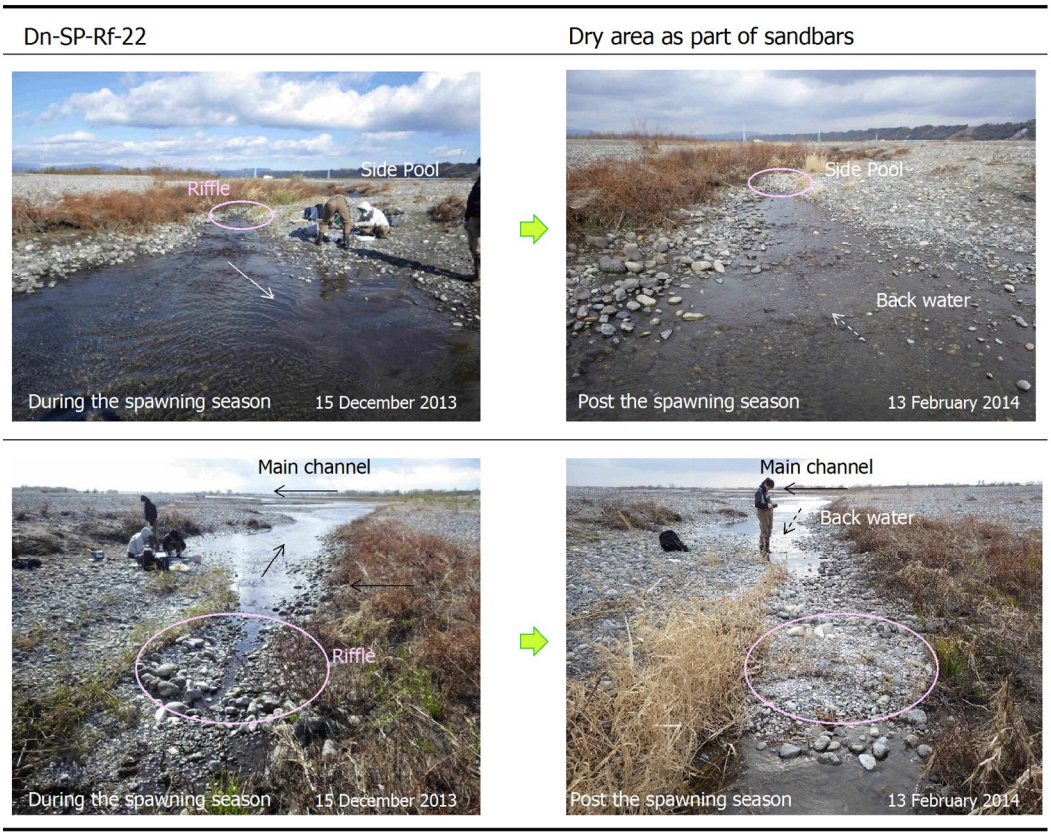


Figure 4.4.2 Degrading processes of suitable spawning redds at Up-SP-Rf-21.

This result may indicate that the water stage was lowered due to reduced discharge as part of seasonal variability under flow regimes. However, as shown in Figure 4.4.3, which depicts discharge and water-stage hydrographs and dates at which photos of during and post the spawning season were taken, this figure shows that there were no relevant differences in discharge and water stages during and post the season. Another photo close to riverbed showed clear differences at a micro habitat scale (Figure 4.4.4). During the spawning season, the riverbed is composed of sand and loose gravels. On the other hand, in the post-spawning season, amount of spring water welled up were reduced by fine sediment deposition, thus causing clogging of waterways for the spring water. Since suitable spawning redds require but not limited to clear water represented by high DO values, loose riverbed represented by high riverbed softness, and riverbed composed of sand and gravels but not of fine sediment, as previously discussed in section 4.3.2 to section 4.3.4, the change occurred after the spawning season can be explained as deteriorating processes for suitable spawning redds and can also be considered to be intermittent habitats highly depending on intensity and timing of a flood event. A similar phenomenon has been seen at a restoration project on spawning habitats for Brown trout (*Salmo trutta*) through gravel addition and gravel cleaning, which was carried out in the Moosach River of the Danube River basin in Germany (Plug et al, 2013). The result showed that suitable habitats have been sustained for the first two years since restoration and then have turned into degrading processes toward unsuitable habitats by accumulation of fine sediment, which was expected to be reached 5 to 6 years after the restoration (Plug et al, 2013). Deteriorating processes of spawning redds in the Tenryu River seem to occur more rapidly

than those in the Moosach River, indicating that duration of suitable habitats for Ayufish will not last long after the creation, in other word, their habitat longevity is particularly short. Thus, not only spatial heterogeneity but also temporal variables due to disturbances should be duly addressed when analyzing the development and deteriorating processes under given flow and sediment regimes.

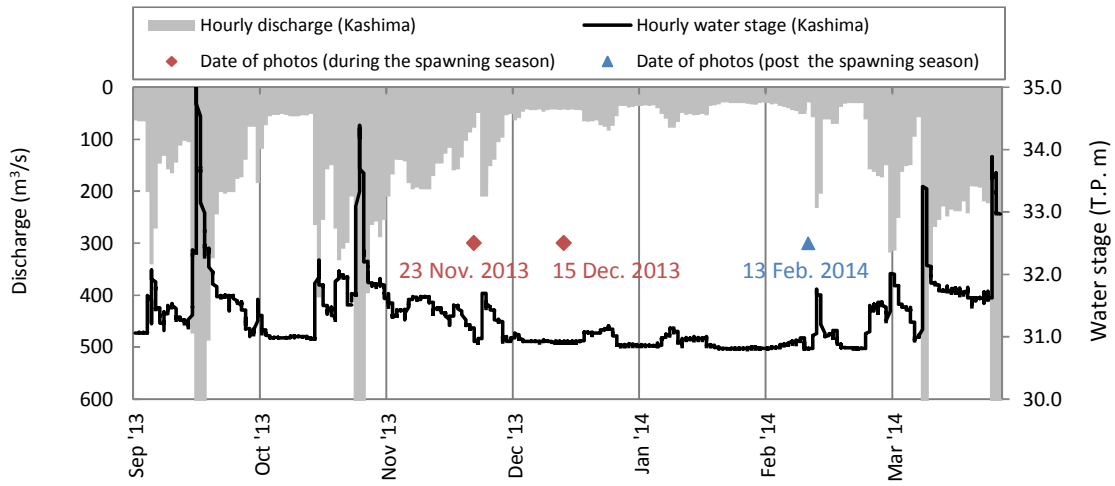


Figure 4.4.3 Discharge and water-stage hydrographs around the spawn season.

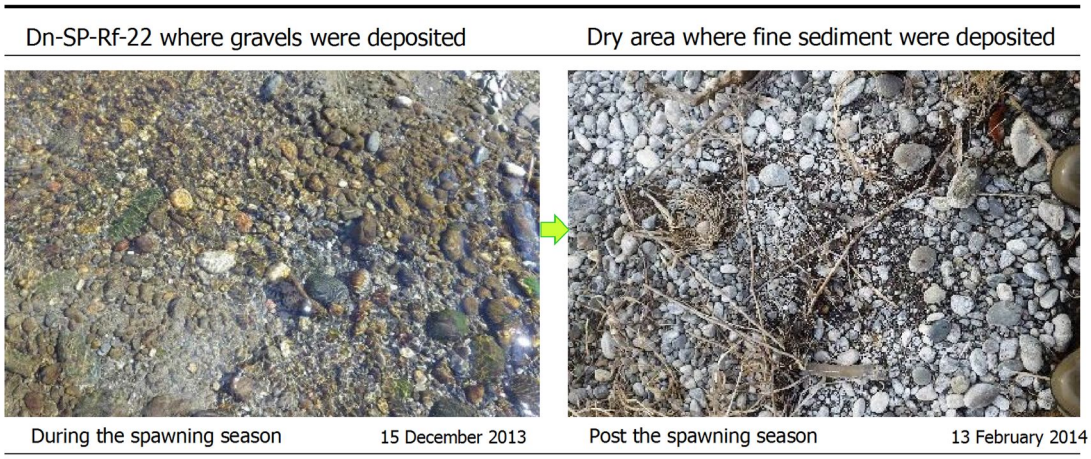


Figure 4.4.4 Riverbed change at a micro habitat scale during and post the spawning season.

We discussed formation and conditioning of spawning redds for Ayufish (*Plecoglossus altivelis altivelis*) and how they are dependent on intensity and timing of a flood event leading to riverbed changes. Figure 4.4.5 shows scenarios for suitable spawning redds. The scenario A refers to a desirable scenario since a middle-to-large flood occurs, habitat suitability for the spawning is optimized by this flood, and habitat suitability gets lowered (e.g., due to gradual clogging of sand and gravels) but it remains higher than ecological requirements during the spawning season. On one hand, in the scenario B, a late flood occurs during the spawning season. This means that suitable habitats for the spawning and spawned eggs were eliminated by this disturbance. Even though suitable habitats are newly created instead of existed ones,

the spawning season comes to an end within a short period not allowing enough for many species to spawn. In the scenario C, an early flood occurs far prior to the spawning season, leading to reduced habitat suitability lower than ecological requirements during the spawning season. When implementing ecological restoration for spawning redds for Ayufish as well as other species in general, how to design intensity and timing of disturbances is of particular importance. However, natural flow regimes cannot be operated unless upstream dams (or reasonable hydraulic structures) are operational to mimic flood pulse in order to develop a scenario A in Figure 4.4.5. Under natural conditions where mimicking of flood pulse is not expected by operation, alternative measures should be adopted to induce similar riverbed changing patterns, e.g., by channel modifications or sediment augmentations that satisfy ecological requirements.

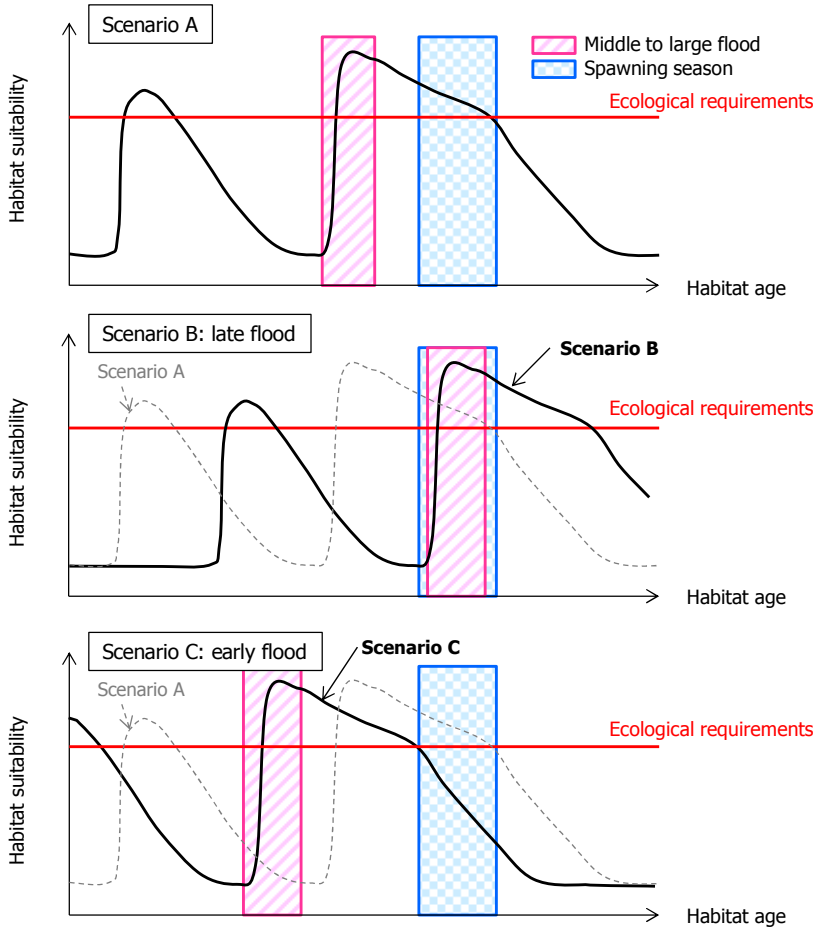


Figure 4.4.5 Scenarios for development processes of suitable spawning redds for *Plecoglossus altivelis altivelis*.

4.4.2 Approaches to ecological evaluation of spawning redds for *plecoglossus altivelis altivelis*

A set of results brought us to the following assumption regarding the requirements of suitable spawning redds that: locations of spawning redds used to be channels; these channels were deposited due to mass movement of sandbars along a sandbar front prior (but not too early or late) to the spawning period; riverbed layers of sandbar front were composed of small loose gravels on the surface layers; and composed on the other hand of coarse gravels on the interstitial layers, which could have the potential to create spring water providing important inputs of high dissolved oxygen (DO) into water flows. When it comes to a restoration project on spawning redds for Ayufish from current degraded systems, it is sophisticated that all the requirements for spawning redds be evaluated quantitatively. In its application of obtained results to practical projects, approaches could be to support habitat changing patterns (i.e., a part of fluvial systems) to occur, which can determine formation and functioning processes of spawning redds as analyzed over this chapter, and these processes could be explained by physical parameters.

Figure 4.4.6 shows simulation results of riverbed variations by the middle flood in September 2013. A quasi-three-dimensional flow and bed variation model developed by Okamura et al (2010) and Okamura and Fukuoka (2012) was used for this simulation and was verified by high and low flow characteristics (see subsequent section 5.2 for detail on the model and verification). This figure also depicts locations of habitat units where surveys on riverbed softness were conducted. Habitats of soft riverbed obtained by the middle flood such as U-SP-Rf-21, D-SP-Rf-22, U-SP-1, and U-BW-22 (see Figure 4.3.3 for survey results) were particularly deposited according to simulation results. On one hand, habitats of hard riverbed such as U-Rf-1, U-Rf-2, U-Rf-21, and U-Rf-22 were not apparently deposited according to simulation results. When deposition area is along a sandbar front such as U-SP-Rf-21 and D-SP-Rf-22, where spawning redds were found, these area can be assumed to have the potential to provide small gravels suitable for the spawing redds at the recession stage of floods. This result indicates that soft or hard riverbed softness and riverbed with small gravels are likely to be explained by deposition area along bar front and this process can be evaluated by adopting flow and bed variation models.

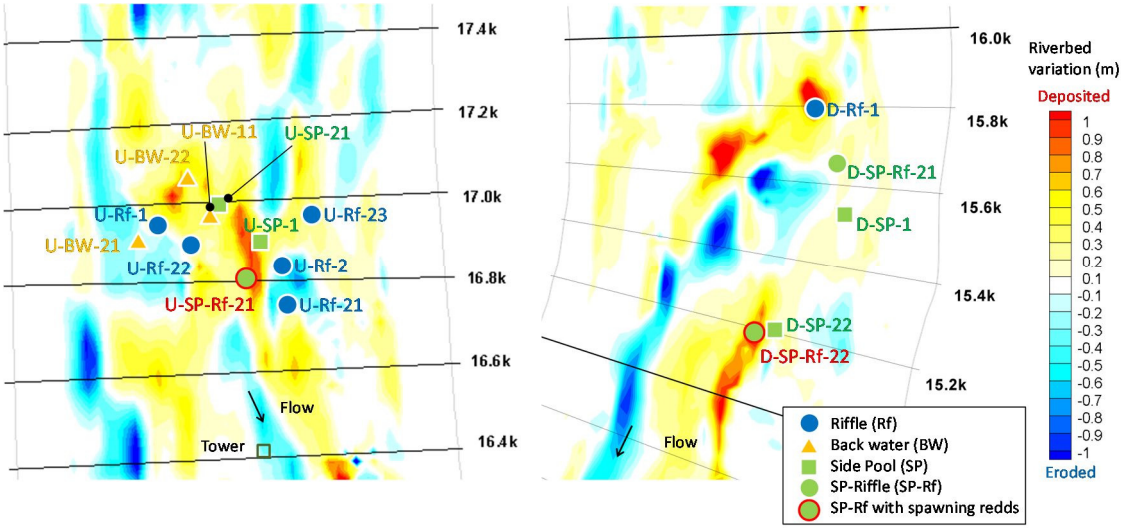


Figure 4.4.6 Simulation results of riverbed variations by the middle flood in September 2013.

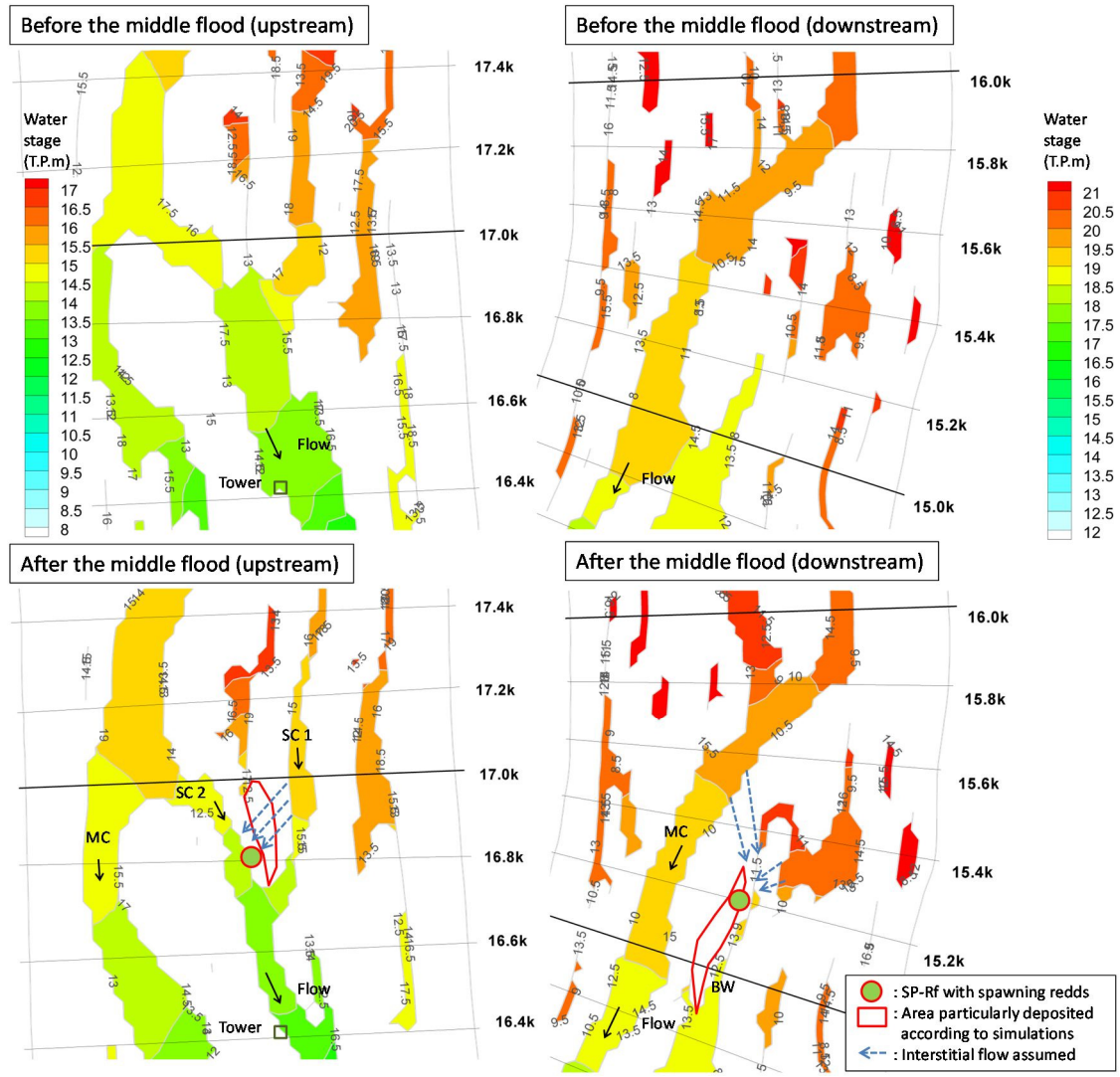


Figure 4.4.7 Simulation results of water stage distributions under low flows before and after the middle flood in September 2013. MC refers to the main channel, SC refers to the secondary channel, and BW refers to the back water.

Figure 4.4.7 shows simulation results of water stage distributions under low flow conditions before and after the middle flood in September 2013. In the upstream site after the middle flood (see left bottom of Figure 4.4.7), the water stage at 16.9 k-point of the secondary channel 2 (SC2) is approximately 1.0 m higher than that at 16.8 k-point of the secondary channel 1 (SC1). Area between these secondary channels was particularly deposited according to simulation results, indicating that spring water in interstitial layers from SC1 to SC2 are subject to occurring under the loose gravel riverbed created by particular eposition. In the downstream site after the middle flood (see right bottom of Figure 4.4.7), the water stage at 15.5 k-point of the main channel (MC) is approximately 1.0 m higher than that at 15.2 k-point of a back-water (BW). Area between the MC and BW were not particularly deposited but certainly deposited by the middle flood (see Figure 4.4.6), indicating that the same system as the upstream seem to work in the downstream spawning redds was found. Since spring water can provide inputs of high DO concentration, this result shows that high DO values and interstitial flows by spring water are likely to be explained by differences in adjacent water stages and deposition area and this process can be evaluated by adopting flow and bed variation models.

Even though there are various requirements of spawning redds for Ayufish, in its application to a restoration project, this section discussed approaches to simplifying exoplanetary valuables and to evaluating development processes of spawning redds using a flow and bed variation model as an example of the Tenryu River. There are several restoration projects on spawning habitats for Salomon and Trout, which habitat structures (requiring loose gravel riverbed) are similar, for example in Rhine (ICPR, 2004), Mokelumne River (Merz et al, 2006) and Trinity River (Brown and Pasternack, 2007) in California. These projects look at restoration of sandbars and creating loose gravel riverbed by augmentation, etc. However, some of results indicated that, for successful and sustainable implementation of restoration projects, causal mechanisms associated with geomorphic processes at the hydraulic and geomorphic unit scales should be explicitly evaluated (Brown and Pasternack, 2007) and large scale restoration at the basin scale should be attempted for middle and long term strategies (Plug et al, 2013). This study tracked and analyzed development processes of spawning redds, addressing shifting habitat history (i.e., spatiotemporal patterns) under given flow and sediment regimes in its ecological evaluation. Therefore, obtained results through this study can also provide inputs to other similar projects as one of approaches to analyzing shifting habitat history for ecological evaluation duly considering geomorphic processes.

4.5 Conclusions

Throughout this study on riverbed characteristics of spawning redds for Ayufish (*Plecoglossus altivelis altivelis*) and changing habitats, remarkable results were obtained. Surveys on exploring spawning redds for Ayufish were conducted and found two locations of spawning redds and eggs on 22 November and 15 December 2013. These locations are not riffles, where have been generally known to be suitable redds, but SP-Rfs, which was a small channel flowing from a side pools connected with spring water. Two

SP-Rfs, where spawning redds and eggs were found, had higher dissolved oxygen (DO) concentration in flows and soft (loose) riverbed as compared with other habitats such as riffles, back waters, and side pools, having assumed that suitable spawning redds for Ayufish require lotic and spring waters with higher DO and soft riverbed. A middle flood occurred two month prior to a spawning period brought sediment onto a back water in the form of deposition, having created a side pool, and a riffle was created along an adjacent secondary channel upstream. Increase in water level due to creation of this riffle led to a side pool connected with spring water, flowing to a small channel, namely SP-Rfs. Results obtained through analysis using aerial photos and riverbed variations occurred by middle term changes at a reach scale showed that spawning redds found used to be channels and were created by deposition along a sandbar front due to a middle flood. There seems to be coexisting of alternating bars and braided bars (relatively smaller than alternating ones) and a mass movement downstream at a scale of the channel configuration, and both of which are likely to contributing to spatial distributions of spawning redds for Ayufish. It is assumed that: locations of spawning redds used to be channels; these channels were deposited due to mass movement of sandbars along a sandbar front; riverbed layers of sandbar front were composed of small loose gravels on the surface layers, which could be one of important physical conditions determining suitable for spawning redds, and composed on the other hand of coarse gravels on the interstitial layers, which could have the potential to create spring water providing important inputs of oxygen into water flows. The analysis also revealed that suitability of spawning redds gradually gets reduced, thus indicating the importance of intensity and timing of a middle-to-large flood event, which can induce riverbed change in the form of deposition around the sandbar front.

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5 Habitat age effects on biodiversity of macro-invertebrates

5.1 Introduction and objectives

The riverbed is composed of various habitats such as riffles and pools, side pools, back waters, etc. These habitats are sustained, created, and eliminated as a result of disturbances induced by flood and sediment transport (Poff et al, 1997 and Sumi and Kantoush, 2010), thus providing habitats with various habitat longevity. It is considered that fluvial species segregate habitats according to their characteristics under disturbances (Takemon, 2005). In order to evaluate the river environment based on ecological knowledge, there is a need to understand relations between shifting habitat history and responses of species to its shifting patterns. Ecological researches in rivers have been proposing for recent decades several hypotheses such as the habitat templet concept, which focuses on the premise that the habitat under spatial and temporal heterogeneity conditions provides the templet on which evolution forges species characteristics (Southwood, 1977 and 1988 and Townsend, 1994) and the patch dynamics concept, which explains streams conform reasonably and closely to the patch dynamics explanation of community organization that emphasizes temporal phenomena (e.g., disturbances) and focuses on the importance of history and chance (Townsend, 1989). These concepts are different approaches to the river ecology from those traditionally discussed, which have emphasized that competition is overwhelmingly the most important in shaping stream communities (Yodzis, 1986) and several researches have appeared that address the importance of spatial and temporal heterogeneity (Ward et al, 2002 and Tockner et al, 2010). Recent studies implicated that habitat diversity in a shifting habitat mosaic could possibly optimize biodiversity, for example, a model of the shifting habitat steady state (Arscott et al, 2002 and van der Nat et al, 2003) and habitat age (Tockner et al, 2010) in the Tagliamento River in North Italy. However, only a few studies have traced spatial and temporal distributions of species that use habitats and quantitatively revealed these characteristics and behaviors. Further, even though there are previous studies analyzing habitat segregation of species from a perspective of spatial distributions (for example, Takemon et al, 1995), quite a few studies have analyzed temporal changing patterns and habitat age in addition to its spatial distributions, and its responses of species.

In this study, a particular attention was paid to age of habitats, i.e., riffles, back waters, and side pools, and macro-invertebrates as represented species for analyzing responses to disturbances. Habitat age effects on biodiversity macro-invertebrates were analyzed based on the photo data by interval-recording cameras and field survey data. Here we discuss habitat age rather than longevity, since our research period is not long enough to identify reasonable number of habitats they come to a birth and an end of their lives. However, we could understand various characteristics of habitat changing patterns and its relation to response of species by tracing them in detail through interval recording cameras and sampling of macro-invertebrates.

5.2 Methods

In this study, we used plenty of photo data taken by interval-recording cameras, which have been installed, since August 2012, 60 m high from the riverbed on the electric transmission tower located in the middle of a river corridor in the Tenryu River in Japan. Firstly, we conducted field surveys on macro-invertebrates in each habitat and classified spatial and temporal distributions of selected species. Secondly, based on the classification, we selected several species representing the classification, according to which we analyzed biological repose. Thirdly, we discussed how biological response is related to habitat changing patterns that are determined by spatial and temporal variables due to disturbances under given flow and sediment regimes.

5.2.1 Spatiotemporal patterns of habitats at the study site

The Tenryu River has the catchment area of 5,090 km2 and river length of 213 m in the Nagano, Shizuoka, and Aichi prefecture. The study area is at 16.4 k-point from its river mouth, the slope is 1/520 to 1/650, 60 % representative grain diameter is 60 to 73 mm, riverbed configuration is co-exiting of alternate and braided bars, and channel width is 1000 km. The lowest dam at the downstream reach is called Funagira dam located at 30 k-point for hydropower. A discharge gauging station has been set at Kashima at 25 k-point. There is an electric supply tower located in the middle of the river corridor.

Figure 5.2.1 shows long term habitat distributions and its changing patterns around the camera site, i.e., 16.4 k-point. Aerial phots were taken in August 2010, December 2011, December 2012, and February 2014. During this period a large flood (approximately 5-year RP) occurred between 2010 and 2011, a middle flood (approximately 2-year RP) between 2011 and 2012 and between 2012 and 2014. The large flood between 2010 and 2011 caused significant changes of the riverbed. At the “A” area in (a) and (b) of Figure 5.2.1, the main channel shifted to other secondary channels. At the “B” area in (a) and (b) of Figure 5.2.1, sediment was deposited on the secondary channel, shifting from the secondary channel to side pools. On the other hand, the two middle floods from 2011 to 2014 caused some changes. At the “C” area, a secondary channel has been widened by eroding adjacent banks. At the “D” area, a riffle was reduced by deposition. Thus, it can be said that disturbances caused by a large flood have the potential to changing channel configuration and those caused by a middle flood have the potential to changing the riverbed at a habitat scale in the Tenryu River. Figure 5.2.2 shows number of habitat units of riffle (Rf), back water (BW), and side pool (SP) in the camera site. Characteristics of this study site could be summarized that number of Rfs have been reducing and SPs have been increasing under the shifting history of the riverbed at a reach scale. Longitudinal riverbed variation within a river corridor in Figure 5.2.3 also explains that currently this study site has been deposition dominant area (i.e., sediment volume of deposition is larger than that of erosion within a river corridor,) at a large spatial scale in the Tenryu river.

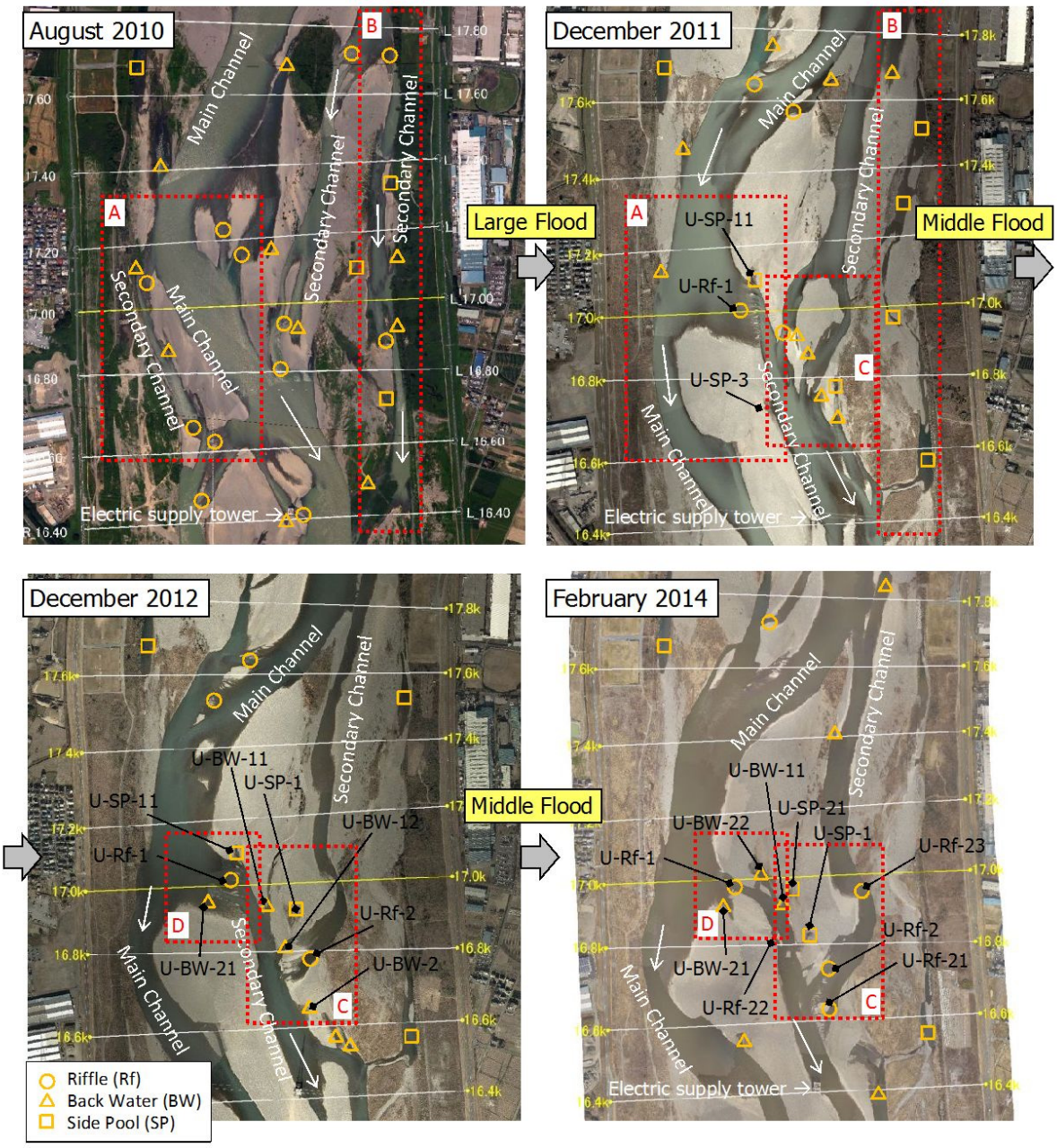


Figure 5.2.1 (a)　Habitat distributions and changing patterns from the camera site. (upstream)

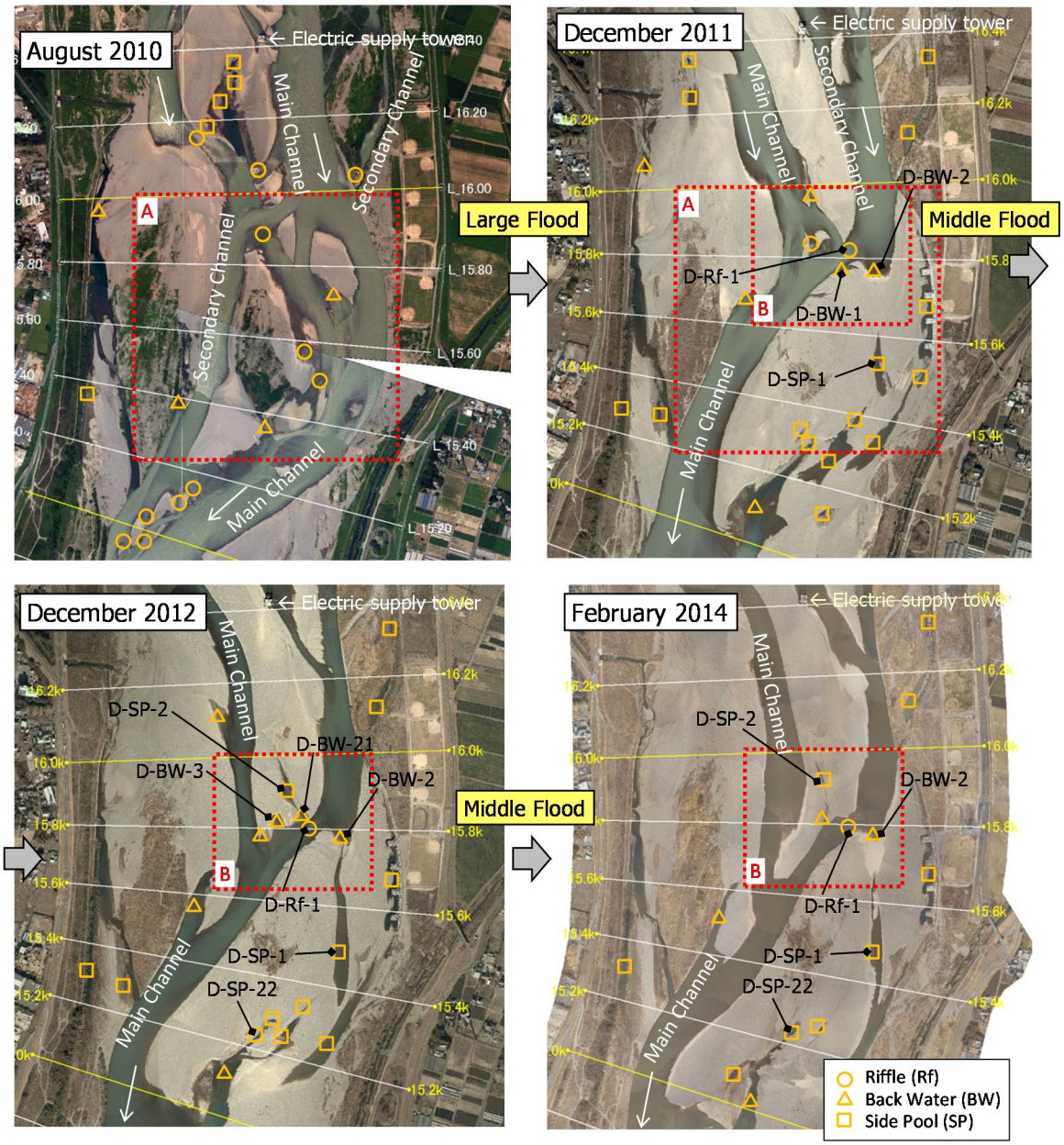


Figure 5.2.1 (b) Habitat distributions and changing patterns from the camera site. (downstream)

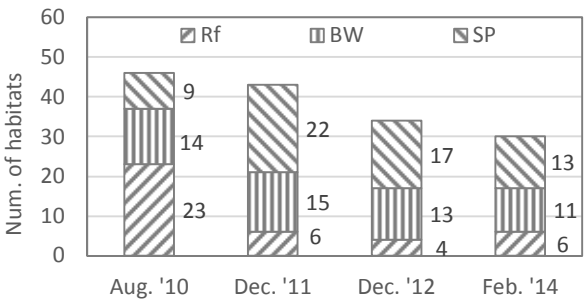


Figure 5.2.2 Number of habitat units in the camera site.

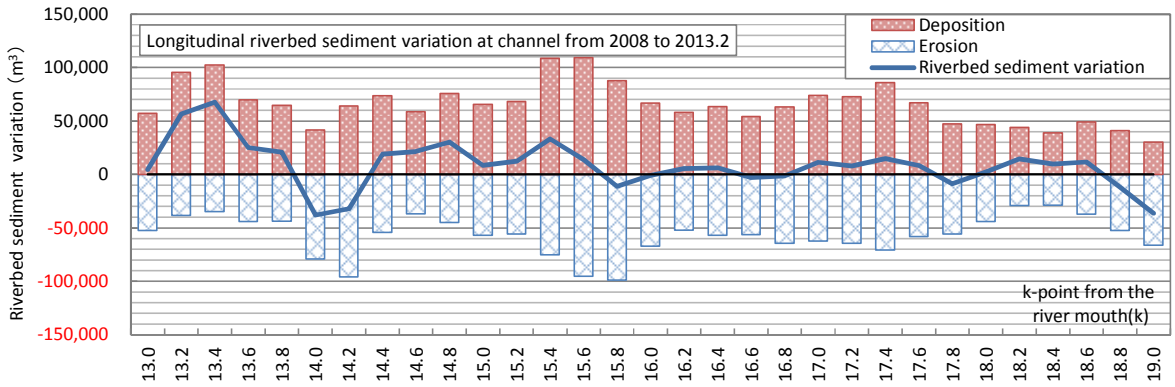


Figure 5.2.3 Longitudinal riverbed variation within a channel at a large spatial scale in the Tenryu River.

5.2.2 Analysis on habitat changing patterns and disturbance regimes via interval recording cameras

Interval-recording cameras have been installed at an electric transmission tower located at the middle of the river corridor and have been hourly taking photos upstream and downstream reach from the camera site. Based on a set of photo data, we analyzed spatial and temporal changing patterns of each habitat and its relation to disturbance intensity and timing (equal to frequency). The survey has been conducted for one and a half year since August 2012 to February 2014. During this survey period, a middle flood (2-year RP) has occurred. Aerial photo data as previously shown in Figure 5.2.1 were used in order to analyze these components including larger floods, which occurred before interval-recording cameras had been installed. Figure 5.2.4 and Figure 5.2.5 show a set of photo data on shifting habitat history upstream and downstream from the camera site respectively.

Figure 5.2.6 shows summary of sifting habitat history including habitat age, discharge hydrograph, and sampling records of macro-invertebrates (see section 5.2.3 for details). Habitats were newly created by a large flood occurred in September 2011 and subsequent middle floods occurred in July 2012 and September 2013. Some changes occurred by an annual flood occurred in October 2013, e.g., by expanding U-Rf-21 further downstream. Small changes at a macro habitat scale occurred at small floods, e.g., in October 2012 by eroding and synthesizing U-BW-1 and U-SP-2 into U-BW-11. Some differences between large and middle to annual floods can be explained that these floods have the potential to create new habitats at a habitat scale, but only a large flood can cause significant change so that channel configuration changes such as altering a main channel from one to another location within a river corridor. As such, key discharges representing disturbance levels can be large, middle to annual, and small floods and these discharges should be taken into account when analyzing responses of macro-invertebrates to disturbances.

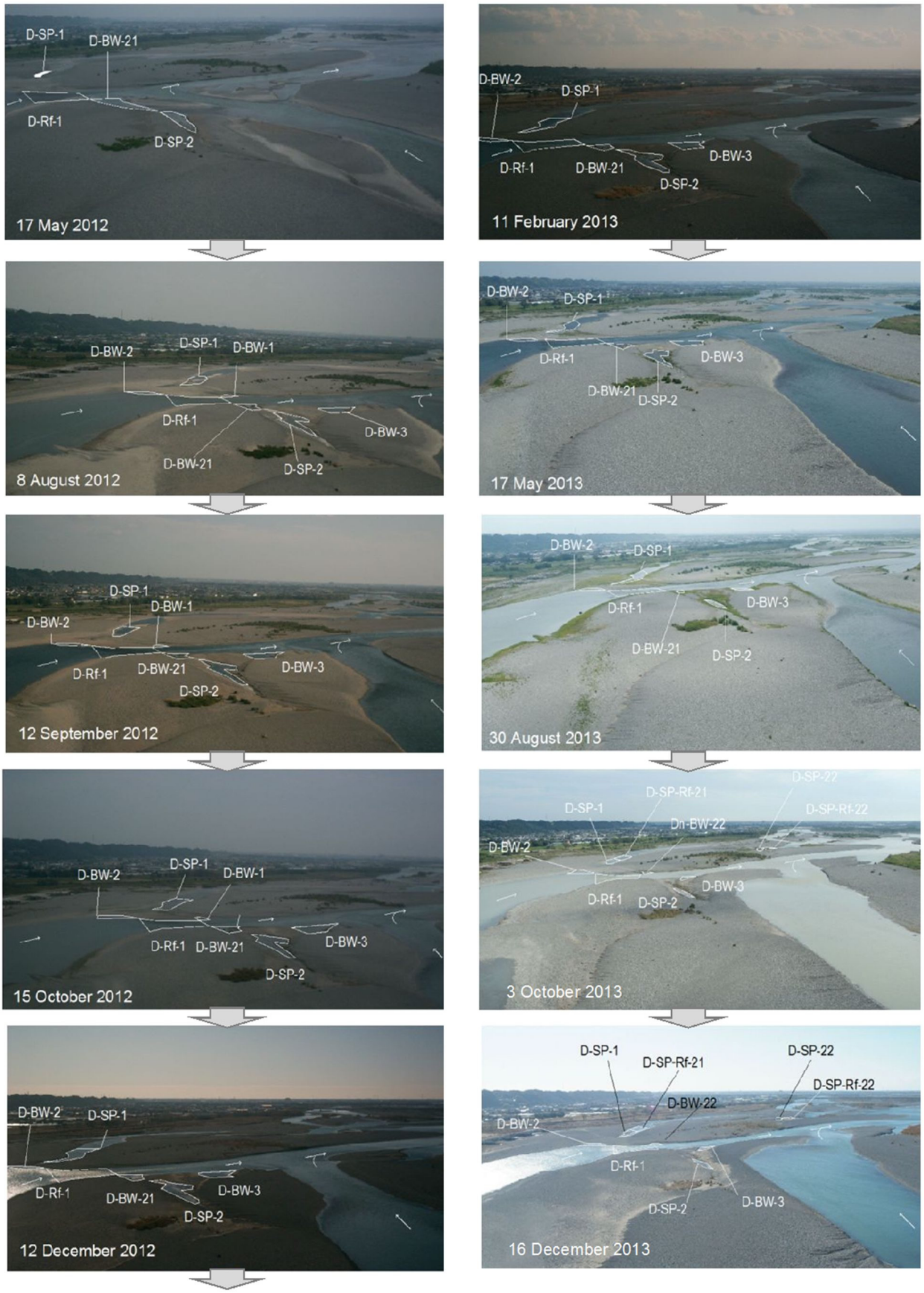


Figure 5.2.4 Shifting habitat history upstream from the camera site.



Figure 5.2.5 Shifting habitat history downstream from the camera site.

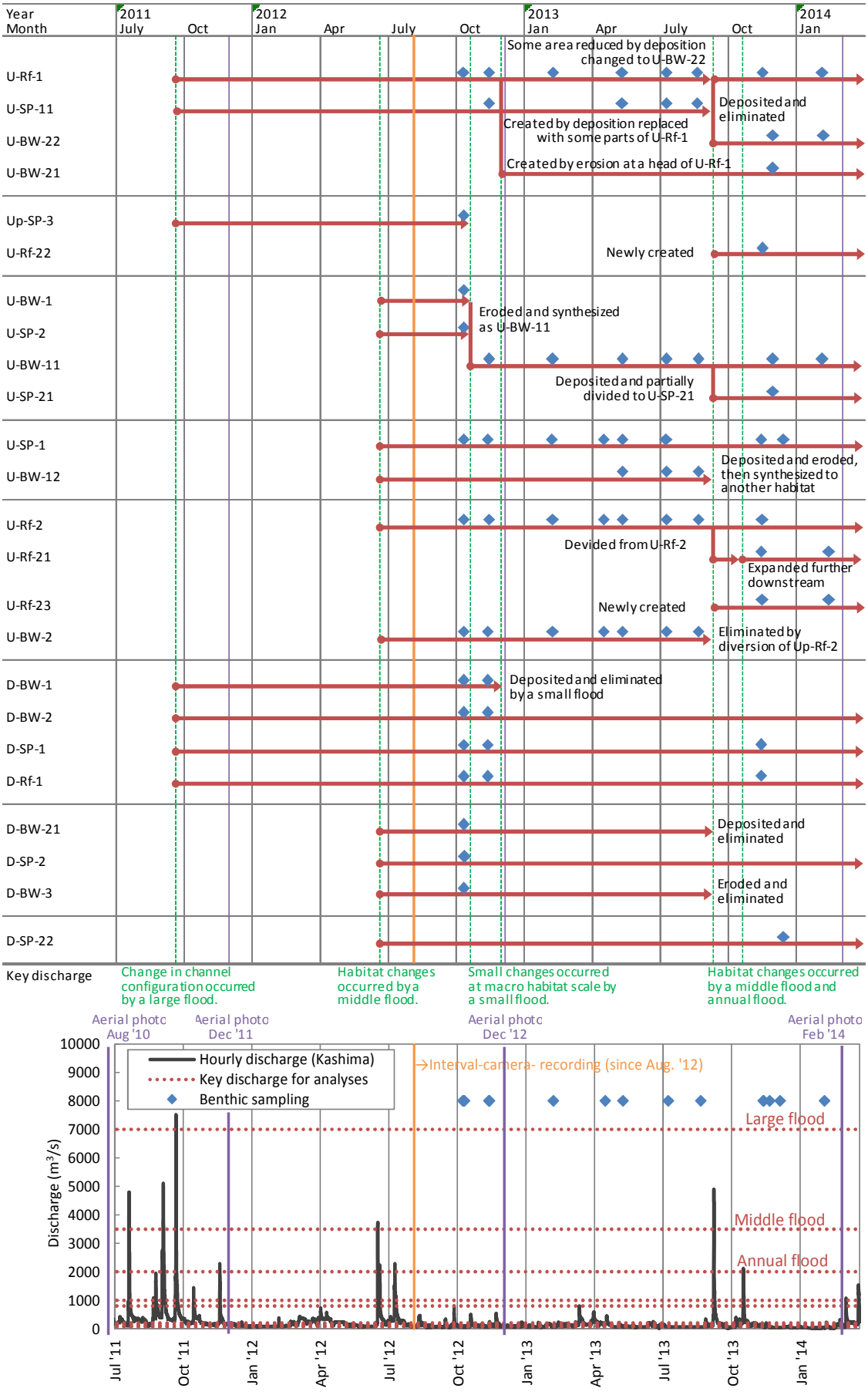


Figure 5.2.6 Summary of sifting habitat history including habitat age, discharge hydrograph, and sampling records of macro-invertebrates.

Basic information on habitat age and longevity based on collected samples are shown in Table 5.2.1, Figure 5.2.7, and Figure 5.2.8. This information is summarized in Table 5.2.2.

Table 5.2.1 Basic information on Habitat age/ longevity based on collected samples.

Habitat type	Habitat name	Number of surverys conducted	Date of birth	Date of elimination or current age	Age / longevity as of 2014/3/31	Habitat age as of 2014/3/31	Habitat longevity	Disturbance discharge at level 2 (lotic)
Rf	U-Rf-1	8	2011/09/21	2014/03/31	Age	922	-	-
	D-Rf-1	3	2011/09/21	2014/03/31	Age	922	-	-
	U-Rf-2	8	2012/06/20	2014/03/31	Age	649	-	-
	U-Rf-22	1	2013/09/16	2014/03/31	Age	196	-	-
	U-Rf-21	2	2013/09/16	2014/03/31	Age	196	-	-
	U-Rf-23	2	2013/09/16	2014/03/31	Age	196	-	-
BW	D-BW-1	2	2011/09/21	2012/11/26	Longevity	-	432	800
	D-BW-2	2	2011/09/21	2014/03/31	Age	922	-	150
	U-BW-1	1	2012/06/20	2012/10/01	Longevity	-	103	200
	U-BW-2	7	2012/06/20	2013/09/16	Longevity	-	453	200
	U-BW-12	3	2012/06/20	2013/09/16	Longevity	-	453	70
	D-BW-3	1	2012/06/20	2013/09/16	Longevity	-	453	800
	D-BW-21	1	2012/06/20	2013/09/16	Longevity	-	453	100
	U-BW-11	7	2012/10/01	2014/03/31	Age	546	-	800
	U-BW-21	1	2012/11/26	2014/03/31	Age	490	-	200
	U-BW-22	2	2013/09/16	2014/03/31	Age	196	-	200
SP	U-SP-11	4	2011/09/21	2013/09/16	Longevity	-	726	800
	U-SP-3	1	2011/09/21	2012/10/01	Longevity	-	376	200
	D-SP-1	2	2011/09/21	2014/03/31	Age	922	-	150
	U-SP-2	1	2012/06/20	2012/10/01	Longevity	-	103	800
	U-SP-1	8	2012/06/20	2014/03/31	Age	649	-	1000
	D-SP-2	1	2012/06/20	2014/03/31	Age	649	-	800
	D-SP-22	1	2012/06/20	2014/03/31	Age	649	-	800
	U-SP-21	1	2013/09/16	2014/03/31	Age	196	-	200

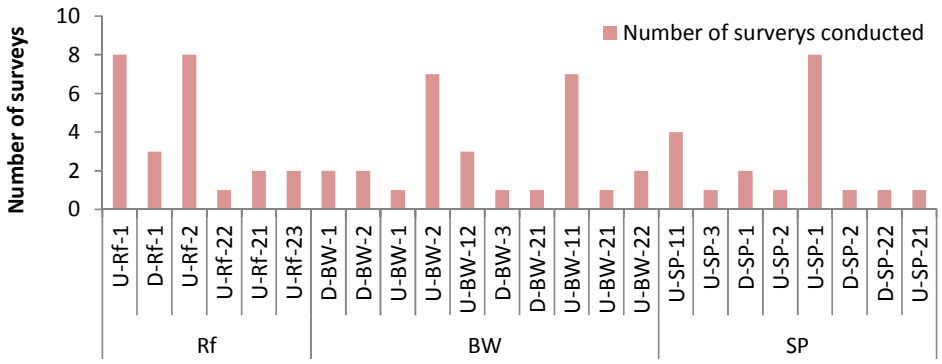


Figure 5.2.7 Number of surveys conducted at each habitat.

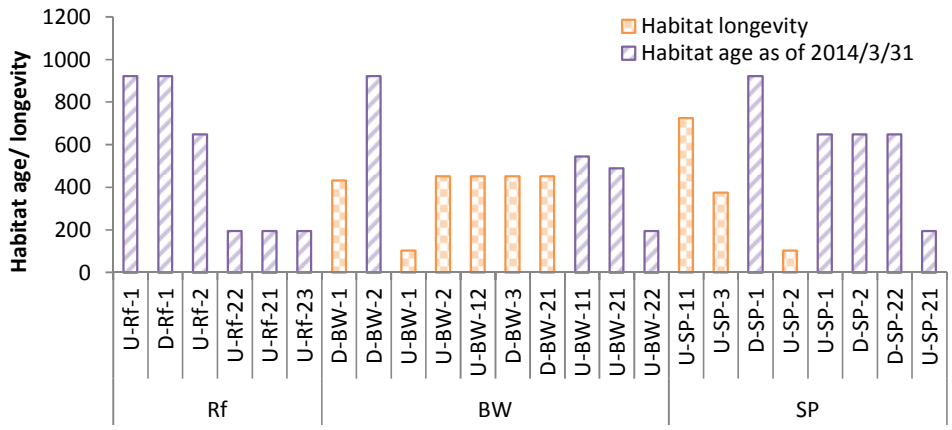


Figure 5.2.8 Habitat age/ longevity at each habitat.

Table 5.2.2 Summary of basic information on Habitat age/ longevity

Habitat type	Number of habitat types surveyed	Number of total surverys conducted	Average number of samples per habitat	Habitat age		Habitat longevity		Disturbance discharge at level 2
				Number of samples	Average age	Number of samples	Average longevity	
Rf	6	24	4.00	6	514	0	-	-
BW	10	27	2.70	4	539	6	391	70 to 800
SP	8	19	2.38	5	613	3	402	150 to 1000
Total	24	70	2.92	15	553	9	395	-

5.2.3 Analysis on biological responses of macro-invertebrates

There are various habitats within photo frames of interval-recording cameras installed, of which 6 units of riffles (Rfs), 10 units of back waters (BWs), and 8 units of side pools (SPs) were selected. In these selected habitats, macro-invertebrates have been sampled approximately every two month. For the sampling, a unit effort for each habitat was standalized with 10 minutes per habitat, under which all micro habitats were comprehensively sampled collected with a 0.25 mm screen, thus enabling to compare results of each habitat quantitatively. Total sample numbers of 24 in Rfs, 28 in BWs, 19 in SPs were collected and they were fixed with 70% ethanol solutions for the subsequent classification process. In order to remove seasonality from sampled data, we divided years to four seasons of spring from April to June, summer from July to September, autumn from October to December, and winter from January to March, and selected species that were found in any habitat for all four seasons. As a result of selection processes for removal of seasonality, 50 species were selected for the subsequent analysis as shown in Table 5.2.3. Numbers depicted in this table shows average species abundance per unit habitat per unit effort.

Table 5.2.3 Selected list of species removing seasonality for the analysis

Species information					Average species abundance per unit habitat per unit effrot																				
SP. No.	Class	Order	Family	Species name	All habitat					Rf					BW					SP				
					Winter	Spring	Summer	Autumn	Identified	Winter	Spring	Summer	Autumn	Identified	Winter	Spring	Summer	Autumn	Identified	Winter	Spring	Summer	Autumn	Identified
1	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	15	7	97	238	4	3			268	2	73	7	97		3	4			26	2
2	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	37	20	86	24	4	71		128	32	3	27	2	107	2	4	24	57	4	17	4
3	Gastropoda	Basommatophora	Physidae	*Physa acuta*	75	77	359	65	4		1	12	1	3	133	69	316	57	4	17	118	676	120	4
4	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	344	22	91	27	4	686	64	71	13	4	1	1	132	24	4				68	1
5	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	133	126	48	34	4	52	227		18	3	231	81	48	50	4	1	16			2
6	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	55	80	130	28	4		128			1	61		130	48	3	32	32		8	3
7	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	31	17	1	35	4				12	1	9	32	1	32	4	76	2	1	49	4
8	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	36	115	120	61	4	49	228	179	66	4	15	1	3	1	4				66	1
9	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1	66	35	16	4	1	66	43	22	4	1		3	1	3				1	1
10	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	49	53	50	17	4	2	128		17	3	85	47	50	14	4	1	26		19	3
11	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	8	39	199	6	4				1	1			396		1	8	39	2	9	4
12	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	7	3	33	32	4			7		1	10	3	53	45	4	2		1	7	3
13	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	10	2	19	33	4	10	2	19	42	4					0				2	1
14	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	100	17	19	17	4	3	1	34	18	4	198	33	4	22	4	1			5	2
15	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	51	128	614	13	4	51	128	768	15	4			1		1				1	1
16	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	33	42	487	40	4	33	22	385	40	4	31	73	521	15	4	34	39		57	3
17	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	23	91	1	30	4	23	135		33	3		2	1		2				2	1
18	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	105	3	54	33	4	157	5	67	37	4	1	1	3		3				1	1
19	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	13	1	27	28	4					0	14	1	27		3	12	1		28	3
20	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	17	12	1	25	4		1	1	64	3	22	1		5	3	10	33	1	27	4
21	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	34	1	132	70	4	44	1	132	84	4	1				1				1	1
22	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	165	90	1793	354	4	326	135	2688	406	4	2	2	3		3	6			71	2
23	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	60	29	383	20	4	64	2	688	1	4	88	12	242	20	4	13	132	2	27	4
24	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1	2	1	2	4		2	1	1	3		1	1		2	1			2	2
25	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	4	2	3	3	4	5			4	2	3	2	3	2	4	5			3	2
26	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	564	268	727	234	4			389		1	698	261	916	247	4	298	272	328	219	4
27	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	25	2	120	22	4	1	2	146	25	4	74		86	2	3					0
28	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	85	39	407	255	4	117	39	609	391	4	5		1	66	3				16	1
29	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	201	28	146	274	4	280	28	201	342	4	2		65	2	3	1				1
30	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	9	91	149	11	4	10	91	257	13	4	1		4	1	3				2	1
31	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	73	106	147	23	4	32		458	28	3	81	65	61	4	4	78	127	9	31	4
32	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2	4	8	9	4	2	4	11	9	4			2		1					0
33	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	12	1	3	7	4				1	1	12	1	3	8	4				9	1
34	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	41	31	283	77	4		2	361	17	3	54	11	359	70	4	27	143	91	136	4
35	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	24	20	32	18	4	3	25	24	21	4	54	4	46	30	4	6	29	20	6	4
36	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	6	41	98	22	4	1	4	1	25	4	1	99	194	26	4	16	2	3	11	4
37	Insecta	Diptera	Tipulidae	*Tipula* sp.	4	11	29	5	4	1		67	2	3	5	3	4	3	4	5	18	41	9	4
38	Insecta	Diptera	Tipulidae	*Antocha* sp.	226	74	82	9	4	189	99	112	13	4	333	1	58	2	4	17			2	2
39	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3	2	5	3	4	5	3	7	3	4	3	2	4	2	4	2	1		1	3
40	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	10	17	11	5	4	1	3		1	3	2	10	12		3	32	39	10	9	4
41	Insecta	Diptera	Chironomidae	Tanypodinae	3	13	20	8	4		15	55	8	3	1	20	3	13	4	5	6	3	2	4
42	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	65	35	17	65	4	86	68	17	70	4	64	1			2	2			1	2
43	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	51	272	68	157	4	58	517	85	184	4	3	190	78	109	4	112	69	35	174	4
44	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	363	283	46	327	4	745	348	4	613	4	302	337	67	72	4	65	104		133	3
45	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1	2	66	3	4					0		3	66	2	3	1	1		5	3
46	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	5	128	120	61	4		259	3	26	3		118	199	32	3	5	34		102	3
47	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	2	3	1	10	4			1		1	2	4	1	1	4		3	1	18	3
48	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	40	90	132	58	4			49	8	2	49	129	230	51	4	23	50	18	74	4
49	Insecta	Diptera	Dolichopodidae	Dolichopodidae	13	2	27	6	4			2		1	2	2	44	2	4	24		1	10	3
50	Insecta	Diptera	Empididae	Empididae	108	1	32	12	4	26			17	2	203		32	10	3	116	1		8	3

5.3 Results

5.3.1 Habitat disturbance regimes

Using a set of hourly photo data obtained through interval-recording cameras and an hourly discharge hydrograph, we classified habitat disturbance regimes as shown in Table 5.3.1 and Figure 5.3.1. We checked all the photo data and analyzed disturbance regimes from level 0 to level 2. Level 0 is a side pool (SP) system under low flow conditions. Channels and a SP are disconnected and no disturbances occurred. Level 1 is a back water (BW) system, which a BW is connected with channels but not disturbed because it is a lentic habitat. Increase in a water stage to a certain level (relatively small) can change a SP system to a BW system. Level 0 and level 1 are both lentic (relatively close to still) systems. Level 2 is on the other hand a lotic system. Further increase in a water stage to a certain level can change a lentic system to a lotic system, by overflowing flood water from upstream onto habitats. Riffles (Rfs) could be classified as the level 2 under low flow conditions. Level 3 to level 5 are classified as annual, middle, and large floods, which are considered to be key discharges that have the potential to change the riverbed at different levels as explained in section 5.2.1and section 5.2.2. At level 0 to level 2, each habitat has a peculiar discharge that determines disturbance levels. This explains that each habitat has different heights or riverbed characteristics in relation to flood water. At level 3 to level 5, all the habitats are below flood water at the peak discharge, but have different friction velocity or share stress, not depending on habitat characteristics but flood discharge. When discussing habitat age effects against disturbance regimes, this classification would be of particular importance to responses of macro-invertebrates, which will be discussed in section 5.3.3.

Table 5.3.1 A schematic diagram of classified disturbance regimes.

Discharge (m^3/s) greater than:	0	70	100	150	200	800	1000	2000	3500	7000
	Low flow						High flow	Annual flood	Middle flood	Large flood
U-Rf-1	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-SP-11	Level 0	Level 0	Level 1	Level 1	Level 1	Level 2	Level 2	Level 3	Level 4	Level 5
U-BW-22	Level 1	Level 1	Level 1	Level 1	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-BW-21	Level 1	Level 1	Level 1	Level 1	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-BW-1	Level 1	Level 1	Level 1	Level 1	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-SP-2	Level 0	Level 0	Level 1	Level 1	Level 1	Level 2	Level 2	Level 3	Level 4	Level 5
U-BW-11	Level 1	Level 1	Level 1	Level 1	Level 1	Level 2	Level 2	Level 3	Level 4	Level 5
U-SP-21	Level 0	Level 1	Level 1	Level 1	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
Up-SP-3	Level 0	Level 0	Level 1	Level 1	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-SP-1	Level 0	Level 0	Level 1	Level 1	Level 1	Level 1	Level 2	Level 3	Level 4	Level 5
U-BW-12	Level 1	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-Rf-22	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-Rf-23	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-Rf-2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-Rf-21	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
U-BW-2	Level 1	Level 1	Level 1	Level 1	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
D-BW-1	Level 1	Level 1	Level 1	Level 1	Level 1	Level 2	Level 2	Level 3	Level 4	Level 5
D-BW-2	Level 1	Level 1	Level 1	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
D-SP-1	Level 0	Level 0	Level 0	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
D-Rf-1	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
D-BW-21	Level 1	Level 1	Level 2	Level 2	Level 2	Level 2	Level 2	Level 3	Level 4	Level 5
D-SP-2	Level 0	Level 0	Level 1	Level 1	Level 1	Level 2	Level 2	Level 3	Level 4	Level 5
D-BW-3	Level 1	Level 1	Level 1	Level 1	Level 1	Level 2	Level 2	Level 3	Level 4	Level 5
D-SP-22	Level 0	Level 0	Level 1	Level 1	Level 1	Level 2	Level 2	Level 3	Level 4	Level 5

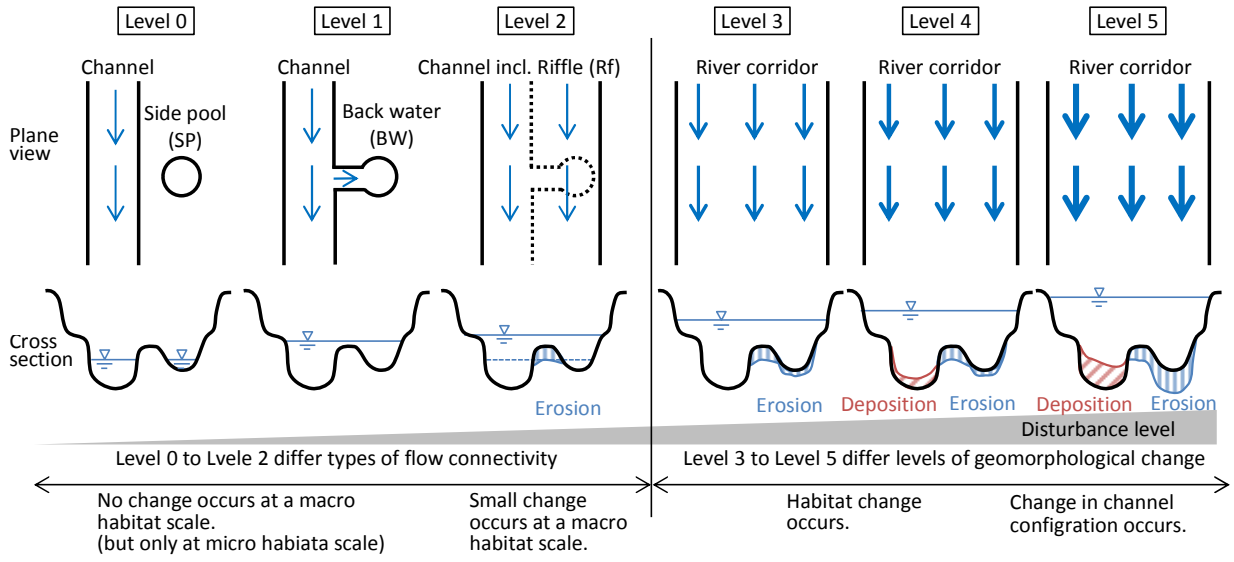


Figure 5.3.1 A schematic diagram of classified disturbance regimes.

5.3.2 Distribution patterns and responses of macro-invertebrates to a middle flood

During a period of surveys on macro-invertebrate sampling, the study site experienced a middle flood occurred in September 2013 (referred to as MF), and certainly changed response of species as compared to other periods. Therefore, a particular attention was paid on change in distribution patterns of species before and after the middle flood, looking into it as an important factor that determines spatial and temporal distribution patterns of species. Figure 5.3.2 shows spatial and temporal distributions of species abundance in riffles (Rfs), back waters (BWs), and side pools (SPs). The size of circles in Figure 5.3.2 indicates that species abundance is higher when the size is larger and vice versa as shown at bottom left of each figure. Rfs are channels with lotic systems, where relatively high disturbances ccurred during floods. BWs are lentic systems during low flow conditions, changing to lotic systems at a certain disturbances (i.e., flood intensity). SPs are almost same with BWs and generally disturbances are lower than Rfs and BWs. Therefore, disturbance levels are higher in Rfs, then BWs, and lower in SPs. The survey on macro-invertebrates has started since October 2012 and experienced a middle flood in September 2013. Therefore distribution patterns in October 2013 mean that 4 months past after the middle flood. We also add information on life types in the descriptions of 50 selected macro-invertebrates. We use life types categorized by Merrit and Cummins (1996) for the descriptions but also add life types categorized by Takemon (2005) in Table 5.3.2 so that two characteristics could be compared and referenced. In the descriptions, the term “principal habitats” were used for the selected 50 species and is defined as: habitat (s) that was (were) found more than 50 % (4 times) out of total 8 surveys or that was found more than 50 % of species abundance per one survey per habitat against total species abundance per all surveys per all habitats.

Table 5.3.2 List of selected macro-invertebrates and life type categorization

No.	Class	Order	Family	Species name	Life Type categolization by:		
					Merrit & Cummins (1996)	Takemon (2005)	
1	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	Creepers	Crawlers	Creepers
2	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	Creepers	Crawlers	Creepers
3	Gastropoda	Basommatophora	Physidae	*Physa acuta*	Creepers	Crawlers	Creepers
4	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	Attachers	Attachers	Case builders
5	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	Burrowers	Burrowers	Free burrowers
6	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	Burrowers	Burrowers	Free burrowers
7	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	Creepers	Crawlers	Crawlers
8	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	Creepers	Crawlers	Crawlers
9	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	Creepers	Crawlers	Crawlers
10	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	Creepers	Crawlers	Crawlers
11	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	Creepers	Crawlers	Crawlers
12	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	Swimmers	Swimmers	Swimmers
13	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	Swimmers*	Attachers	Exposed attachers
14	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	Swimmers	Swimmers	Swimmers
15	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	Swimmers	Swimmers	Swimmers
16	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	Creepers	Crawlers	Gliders
17	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	Creepers	Crawlers	Gliders
18	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	Swimmers	Swimmers	Swimmers
19	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	Burrowers	Burrowers	Free burrowers
20	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	Burrowers	Burrowers	Gliding burrowers
21	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	Creepers	Crawlers	Crawlers
22	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	Creepers	Crawlers	Crawlers
23	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	Creepers	Crawlers	Crawlers
24	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	Burrowers	Burrowers	Free burrowers
25	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	Creepers	Crawlers	Crawlers
26	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	Swimmers	Swimmers	Swimmers
27	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	Net-spinners	Attachers	Net-spinners
28	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	Net-spinners	Attachers	Net-spinners
29	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	Net-spinners	Attachers	Net-spinners
30	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	Net-spinners	Attachers	Net-spinners
31	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	Case-bearers	Crawlers	Case-bearers
32	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	Creepers	Crawlers	Crawlers
33	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	Case-bearers	Crawlers	Case-bearers
34	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	Creepers	Crawlers	Crawlers
35	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	Creepers	Crawlers	Crawlers
36	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	Creepers	Crawlers	Crawlers
37	Insecta	Diptera	Tipulidae	*Tipula* sp.	Burrowers	Burrowers	Free burrowers
38	Insecta	Diptera	Tipulidae	*Antocha* sp.	Attachers	Attachers	Net-spinners
39	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	Burrowers	Burrowers	Free burrowers
40	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	Burrowers	Burrowers	Free burrowers
41	Insecta	Diptera	Chironomidae	Tanypodinae	Creepers	Crawlers	Crawlers
42	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	Burrowers	Burrowers	Free burrowers
43	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	Burrowers	Burrowers	Free burrowers
44	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	Burrowers	Burrowers	Free burrowers
45	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	Burrowers	Burrowers	Free burrowers
46	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	Burrowers	Burrowers	Free burrowers
47	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	Burrowers	Burrowers	Free burrowers
48	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	Burrowers	Burrowers	Tube burrowers
49	Insecta	Diptera	Dolichopodidae	Dolichopodidae	Burrowers	Burrowers	Free burrowers
50	Insecta	Diptera	Empididae	Empididae	Burrowers	Burrowers	Free burrowers

Note: Asterisk (*) is marked at the life type of *Baetiella japonica* (Ephemeroptera, Baetidae: No. 13), which is categorized as 'swimmers' according to Merrit & Cummins (1996). However, this species are not able to swim under lotic systems in Japan. Therefore, for *Baetiella japonica*, the life type of 'exposed attachers' or 'attachers' categorized by Takeomon (2005) are adopted throughout this article.

1) *Dugesia japonica* (Tricladida, Dugesiidae)

This life type is a creeper and the principal habitats are Rfs. Species abundance increased in Rfs and SPs after the middle flood, implicating that they may possibly migrate to from BWs to Rfs and SPs. Species migrated to habitats with both high and low disturbance regimes.

2) *Prostoma* sp. (Hoplonemertea, Tetrastemmatidae)

This life type is a creeper but behavior of this species is close to a burrower. Principal habitats are Rfs, BWs, and SPs. Species abundance reduced to zero in BWs and SPs, but slightly reduced in Rfs after the middle flood. Since this species are not capable of swimming well, they were likely to move under deep porosity of the riverbed during the middle flood.

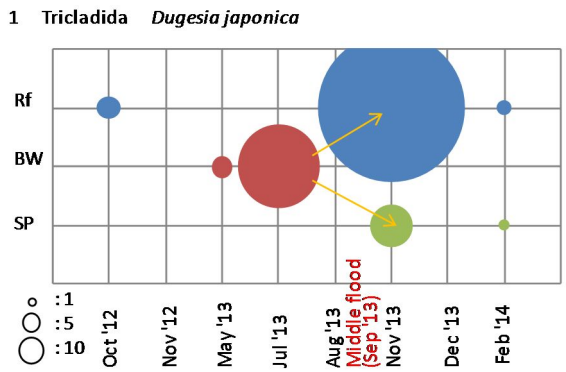




Figure 5.3.2 (1) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

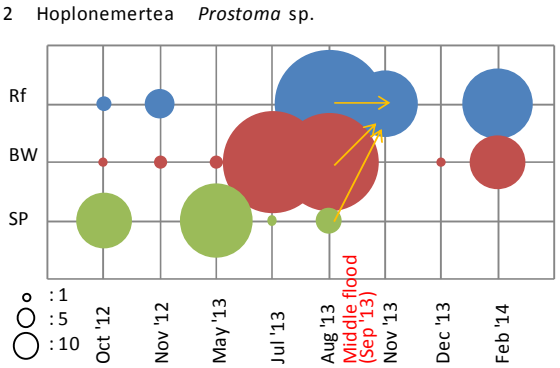


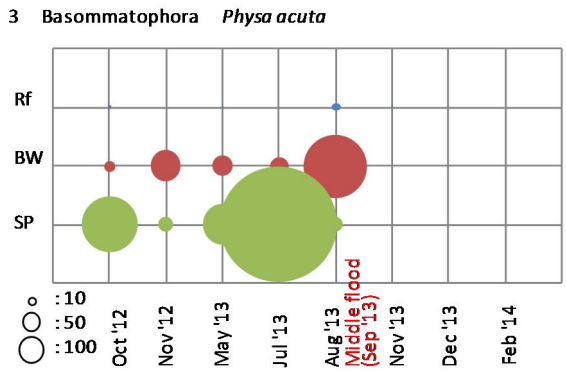
Figure 5.3.2 (2) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

3) *Physa acuta* (Basommatophora, Physidae)

This life type is a creeper. Principal habitats are Rfs, BWs, and SPs. But species abundance in Rfs is much lower than that of BWs and SPs. Since this species are not capable of swimming well, they were eliminated after the middle flood and thus are considered to be disturbance-intolerant.

4) *Limnoperna fortunei* (Mytiloida, Mytilidae)

This life type is an attacher. Principal habitats are Rfs and BWs. This species are not able to inhabit under conditions of cold water temperature. They tend to inhabit in old Rfs and gradually increase abundance. However, they significantly reduced their abundance and no longer found after the middle flood.



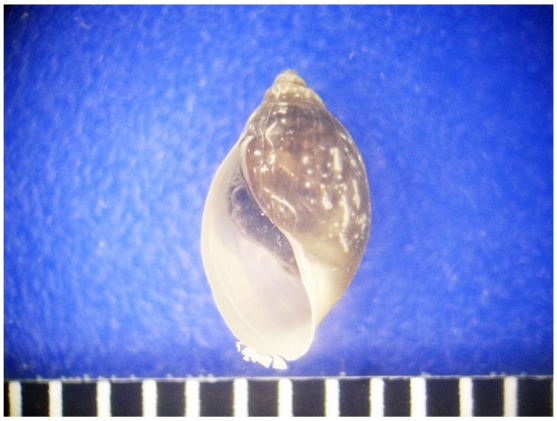
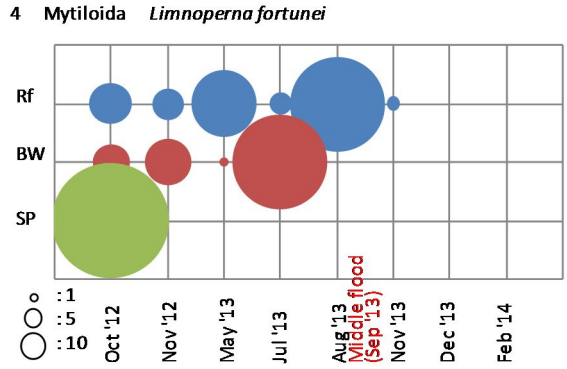


Figure 5.3.2 (3) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.



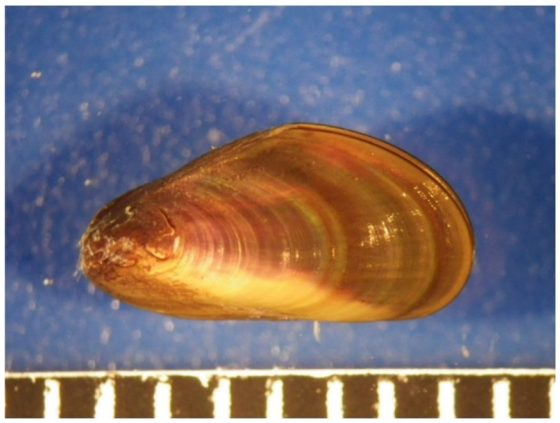


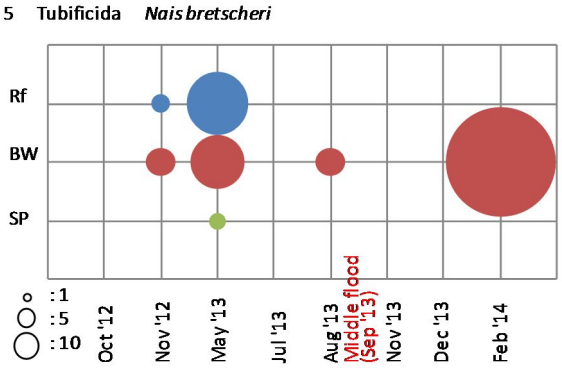
Figure 5.3.2 (4) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

5) *Nais bretscheri* (Tubificida, Naididae)

This life type is a burrower but behavior of this species is close to a creeper. Principal habitats are BWs. This species has low capability of moving. This species intermittently reduced their abundance in BWs after the middle flood.

6) *Slavina appendiculat*a (Tubificida, Naididae)

This life type is a burrower. Principal habitats could not be identified according to our classification criteria. But they seem to be scattered to inhabit in Rfs, BWs, and SPs. Since this species were even neither found at Rfs, BWs, nor SPs in August 2013, which was just before the middle flood, relevant trends and behaviors could not therefore be identified.



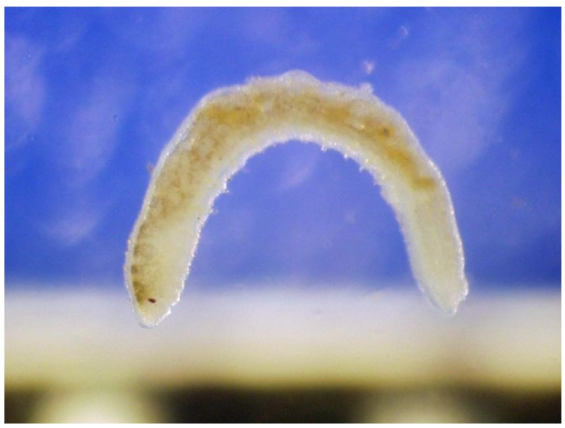


Figure 5.3.2 (5) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

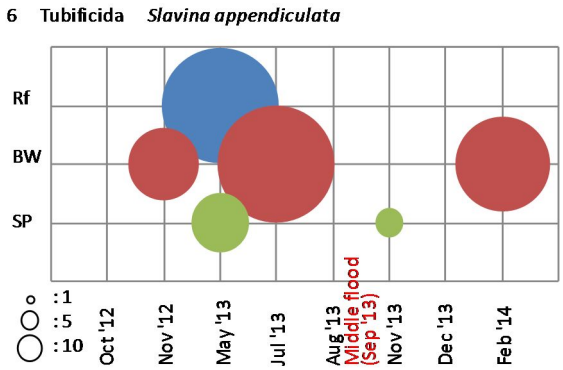




Figure 5.3.2 (6) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

7) *Lebertia* sp. (Acarina, Lebertiidae)

This life type is a creeper. Principal habitats are BWs and SPs. This species were not found at any habitat in August 2013, which was just before the middle flood. They largely increased species abundance in SPs after the middle flood. They were likely to be washed away from the upstream reach and reached to lower disturbances of SPs.

8) *Sperchon* sp. (Acarina, Spercontidae)

This life type is a creeper. Principal habitats are Rfs and BWs, but species abundance in Rfs is much higher than that in BWs. This species inhabit in porosity of the riverbed, are not capable of swimming, and eat Naididae (Tubificida) and Chironomidae (Diptera). Species abundance reduced in Rfs after the middle flood. Some of species could be resisted in Rfs by staying in the polarity in the rivebed, and the other which could and the others were flown away. They were found even in SPs, which were not found in other SPs, they seem to be accidentally flown away, reached to SPs and finally eliminated in SPs.

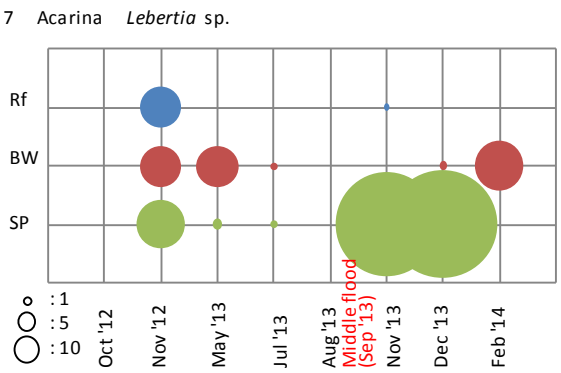


Figure 5.3.2 (7) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

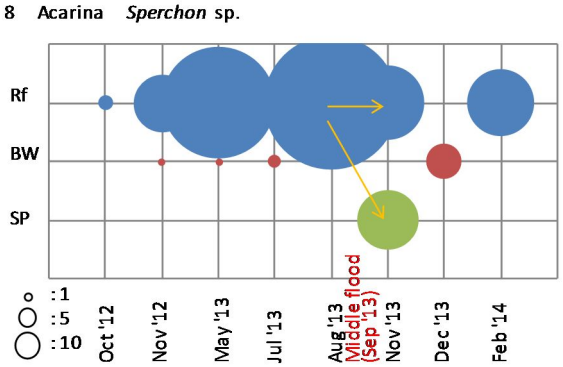




Figure 5.3.2 (8) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

9) *Atractides* sp. (Acarina, Hygrobatidae)

This life type is a creeper. Principal habitats are Rfs. Since this species are not capable of moving well, they were likely to disappear after the middle floods.

10) *Hygrobates* sp. (Acarina, Hygrobatidae)

This life type is a creeper. Principal habitats are Rfs, BWs, and SPs. This species are capable of swimming. They intermittently disappeared in BWs, and increased at both low and high disturbance regimes in Rfs and SPs after the middle flood. In February 2014, they were again found in BWs.

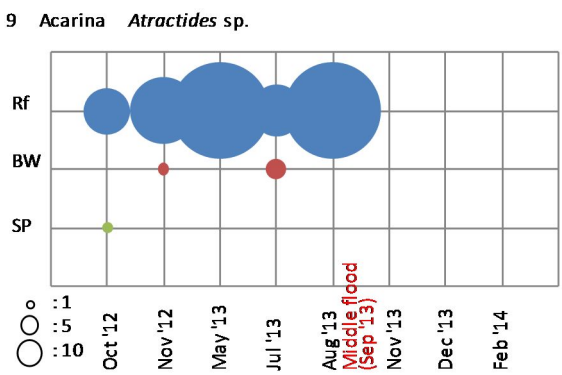




Figure 5.3.2 (9) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

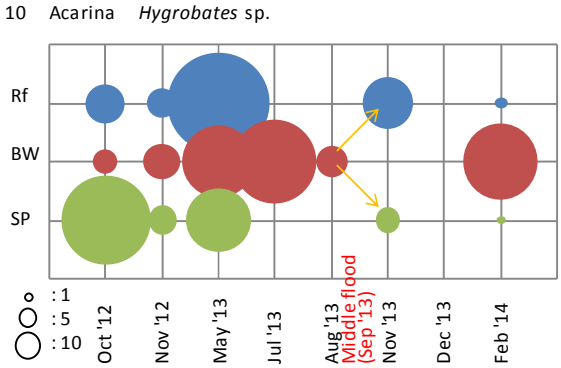


Figure 5.3.2 (10) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

11) *Asellus hilgendorfi* (Isopoda, Asellidae)

This life type is a creeper. Principal habitats are lentic systems of BWs and SPs. This species even inhabit in the underground environment. They were neither capable of moving nor attaching well, therefore they were likely to be flown away after the middle flood.

12) *Paratya improvisa* (Decapoda, Atyidae)

This life type is a swimmer. Principal habitats are lentic systems of BWs and SPs. This species is capable of swimming, but is likely to be flown away since their specific gravity is low. Abundance is higher in BWs before the middle flood, but higher in SPs after the flood, thus assuming that some species flown away were reached to low disturbance regimes at the recession stage of the middle flood.

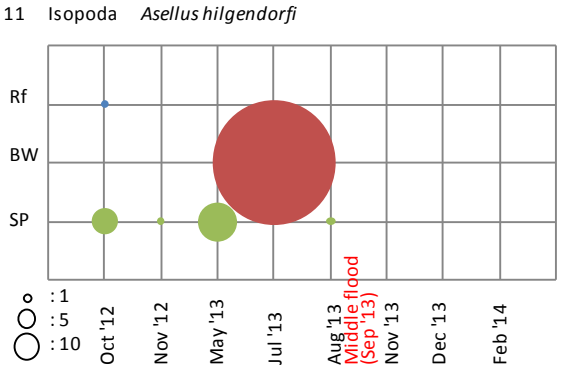


Figure 5.3.2 (11) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

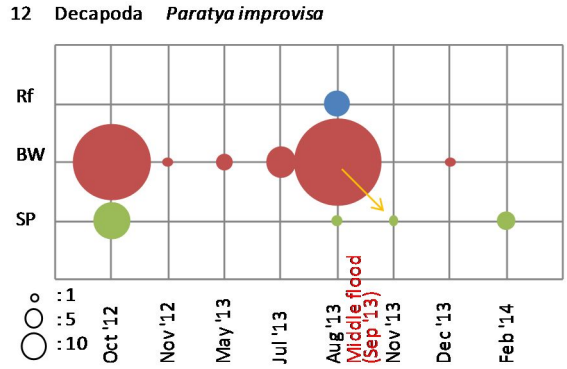




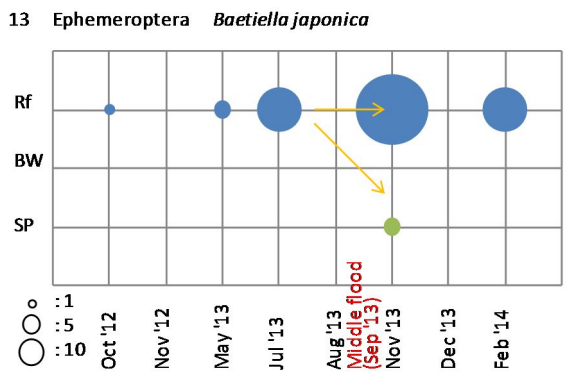
Figure 5.3.2 (12) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

13) *Baetiella japonica* (Ephemeroptera, Baetidae)

This life type is an exposed attacher (Takemon, 2005). Principal habitats are lotic systems of Rfs, of which this species inhabit on the surface of the gravel riverbed and emerge between April and May. They are highly capable of clinging by developing their nails. Since abundance were high in Rfs after the middle flood, they are considered to be disturbance tolerant. After the middle flood, species were found in SPs, which was the first time appearing throughout the survey in SPs. They are not capable of swimming, assuming that some species flown away were reached to low disturbance regimes at the recession stage of the middle flood.

14) *Baetis taiwanensis* (Ephemeroptera, Baetidae)

This life type is a swimmer. Principal habitats are Rfs and BWs. This species disappeared in BWs and increased in Rfs after the middle flood. However, no species were found at any habitat in the following surveys in December 2013 and February 2014.



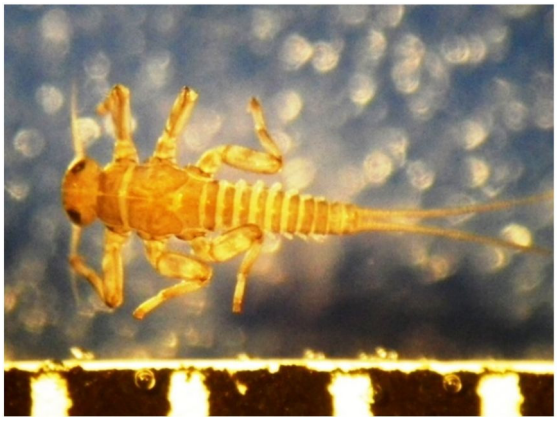
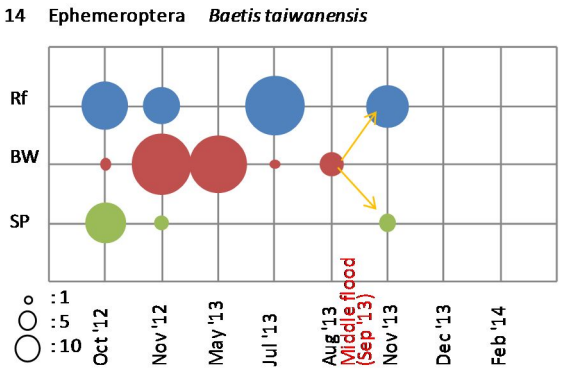


Figure 5.3.2 (13) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.



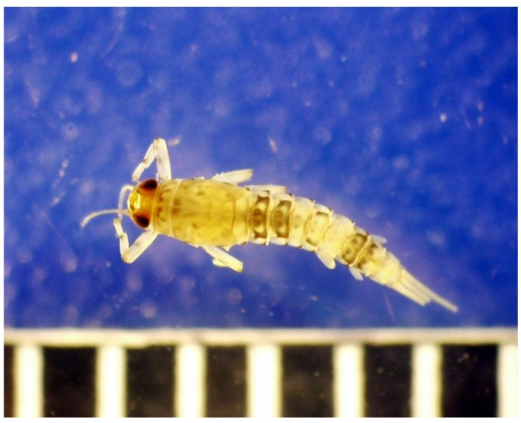


Figure 5.3.2 (14) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

15) *Tenuibaetis flexifemora* (Ephemeroptera, Baetidae)

This life type is a swimmer. Principal habitats are lotic systems of Rfs. This species are highly capable of swimming and disturbance-tolerant, but they disappeared after the middle flood. Since they emerge in autumn, no abundance in November 2013 is because of being emerged. Therefore, distribution patterns of this species disappearing after the middle flood are different from those of other species.

16) *Ecdyonurus* sp. (Ephemeroptera, Heptageniidae)

This life type is a creeper. Principal habitats are Rfs, BWs, and SPs. This species reduced in Rfs, intermittently disappeared in BWs, and increased in BWs, assuming that they migrated to habitats of lower disturbance regimes.

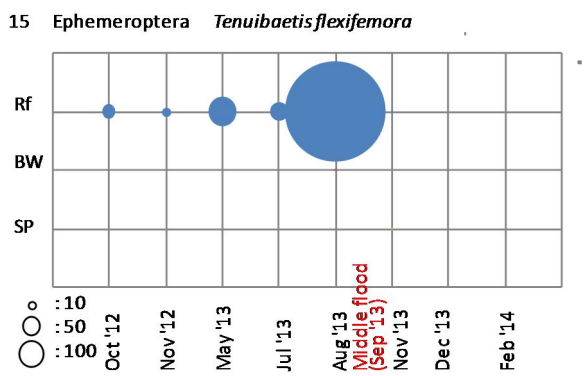




Figure 5.3.2 (15) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

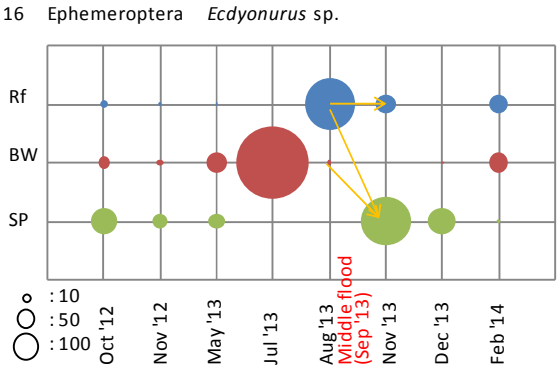


Figure 5.3.2 (16) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

17) *Rhithrogena* sp. (Ephemeroptera, Heptageniidae)

This life type is a creeper. Principal habitats are Rfs. This species inhabit on relatively small gravels in Rfs and are likely to be flown away. Since they are not capable of swimming, they can stay in the same habitat when riverbed gravels are not subject to moving by disturbances and vice versa. Abundance was halved after the middle flood, as compared to before-flood abundance in Rfs, assuming that some of species could resist against middle flood disturbances.

18) *Isonychia japonica* (Ephemeroptera, Isonychiidae)

This life type is a swimmer. Principal habitats are Rfs. This species abundance reduced after the middle flood in Rfs and no longer found, assuming that they were flown away.

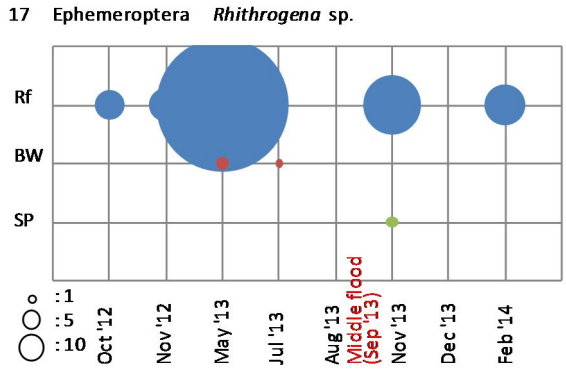




Figure 5.3.2 (17) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

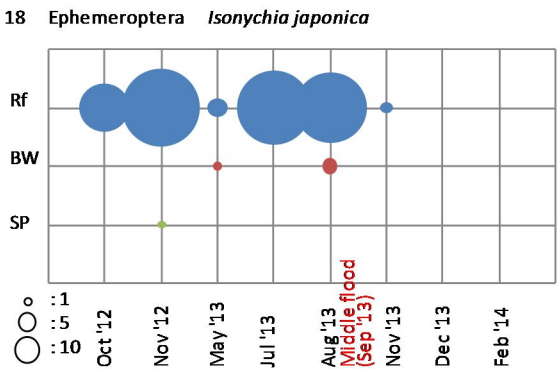




Figure 5.3.2 (18) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

19) *Ephemera orientalis* (Ephemeroptera, Ephemeridae)

This life type is a burrower, but this species are capable of swimming well. Principal habitats are lentic systems of BWs and SPs, inhabiting on the sandy riverbed. Flow resistance of species can be reduced by curling themselves up and thus they can increase their dropping velocity. For this reason, it is assumed they could be found after the middle flood, particularly migrating from BWs before the middle flood to SPs, which are habitats of lower disturbance regimes.

20) *Potamanthus formosus* (Ephemeroptera, Potamanthidae)

This life type is a burrower. Principal habitats are lentic systems of BWs and SPs. This species increased abundance in Rfs and SPs after the middle flood, and were subsequently found in BWs and SPs but not found in Rfs. It is assumed that they moved back to principal habitats of BWs and SPs after the middle flood.

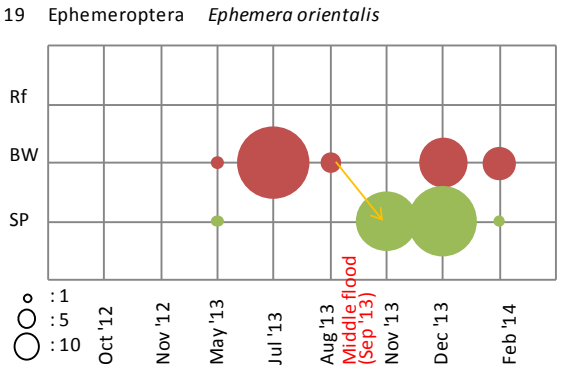


Figure 5.3.2 (19) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

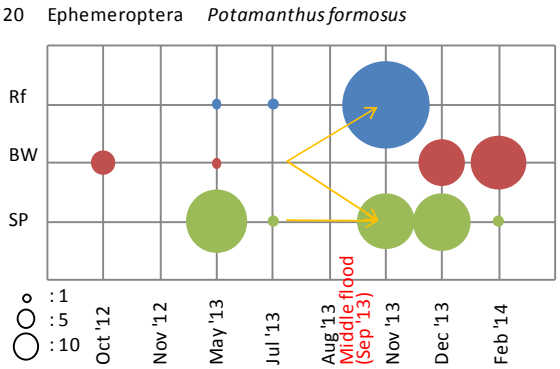


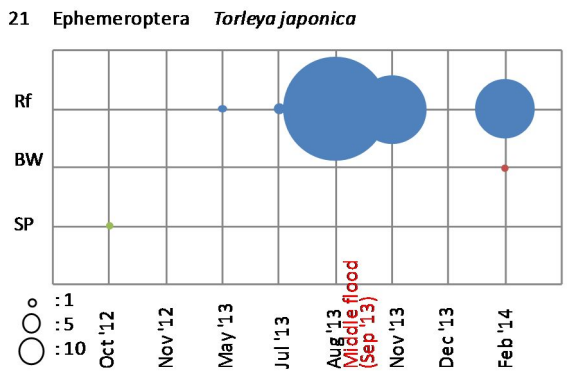
Figure 5.3.2 (20) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

21) *Torleya japonica* (Ephemeroptera, Ephemerellidae)

This life type is a creeper but behavior of this species is close to a burrower. Principal habitats are lotic systems of Rfs. This species are not capable of moving well but tend to submerge into the under-gravel riverbed. Certain abundance of this species were found in Rfs after the middle flood, assuming that they could be resisted by submerging into the under-gravel riverbed.

22) *Uracanthella punctisetae* (Ephemeroptera, Ephemerellidae)

This life type is a creeper. Principal habitats are lotic systems of Rfs. This species are capable of clinging to the gravel riverbed, but they cannot be resisted when gravels move due to disturbances. The species abundance was maximized before the middle flood, but significantly reduced after the flood. They were also found in SPs after the flood, assuming that part of species were flown away and reached to habitats of lower disturbance regimes.



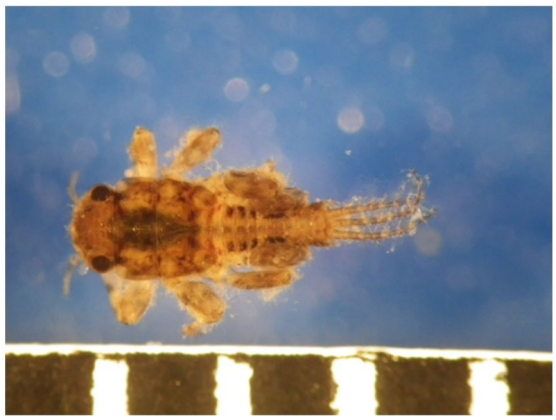
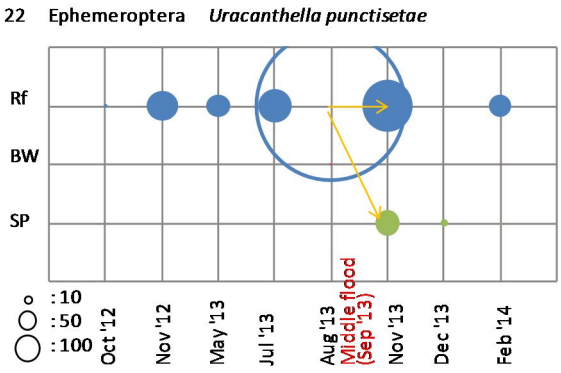


Figure 5.3.2 (21) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.



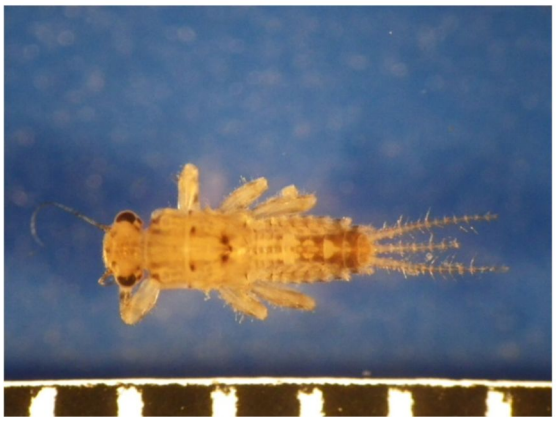


Figure 5.3.2 (23) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

23) *Caenis* sp. (Ephemeroptera, Caenidae)

This life type is a creeper. Principal habitats are Rfs, BWs, and SPs. This species are not capable of swimming and flown away due to disturbance, therefore eliminating after the middle flood. However, they have high dropping velocity because of high specific gravity per surface area, assuming that they were reached to SPs, where are lower disturbance regimes at the flood recession stage.

24) *Sinogomphus flavolimbatus* (Odonata, Gomphidae)

This life type is a burrower. Principal habitats could not be identified according to classification criteria in this study. This species were found before the middle flood, but found in SPs after the flood, assuming that they migrated to habitats of lower disturbance regimes by the middle flood.

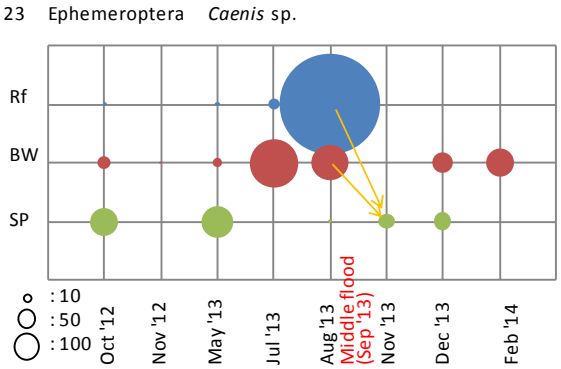


Figure 5.3.2 (23) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

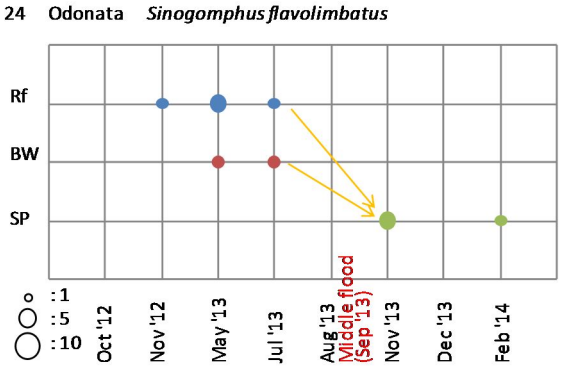




Figure 5.3.2 (24) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

25) *Neoperla* sp. (Plecoptera, Perlidae)

This life type is a creeper. Principal habitats are lentic systems of BWs and SPs. This species were found in BWs before the middle flood, but intermittently found in Rfs and SPs after the flood, and then subsequently found again in lentic systems of BWs and SPs.

26) *Micronecta* sp. (Hemiptera, Corixidae)

This life type is a swimmer. Principal habitats are lentic systems of BWs and SPs. This species are capable of swimming but not capable of clinging, thus eliminating in BWs after the middle flood. However, the species abundance reduced in SPs just before the middle flood, making it difficult to analyze relevant behavior. Since they were found in BWs after the middle flood, after becoming low flow conditions over the middle flood, assuming that they were flown from upstream and reached to BWs or some species were flying back to BWs used to swim. They can rapidly increase the abundance and grow up early once they invaded, meaning that generation alternation is processed faster.

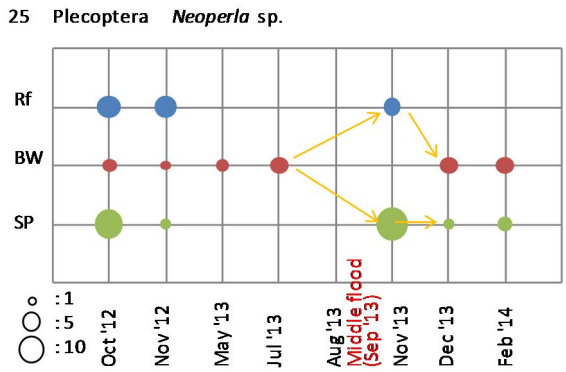




Figure 5.3.2 (25) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

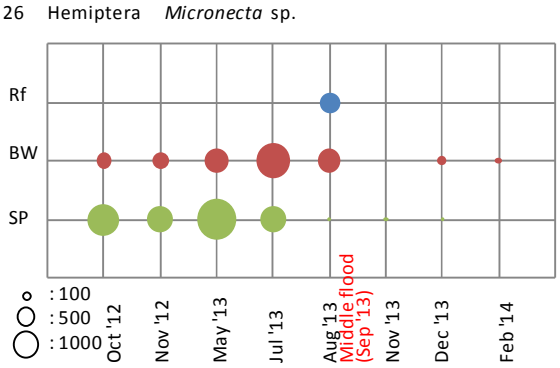


Figure 5.3.2 (26) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

27) *Cheumatopsyche brevilineata* (Trichoptera, Hydropsychidae)

This life type is a net-spinner. Principal habitats are lotic systems of Rfs. This species are capable of attaching. Therefore, some species resisted in Rfs by the middle flood, although some of other species reduced. The others were considered to be flown away. In BWs, they were found several times before the middle flood, but flown away after the flood. After the middle flood they were no longer found at any habitats.

28) *Cheumatopsyche infascia* (Trichoptera, Hydropsychidae)

This life type is a net-spinner. Principal habitats are Rfs and BWs. Since this species are capable of attaching, they were able to resist after the middle flood.

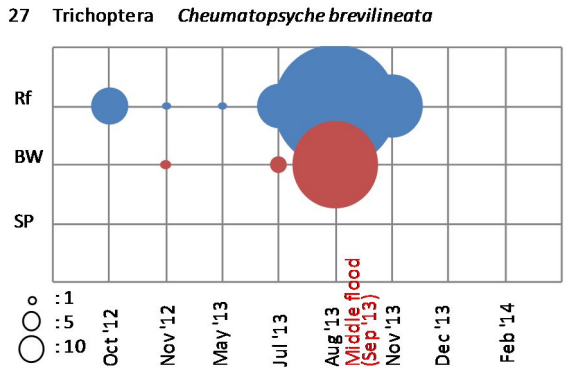




Figure 5.3.2 (27) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

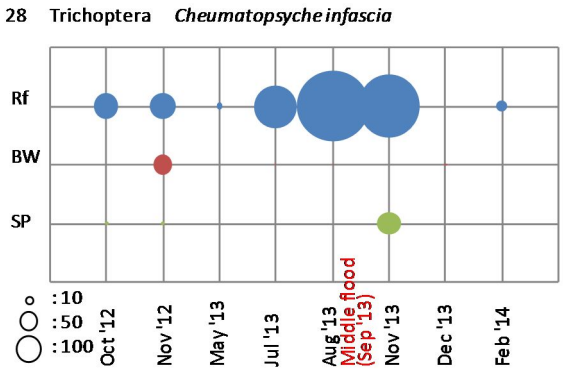




Figure 5.3.2 (28) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

29) *Hydropsyche orientalis* (Trichoptera, Hydropsychidae)

This life type is a net-spinner. Principal habitats are Rfs. Since this species are capable of attaching, they were able to resist after the middle flood.

30) *Stenopsyche marmorata* (Trichoptera, Stenopsychidae)

This life type is a net-spinner. Principal habitats are Rfs. Even though this species are capable of attaching, they inhabit in polarity of the gravel riverbed and are not able to resist when gravels move due to disturbances. In contrast for reference, Hydropsyche sp. (Trichoptera, Hydropsychidae) are capable of directly attaching to gravels, therefore they are not significantly flown away. Stenopsyche marmorata decreased abundance in Rfs, since the middle flood had the stream power to transport gravels. However, some of them were resisted in Rfs, assuming that since the riverbed of Rfs are likely to be hardened by recurrent small floods causing erosion (Hyodo et al, 2014), the gravels of hardened riverbed were not able to be transported and some of them were resisted.

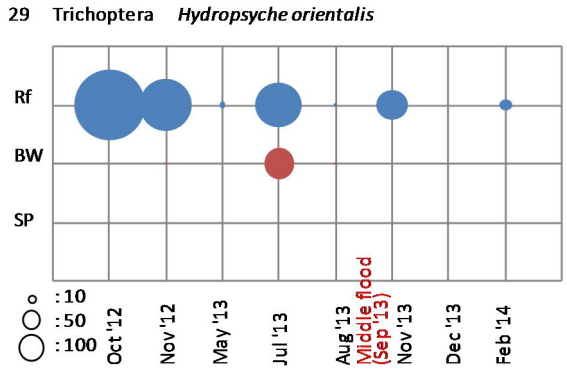




Figure 5.3.2 (29) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

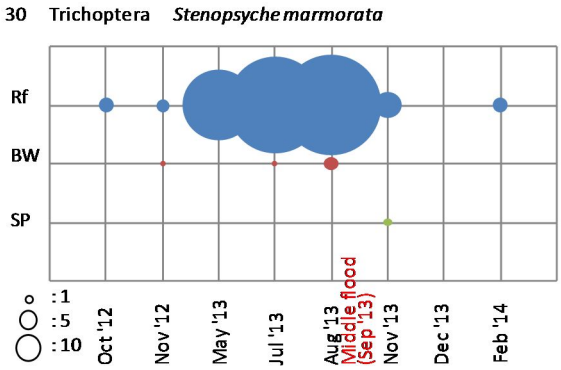




Figure 5.3.2 (30) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

31) *Hydroptila* sp. (Trichoptera, Hydroptilidae)

This life type is a case-bearers. Principal habitats are lentic systems of BWs and SPs. This species eliminated in Rfs (partly found before the middle flood) and BWs, and found in SPs after the middle flood. They are not capable of swimming well, assuming that they were reached to habitats of lower disturbance regimes.

32) *Rhyacophila nigrocephala* (Trichoptera, Rhyacophilidae)

This life type is a creeper, but behaviors of this species are close to a burrower. Principal habitats are Rfs. Even though they are creepers but are capable of burrowing, they could not be flown away but resisted in Rfs after the middle flood. However, they were not found in the subsequent surveys.

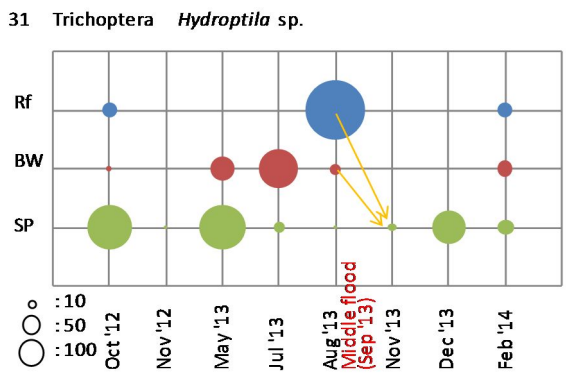




Figure 5.3.2 (31) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

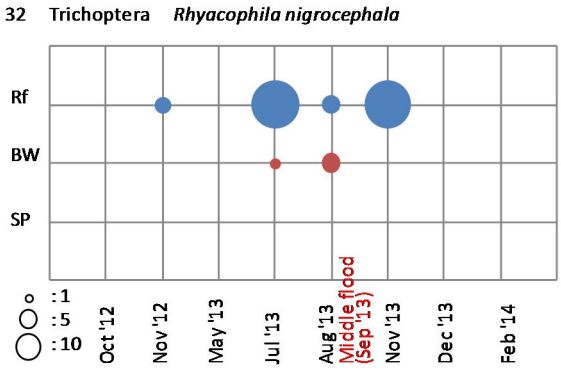




Figure 5.3.2 (32) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

33) *Mystacides* sp. (Trichoptera, Leptoceridae)

This life type is a case-bearer. Principal habitats are BWs. This species are not capable of swimming, assuming that they were eliminated in BWs and reached to SPs of lower disturbance regimes after the middle flood.

34) *Laccobius* sp. (Coleoptera, Hydrophilidae)

This life type is a creeper, but behaviors of this species are close to a burrower. Principal habitats are Rfs, BWs, and SPs. They like to inhabit in lentic area adjacent to water and terrestrial boundaries, leading to higher species abundance in BWs and SPs than Rfs. They decreased abundance in Rfs but partly resisted after the middle flood, and intermittently eliminated in BWs, assuming that they were migrated to SPs of lower disturbance regimes after the middle flood.

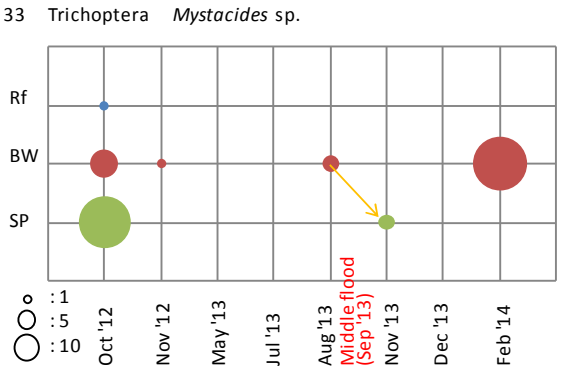


Figure 5.3.2 (33) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

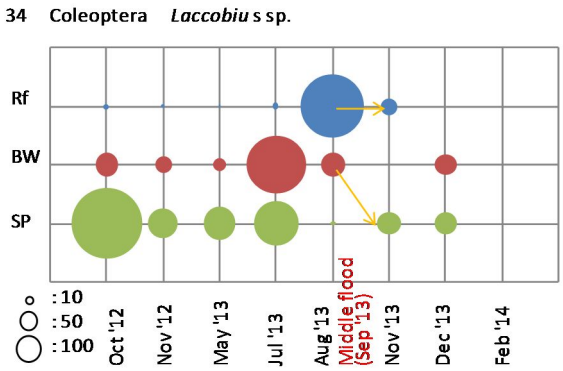




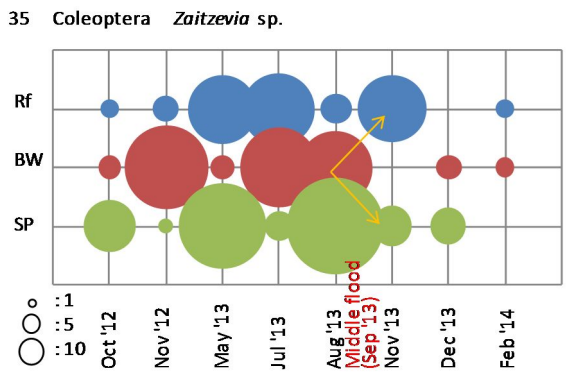
Figure 5.3.2 (34) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

35) *Zaitzevia* sp. (Coleoptera, Elmidae)

This life type is a creeper, but behavior of this species is close to a burrower. Principal habitats are Rfs, BWs, and SPs.

36) *Zaitzeviaria* sp. (Coleoptera, Elmidae)

This life type is a creeper, but behaviors of this species are close to a burrower. Principal habitats are Rfs, BWs, and SPs. They were intermittently eliminated, but were found in Rfs and SPs after the middle flood.



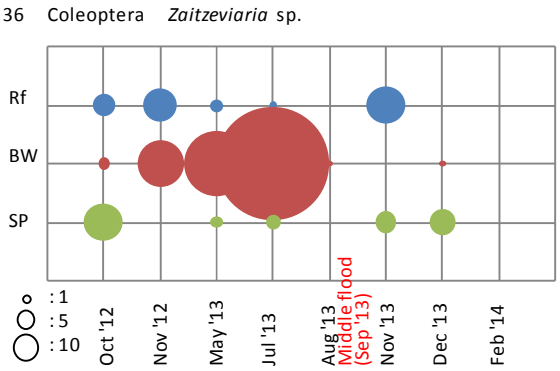




Figure 5.3.2 (35) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

Figure 5.3.2 (36) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

37) *Tipula* sp. (Diptera, Tipulidae)

This life type is a burrower. As principal habitats are Rfs, BWs, and SPs, this species are found not only in lotic systems of Rfs, but also found in lentic systems of BWs and SPs. They were intermittently eliminated in BWs, but found in Rfs and SPs.

38) *Antocha* sp. (Diptera, Tipulidae)

This life type is an attacher. Principal habitats are Rfs and BWs. This species are found not only in lotic systems of Rfs, but also found in lentic systems where the spring water is welling up. They were intermittently decreased in Rfs and eliminated in BWs after the middle flood. They were then found again in Rfs and BWs in the subsequent surveys.

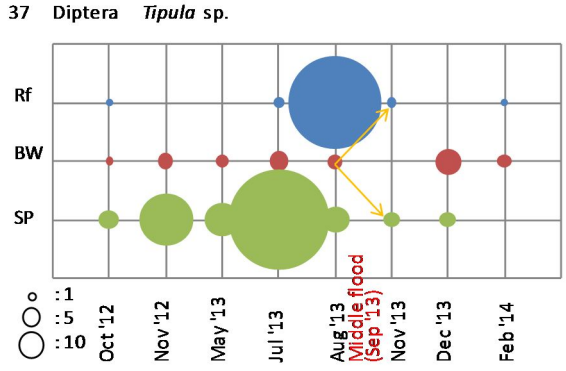




Figure 5.3.2 (37) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

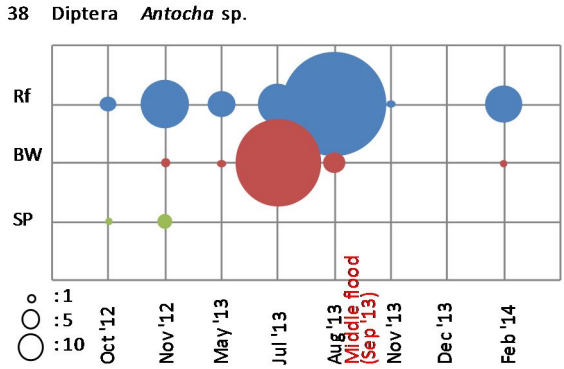




Figure 5.3.2 (38) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

39) *Hexatoma* sp. (Diptera, Tipulidae)

This life types in a burrower. Principal habitats are Rfs, BWs, and SPs. This species are found not only in lotic systems of Rfs, but also found in lentic systems where the spring water is welling up. They were intermittently eliminated in BWs, but found in Rfs and SPs.

40) Ceratopogonidae (Diptera, Ceratopogonidae)

This life type is a burrower. Principal habitats are BWs and SPs. Most of this species are not capable of swimming except Bezzia, but they were found in Rfs after the middle flood. It is assumed that they moved into a burrow below the riverbed or they were eliminated by the middle flood.

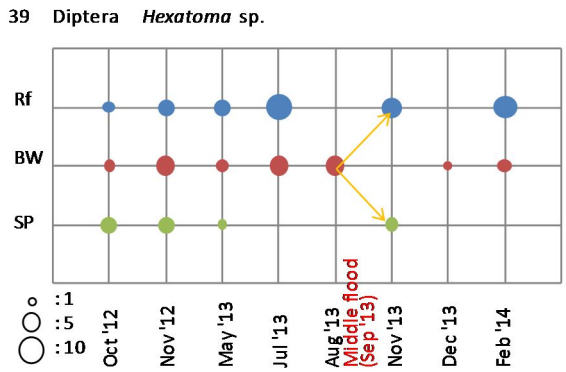
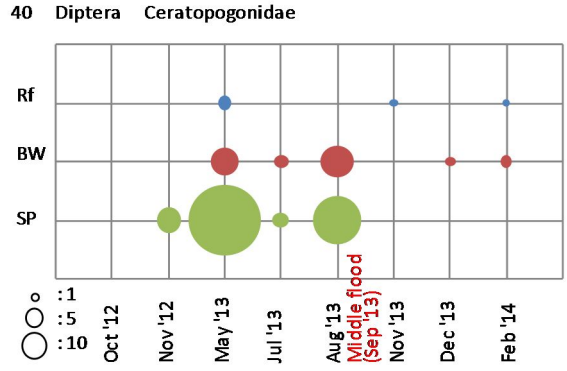




Figure 5.3.2 (39) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.



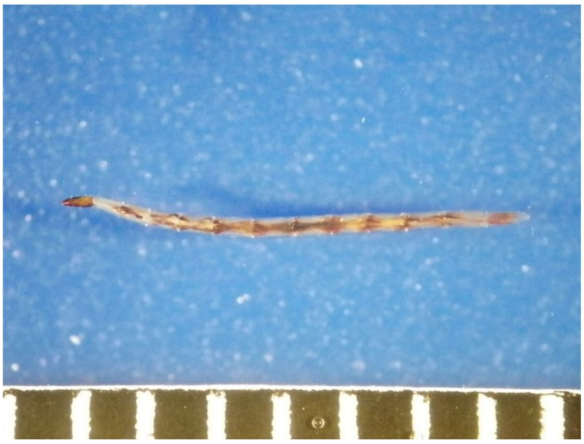


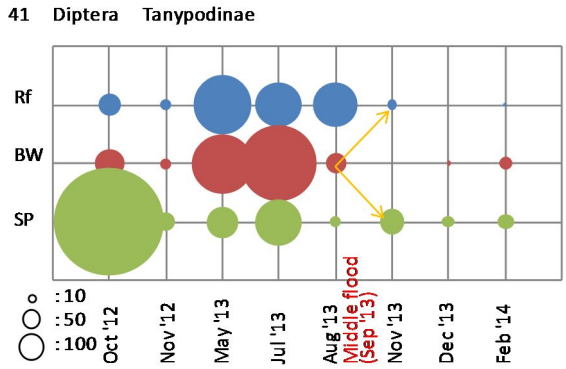
Figure 5.3.2 (40) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

41) Tanypodinae (Diptera, Chironomidae)

This life type is a burrower. Principal habitat are Rfs, BWs, and SPs. They were intermittently eliminated, but found in Rfs and SPs.

42) *Cardiocladius* sp. (Diptera, Chironomidae)

This life types is a burrower. Principal habitats are Rfs. High abundance of this species was found after the middle flood. They could be resisted by the middle flood, since they build nests of less resistance to flows on the gravel surface of the riverbed. They could be regarded as typical species, which are flood disturbance-tolerant.



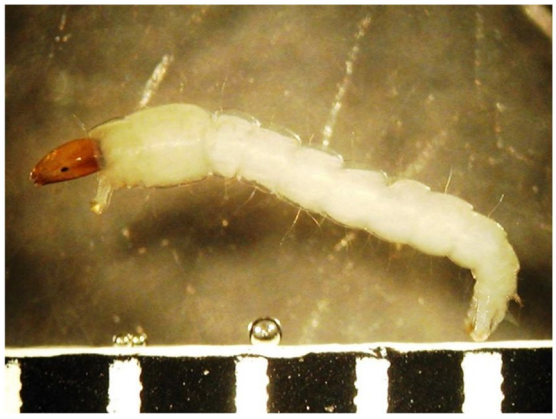


Figure 5.3.2 (41) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

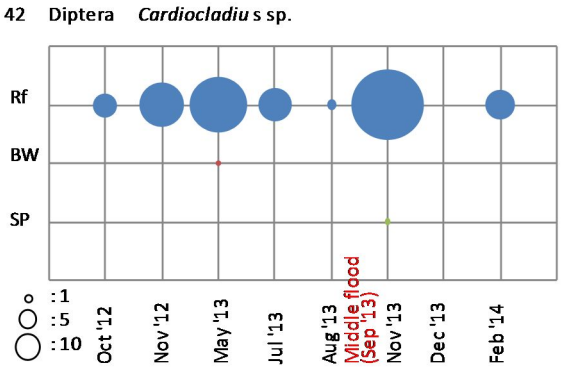




Figure 5.3.2 (42) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

43) *Cricotopus* sp. (Diptera, Chironomidae)

This life type is a burrower. Principal habitats are Rfs, BWs, and SPs. This species were intermittently eliminated, but found in Rfs and SPs.

44) *Orthocladius* sp. (Diptera, Chironomidae)

This life type is a burrower. Principal habitats are Rfs, BWs, and SPs. This species were intermittently eliminated, but increased in Rfs and BWs.

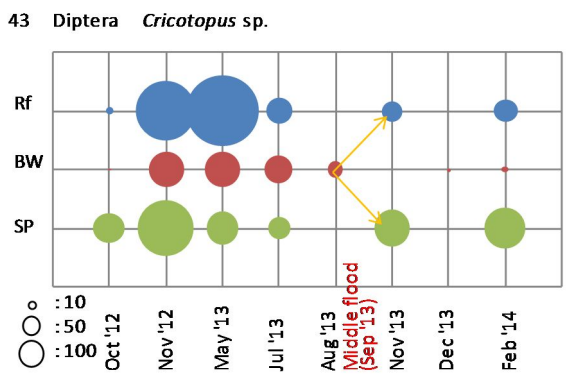




Figure 5.3.2 (43) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

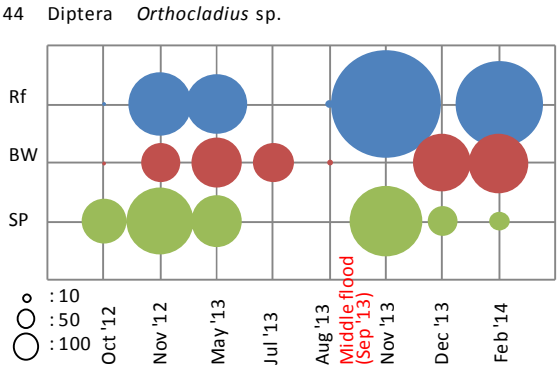


Figure 5.3.2 (44) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

45) *Cryptochironomus* sp. (Diptera, Chironomidae)

This life type is a burrower. Principal habitats are BWs, of which this species are favor of the fine sand riverbed. As they are not capable of swimming, they were eliminated after the middle flood. They are likely to be flown away and therefore could be regarded as disturbance-intolerant species.

46) *Dicrotendipes* sp. (Diptera, Chironomidae)

This life type is a burrower. Principal habitats are Rfs, BWs, and SPs. This species were eliminated in Rfs, assuming that they were flown away and reached to SPs of relatively lower disturbance regimes after the middle flood.

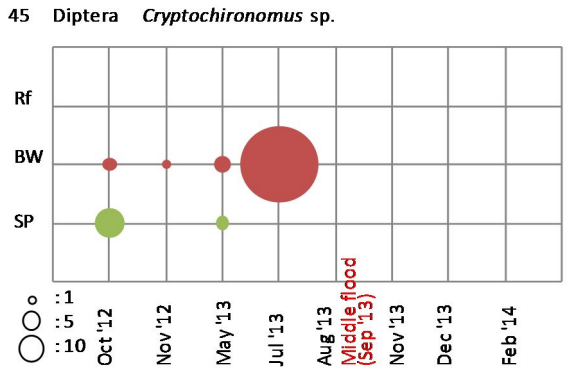




Figure 5.3.2 (45) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

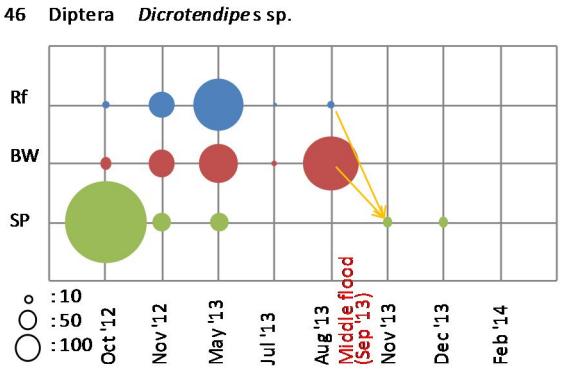




Figure 5.3.2 (46) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

47) *Stictochironomus* sp. (Diptera, Chironomidae)

This life type is a burrower. Principal habitats are lentic systems of BWs and SPs, of which this species inhabit on the sand riverbed. They are not capable of swimming, assuming that they were eliminated by the middle flood.

48) *Tanytarsus* sp. (Diptera, Chironomidae)

This life type is a burrower. Principal habitats are lentic systems of BWs and SPs. This species primarily build tube nests on the surface area of the sand and gravel riverbed. Their life type is only a tube builder among 50 selected species for this analysis, according to the more segmentalized classification of Takemon (2005) than that of Merrit and Cummins (1996). They are capable of swimming, but are likely to be flown away. They can also float up but cannot move to direction by their own will. Low species abundance were found in SPs after the middle flood, assuming that they were flown away from BWs and SPs, and then eliminated.

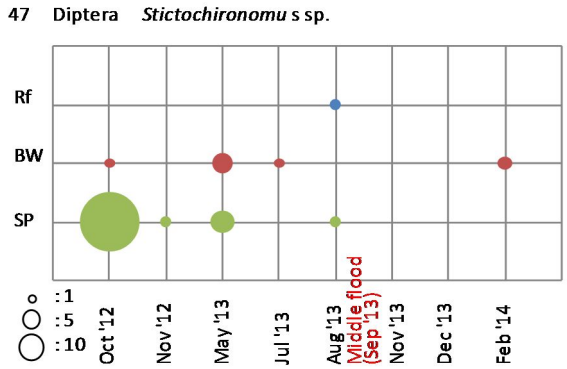




Figure 5.3.2 (47) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

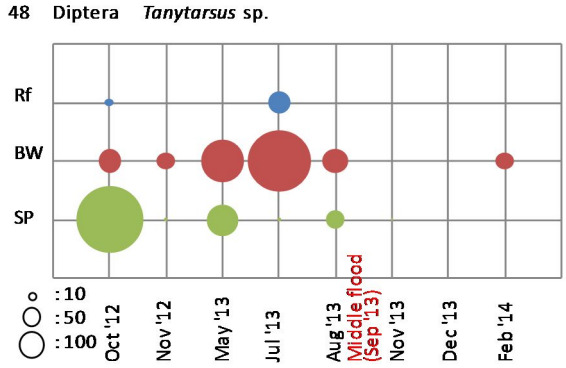




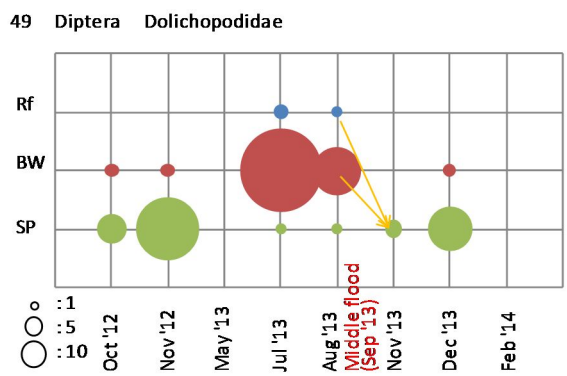
Figure 5.3.2 (48) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

49) Dolichopodidae (Diptera, Dolichopodidae)

This life type is a burrower. Principal habitats are lentic systems of BWs and SPs. This species are favor of inhabiting on silty riverbed. They were eliminated in Rfs after the middle flood, they were reached to SPs of relatively lower disturbance regimes.

50) Empididae (Diptera, Empididae)

This life type is a burrower. Principal habitats are BWs. This species were eliminated in BWs, but found in Rfs after the middle flood. They were then found in Rfs, BWs, and SPs in the subsequent surveys.



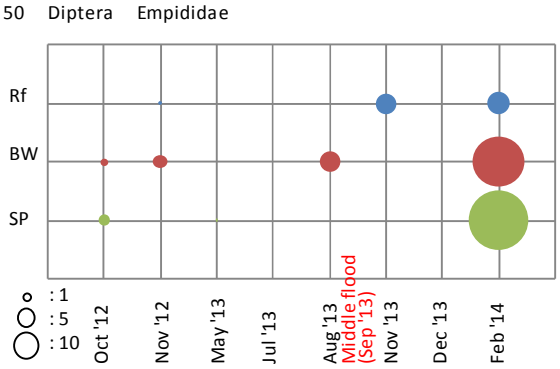




Figure 5.3.2 (49) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

Figure 5.3.2 (50) Spatiotemporal distributions of macro-invertebrates by average abundance per unit habitat.

51) Classification of responses of macro-invertebrates to a middle flood

Based on the detailed descriptions of 50 selected species, responses of macro-invertebrates to a middle flood are classified as shown in Table 5.3.3. **(a) Disappearing:** refers to species that inhabit in their principal habitats but disappear after the middle flood; **(b) Migrating to habitats of lower disturbance regimes:** refers to species that principally inhabit in habitats of relatively high disturbance regimes but migrated to lower regimes after the middle flood (e.g., from BWs to SPs); **(c) Migrating to habitats of higher disturbance regimes:** refers to species that principally inhabit in habitats of relatively lower disturbance regimes but migrated to higher regimes after the middle flood (from BWs/ SPs to Rfs); **(d) Migrating to habitats of both lower and higher disturbance regimes:** refers to species that principally inhabit in Rfs, BWs, and SPs, but migrated to both lower and higher disturbance regimes after the middle flood (e.g., from BWs to Rfs and SPs); **(e) Disturbance-tolerant:** refers to species that principally inhabit in Rfs and resisted after the middle flood; and **(f) Others:** refer to species that could not be classified according to our criteria, that influenced other factors on their behavior to analyze spatiotemporal distribution patterns, or that could not identify relevant patterns.

Table 5.3.3 Classification of spatiotemporal distribution patterns of species in relation to their life type.

Response of species to a middle flood				**Life type**					
Classification		Principal habitat	Habitat after the middle flood	Net-spinners	Attachers	Creepers	Case-bearers	Swimmers	Burrowers
(a)	Disappearing	Rfs		30		9		18	
		Rfs & BWs			4, 38				
		Rfs, BWs, & SPs				3			
		BWs							5, 45
		BWs & SPs				11			40, 47, 48
(b)	Migrating to habitats of lower disturbance regimes	Rfs	Rfs & SPs			22			
		Rfs & BWs	Rfs & SPs			8			
		Rfs, BWs, & SPs	SPs			23			46
		BWs & SPs	BWs & SPs			7			
		BWs & SPs	SPs				31	12	19, 49
		BWs	SPs				33		
(c)	Migrating to habitats of higher disturbance regimes	Rfs, BWs, & SPs	Rfs			2			
(d)	Migrating to habitats of both lower and higher disturbance regimes	Rfs	Rfs & SPs			1			
		Rfs & BWs	Rfs & SPs					14	
		Rfs, BWs, & SPs	Rfs& SPs			10, 16, 25, 34, 35, 36, 41			37, 39, 43, 44
		BWs & SPs	Rfs & SPs						20
(e)	Disturbance-tolerant	Rfs	Rfs	27, 28, 29	13	17, 21, 32			42
(f)	Others							15, 26	6, 24, 50

Most of macro-invertebrates altered spatial distribution patterns of habits after a middle flood, but they have various spatial and temporal distribution patters according to their life types and individual characteristics. Even though some species were also disturbance-tolerant, i.e., resisting in Rfs, whose life

types are net-spinners, attachers, creepers, and burrowers. Most of species were assumed that they intermittently migrated from principal habitats to other ones in order to evacuate from disturbances. Some species of swimmers were also found in Rfs after the middle flood, indicating that they were not disturbance-tolerant, but they seemed to intermittently use other habitats of lower disturbances as refugees and then come back to their principal habitats. A set of results indicate that diversity and heterogeneity of habitats and disturbance regimes are of particular importance to determining biological diversity. In this section, particular attention was paid mostly on disturbance regimes induced by middle floods, but responses of species are likely to be different depending on types of disturbance regimes (e.g., intensity, timing, frequency, etc.).

5.3.3 Correspondence between habitat ages and species abundance, taxa, and biodiversity

In section 5.3.2, spatiotemporal distribution patterns were analyzed with an emphasis on a middle flood occurred in September 2013, and classified. This classification addressed response of species to a particular disturbance level, but have not been addressing other disturbance regimes, i.e., level 0 to level 5 as defined in Table 5.3.1 and Figure 5.3.1, of which a middle flood is categorized as level 4. Particular importance of our research is that macro-invertebrates at same habitats were sampled and analyzed almost every two month, enabling to analyze changing patterns of species in relation to habitat age. Since disturbance regimes were already categorized, we are also able to discuss what changes under certain disturbance regimes can influence levels of species abundance, taxa, and biodiversity. The term “habitat age” are defined in this research as: number of days past since last disturbed at a certain disturbance level. Figure 5.3.3 shows a schematic illustration depicting definition of habitat age and longevity adopted.

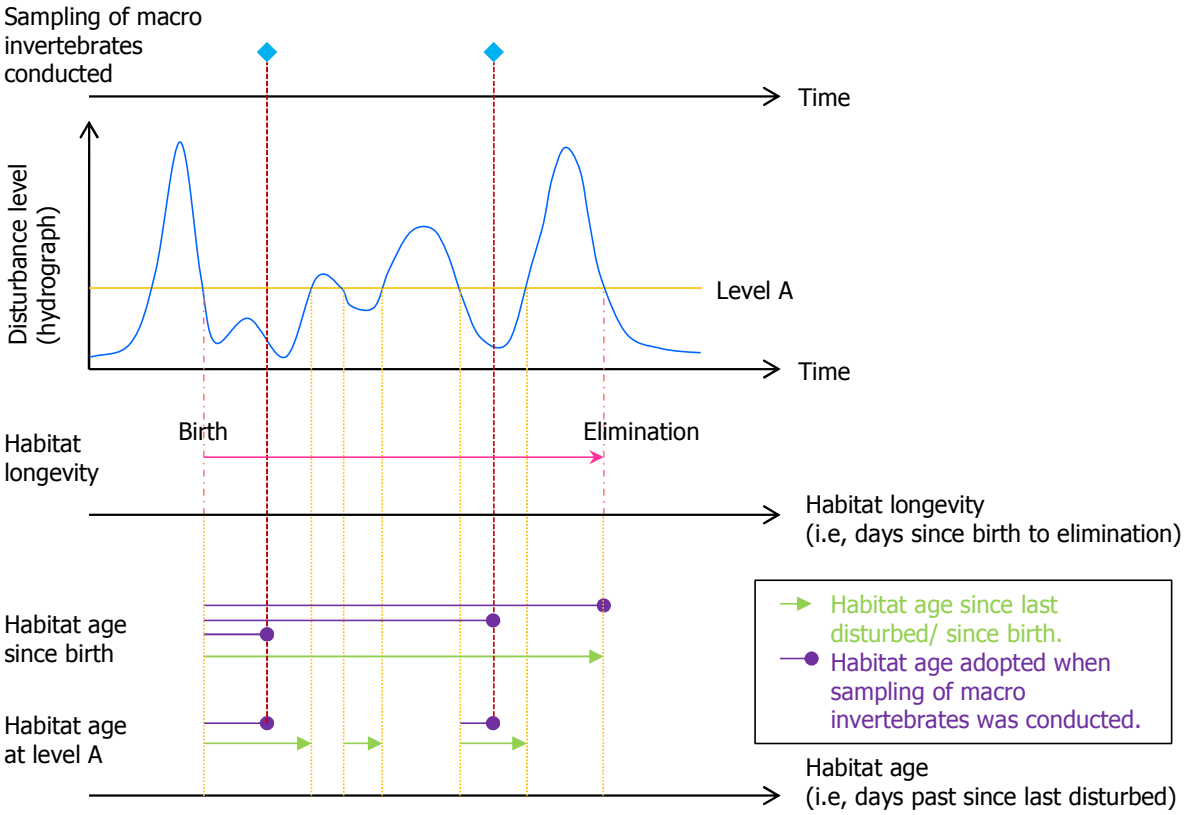


Figure 5.3.3 Schematic illustration of habitat age and longevity adopted when sampling of macro-invertebrates was conducted.

1) Habitat age and richness (species, family, order class)

Here, correspondence between habitat age and species richness is discussed. **Firstly**, we analyzed which levels of richness, i.e., species (and biodiversity), family, order, and class, are influential and correspond to which levels of habitat age, i.e., age since birth, at level 2, and at level 4 (see Figure 5.3.4 (a), (b), and (c) respectively). These disturbance regimes were selected because correspondence of species abundance was somewhat particular in the previous discussions. **Secondly,** habitat age effects on taxa by life types was analyzed (see Figure 5.3.5). Here, habitat ages were represented by age since birth and at level 4 were selected and taxa was represented by species richness to analyze the correspondence.

i) Habitat type

Figure 5.3.4 (a) shows correspondence between habitat age and richness. **Habitat age represents days past since its birth**. Richness by species, family, and order, and biodiversity index of species by Shannon (H') is depicted. Correlation with class is not depicted due to lack of number of samples for the analysis. **Richness represented by species, biodiversity index of species, and family** has similar trends. Richness in Rfs is lower at young and old ages and highest at the middle age, like a concave function. Richness in BWs is gradually increased, like an exponential function. Richness in SPs is almost stable or slightly increased. On the other hand, **richness represented by order** (i.e., bottom right of Figure 5.3.4 (a)) showed a different tread as compared with others. Richness in Rfs is gradually increased and that in BWs and SPs are gradually decreased.

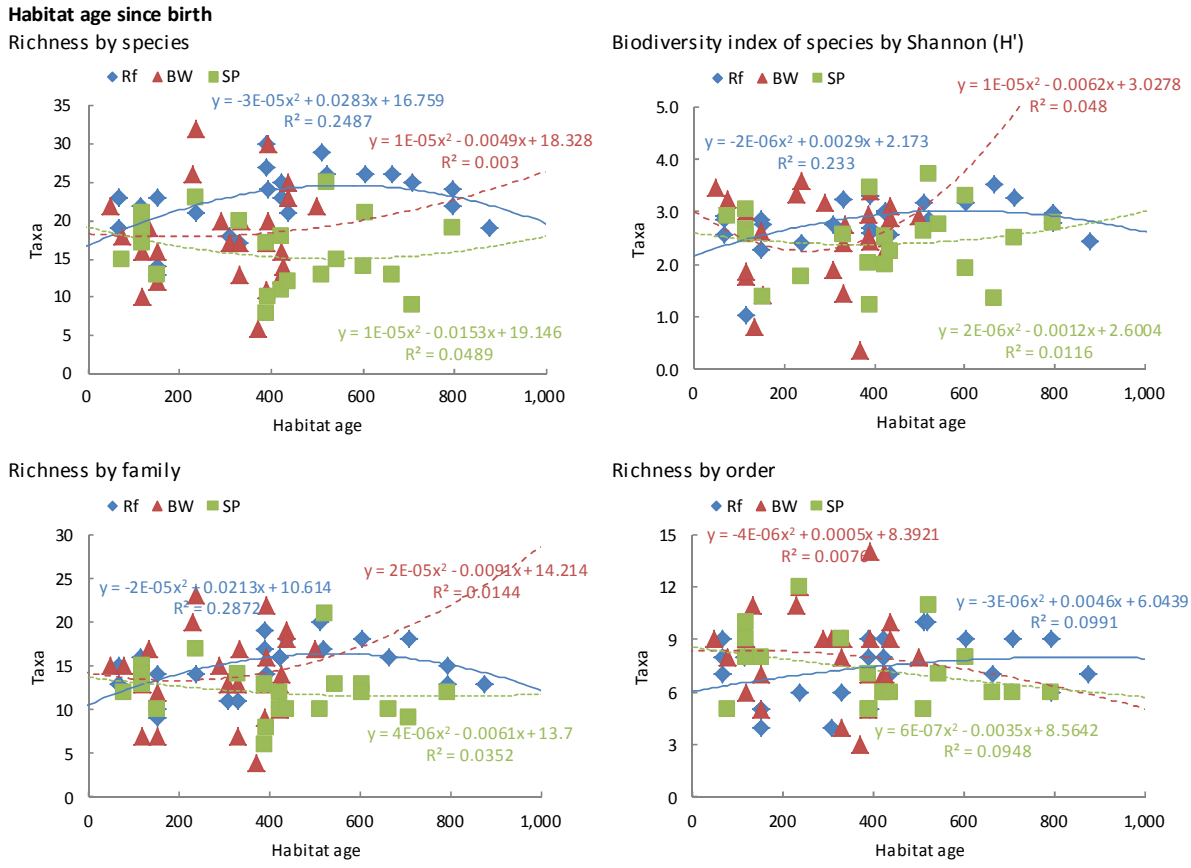


Figure 5.3.4 (a) Correspondence between habitat age and richness. Here, habitat age represents days since habitat birth. Richness by species, family, and order, and biodiversity index of species by Shannon (H') is depicted. Correlation with class is not depicted due to the far lower correlation.

Figure 5.3.4 (b) shows correspondence between habitat age and richness. **Habitat age represents days past since disturbed at level 2**. Richness represented by species, biodiversity index of species, and family has slightly different trends. Richness in Rfs changes like a convex function according to species richness, family richness, and order richness, but changes like an exponential function according to biodiversity index of species. Richness in BWs has similar trends by changing like a convex function according to all richness depicted. Richness in SPs changes differently, which are summarized as it changes like a concave function according to species and order richness, changes like a convex function according to biodiversity index of species, and is gradually decreased according to family richness.

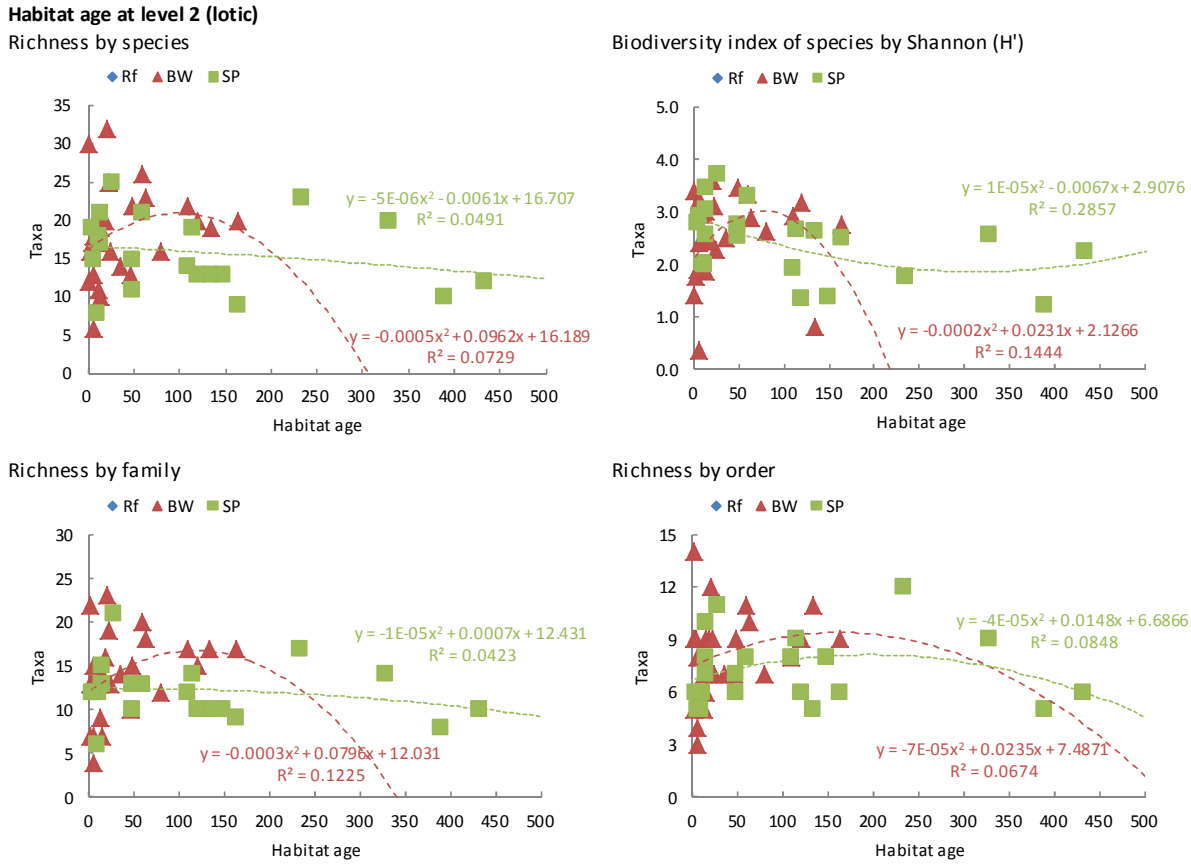


Figure 5.3.4 (b) Correspondence between habitat age and richness. Here, habitat age represents days since disturbances at the level 2.

Figure 5.3.4 (c) shows correspondence between habitat age and richness. **Habitat age represents days past since disturbed at level 4**. Richness represented by species, biodiversity index of species, and family has similar trends. Richness in Rfs does not exist since disturbance regimes at level 2 are lotic systems including Rfs. Richness in BWs is lower at the young age, increased and reached to a peak at the middle age, and rapidly decreased at the old age, like a concave function. Richness in SPs is relatively high and gradually decreased at the old age.

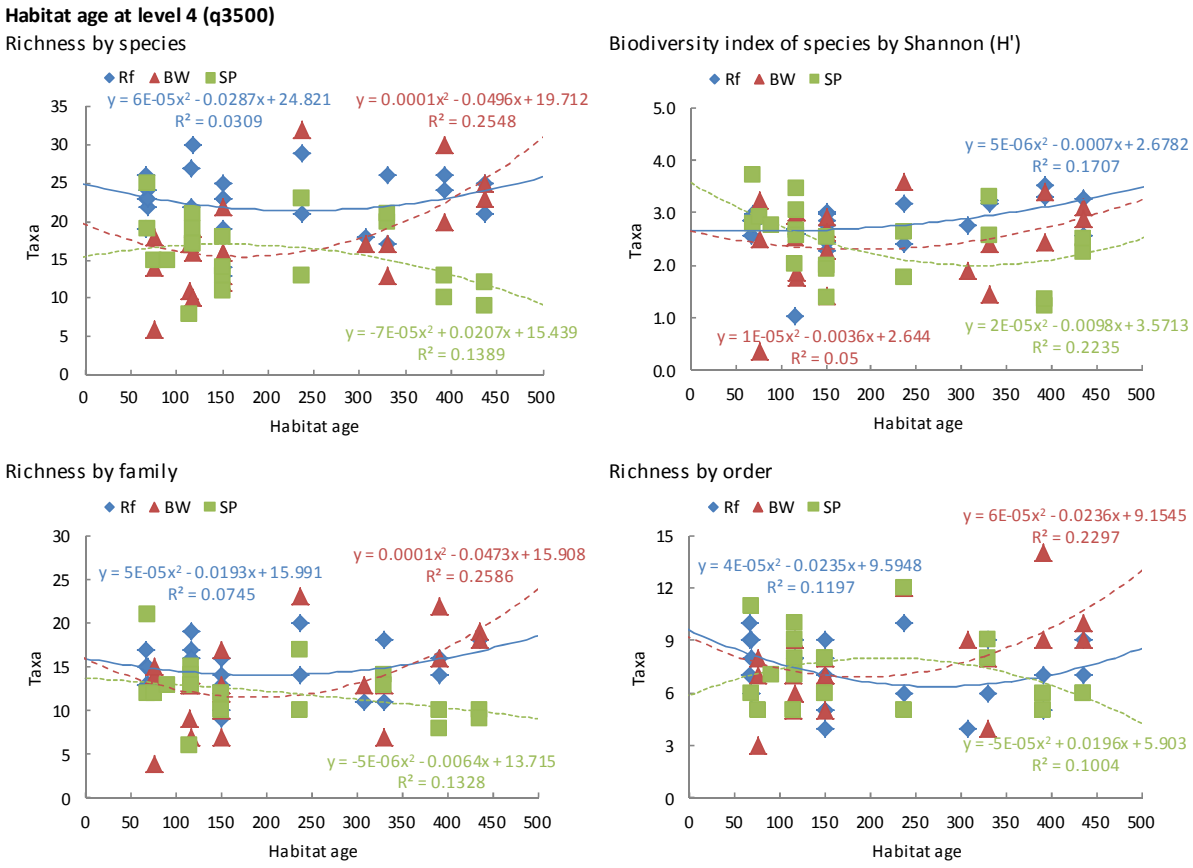


Figure 5.3.4 (c) Correspondence between habitat age and richness. Here, habitat age represents days since disturbances at the level 4.

ii) Life type

Figure 5.3.5 shows correspondence between habitat age and richness by life type. Life types are net-spinners, attachers, creepers, case-bearers, swimmers, and burrowers for the selected 50 species. Of which 4 types of net-spinners, creepers, swimmers, and burrowers are discussed, since attachers and case-bearers are selected only two species respectively. **Habitat age represents days past since its birth at the left figures and days past since last disturbed at the level 4 at the right figures**. **Richness is represented by species richness** and showed different habitat age effects according to both life types and disturbance regimes.

Species richness of net-spinners in Rfs is gradually increased for both habitat age of since-birth and level 4 and it is higher than richness in SPs and BWs at most stages of their habitat age. Most of net-spinners are Trichoptera and they were disturbance-tolerant, resulting in stable richness sustained throughout their habitat ages.

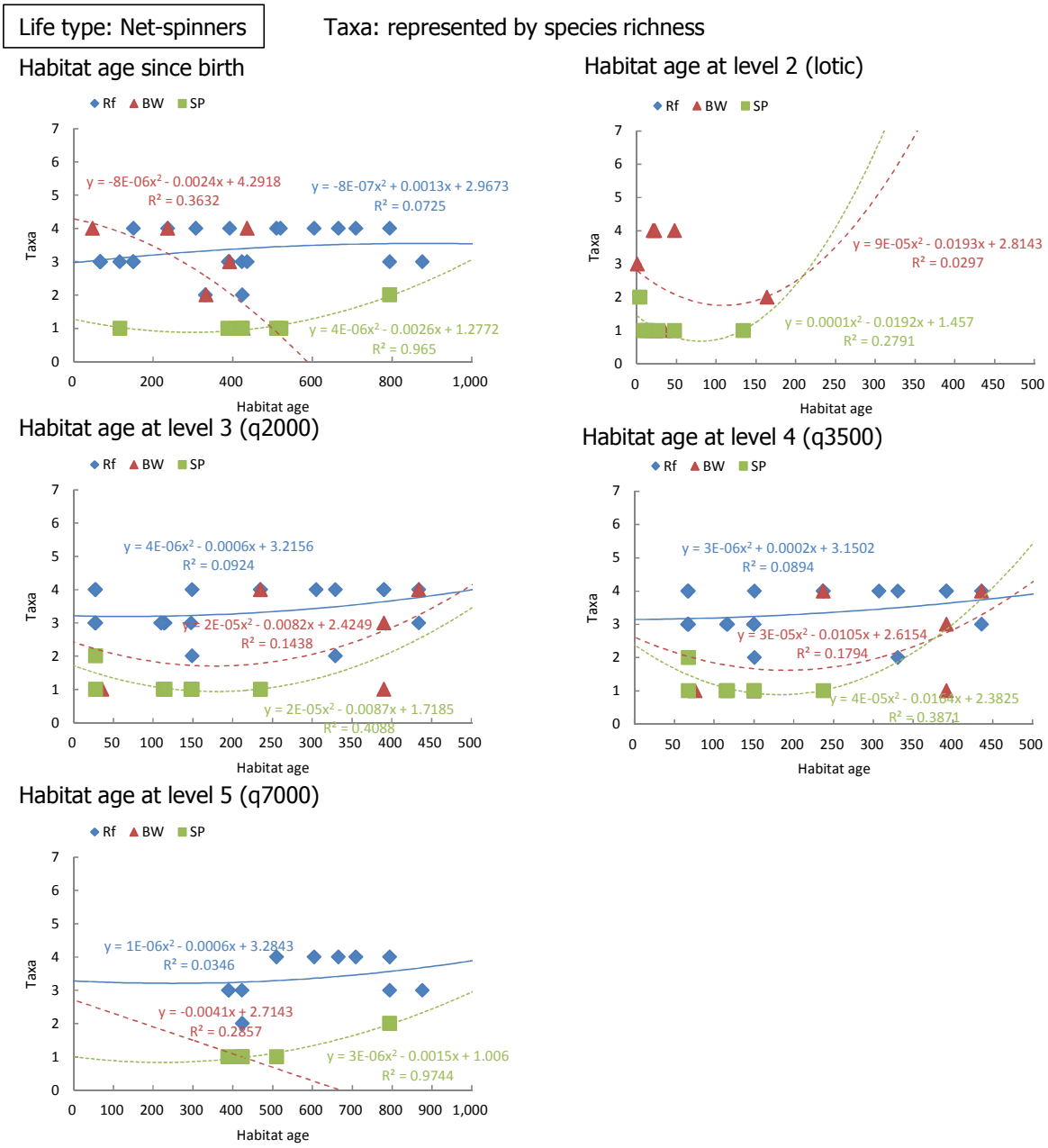


Figure 5.3.5 (a) Correspondence between habitat age and species richness by life type (net-spinners).

Species richness of creepers is confirmed in Rfs, BWs, and SPs. Species richness in Rfs changes like a low gradient concave function for habitat age of since-birth, and changes like a low gradient convex function for habitat age of level 4. But, richness is both stable throughout their habitat ages. On one hand, richness in BWs and SPs changes oppositely between habitat age of since-birth and level 4. When richness of one is increased, the other is decreased. This indicates that in order to sustain richness under shifting habitat conditions, heterogeneous habitats having different ages are important.

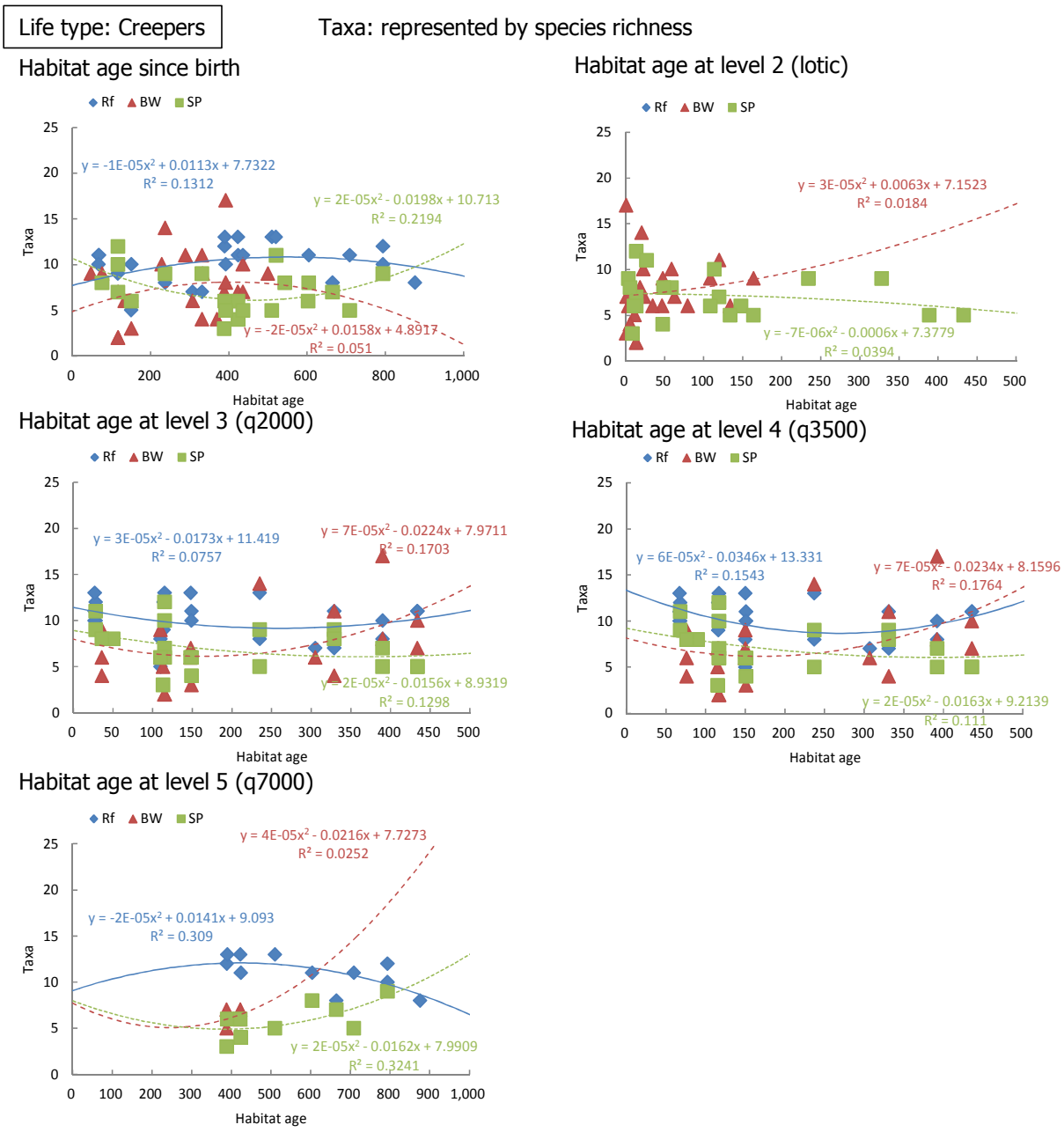


Figure 5.3.5 (b)　Correspondence between habitat age and species richness by life type (creepers).

Species richness of swimmers is decreased in relatively higher disturbance regimes of Rfs and BWs for the habitat age of since-birth, but is stably sustained throughout its age for the habitat age of level 4. This indicates that species richness of swimmers is decreased unless certain disturbances occur, and therefore disturbance at level 4 is one of the requirements for swimmers in order to sustain themselves in shifting habitat conditions.

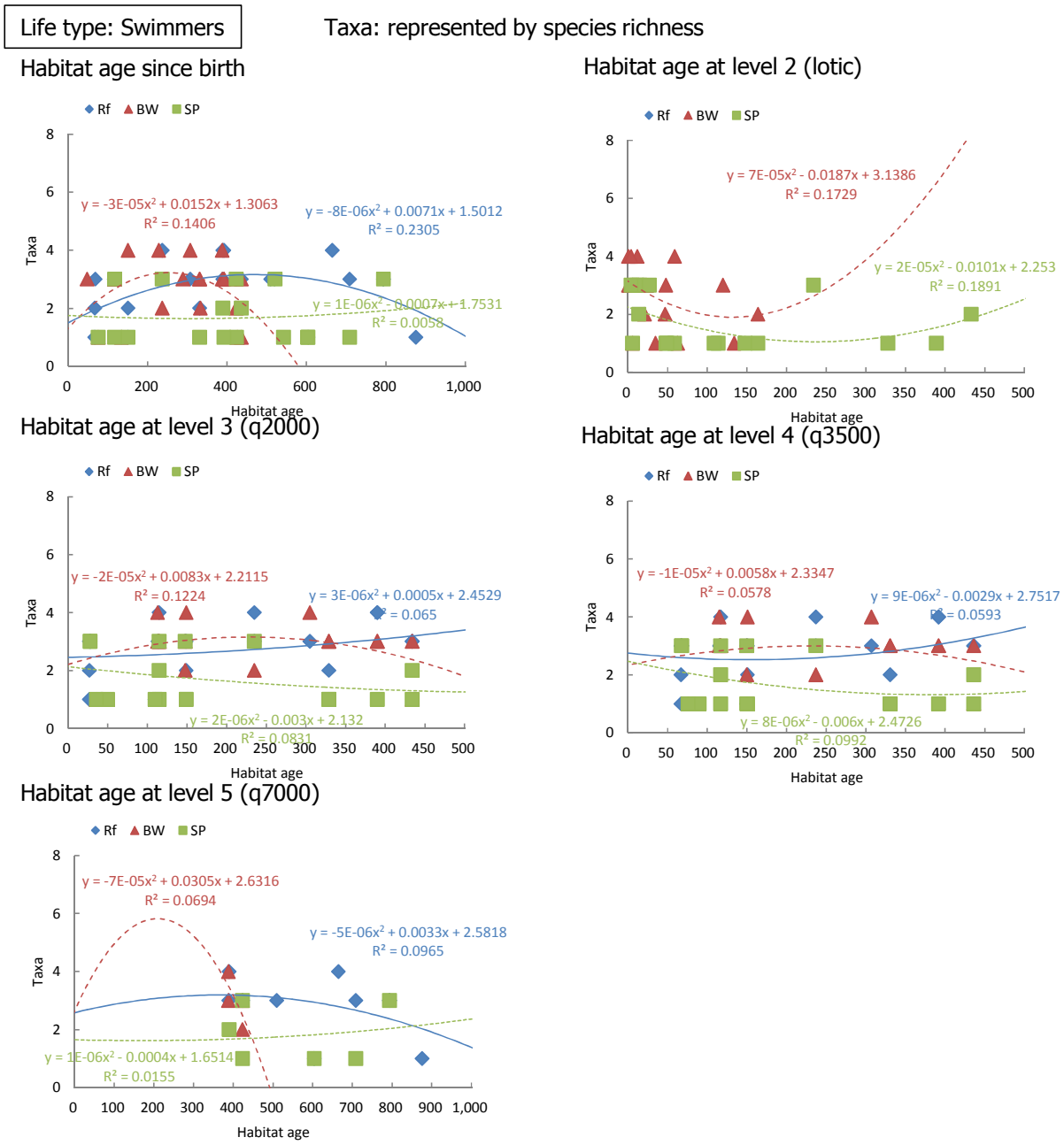


Figure 5.3.5 (c) Correspondence between habitat age and species richness by life type (swimmers).

Species richness of burrowers in SPs changes like a concave function for the habitat age of level 4 and therefore richness is low at the your age and old ages. This pattern occurs, because some species of swimmers were actually disappeared by the middle flood occurred in September 2013 and assumed to be disappeared in June 2012 (by a middle flood). However, richness in SPs is stably sustained for the habitat age of since-birth. This result also indicates the importance of heterogeneous habitats with various ages, since habitats with homogeneous ages will have the same trend to decrease richness at the old age followed by like a concave function.

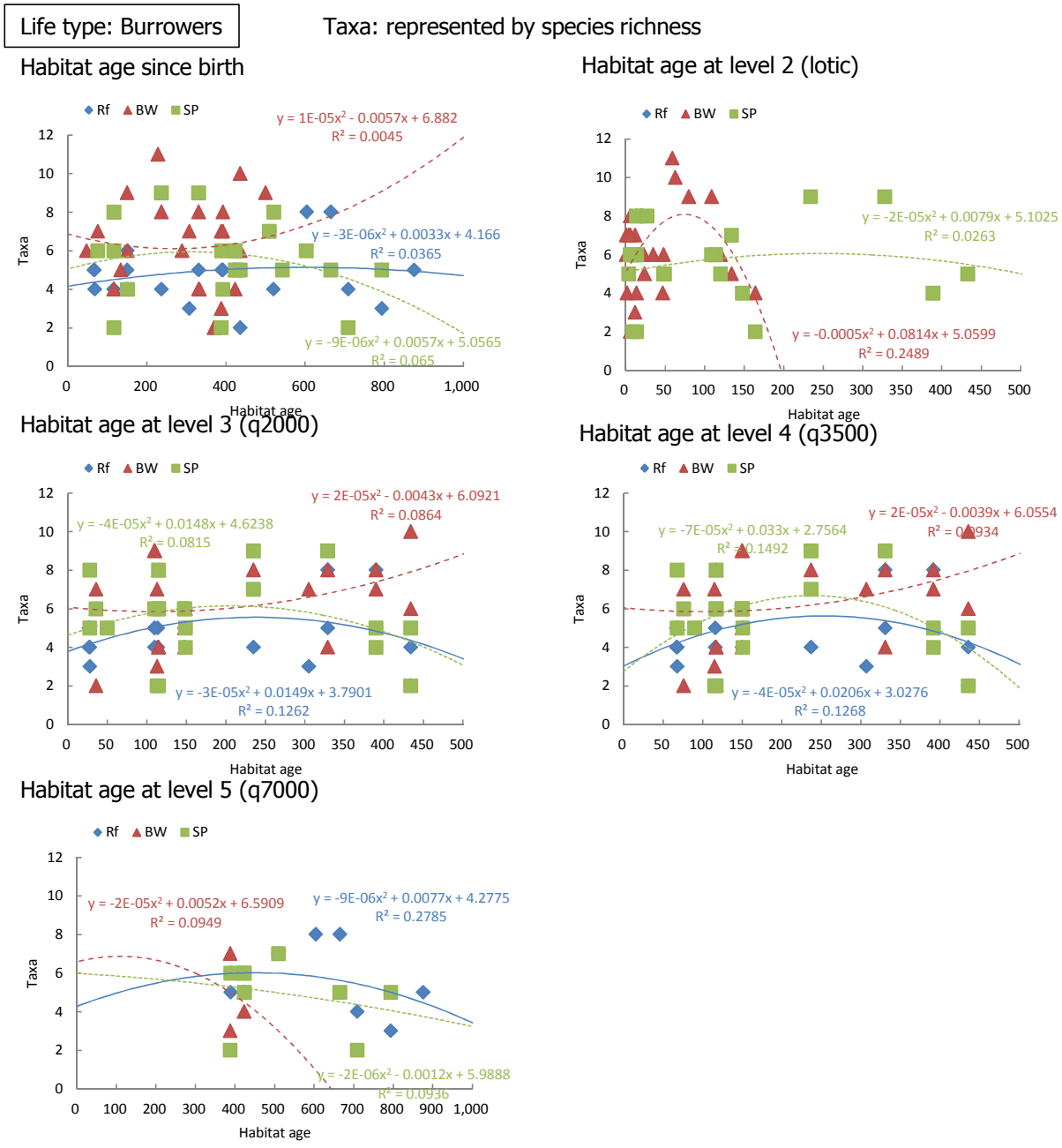


Figure 5.3.5 (d) Correspondence between habitat age and species richness by life type (burrowers).

2) Habitat age and species abundance

In order to analyze correspondence between habitat age and taxa of species, 50 selected species were used and these results are shown in Figure 5.3.6 (1) to (50). Numbers in bracket ( ) in the figure correspond to species reference number, and a number in bracket [ ] in the main texts shows a reference number of the selected list of species previously shown in Table 5.2.3. The following procedures were adopted to analyze approximation in explaining changing patterns of species abundance according to habitat age: more than four survey data were used; approximation that best describes the changing patterns was selected among exponential, liner, log, power, and polynomial (with second-order) approximations; and approximation with the highest correlation coefficient was adopted in case an appropriate approximation could not be decided.

Disappearing types [3, 4, 5, 9, 11, 18, 30, 38, 40, 47, 48] (see Table 5.3.3) have the relatively high correspondence with habitat age at greater than level 3 and 4, since these species disappear after the middle flood (i.e., level 4) and gradually increase their abundance like an exponential function. Species principally living in BWs and SPs showed different characteristics in the correspondence at level 2. They change their abundance almost followed by a concave function, implicating that these habitats could be influenced by a relatively smaller disturbance at level 2, which has own characteristics of disturbance regimes depending on their locations.

In types of intermittently migrating to habitats of lower disturbances after the middle flood [7, 8, 12, 19, 22, 23, 31, 33, 46, and 49], SPs seem to play a role as refugee habitats. They get high abundance at young habitat age and get lower at old age under most disturbance regimes, like a negative exponential function. On the other hand, BWs, i.e., disturbed habitats, have different response under their disturbance regimes. At the level 4, habitats get low abundance to migrate and get higher at old age, like an exponential function. At the level 2, habitats get low abundance at young and old age and reach to peak at middle age, like a concave function.

In types of intermittently migrating to habitats of higher disturbances after the middle flood [2], Rfs seem to play as a role as habitats simply washed away and reached from their principal habitats rather than migrated to refugee habitats. Rfs get lower abundance at the middle age, like a convex function at the level 4 and 5. BWs get zero abundance at the young age and gradually get higher abundance at the old age, like an exponential function.

In types of intermittently migrating to habitats of both lower and higher disturbances after the milled flood [1, 10, 14, 16, 20, 25, 34, 35, 36, 37, 39, 41, 43, and 44], Rfs, BWs, and SPs have a variety in their responses such as exponential, concave, and convex functions. In types of disturbance-tolerant [13, 17, 21, 27, 28, 29, 32, and 42], species in Rfs were resisted from the middle flood. At the age since birth, the correspondence seems to be an exponential function. On the other hand, at the level 4 and 5, Rfs seem to have both concave and convex functions.

1 Tricladida Dugesia japonica

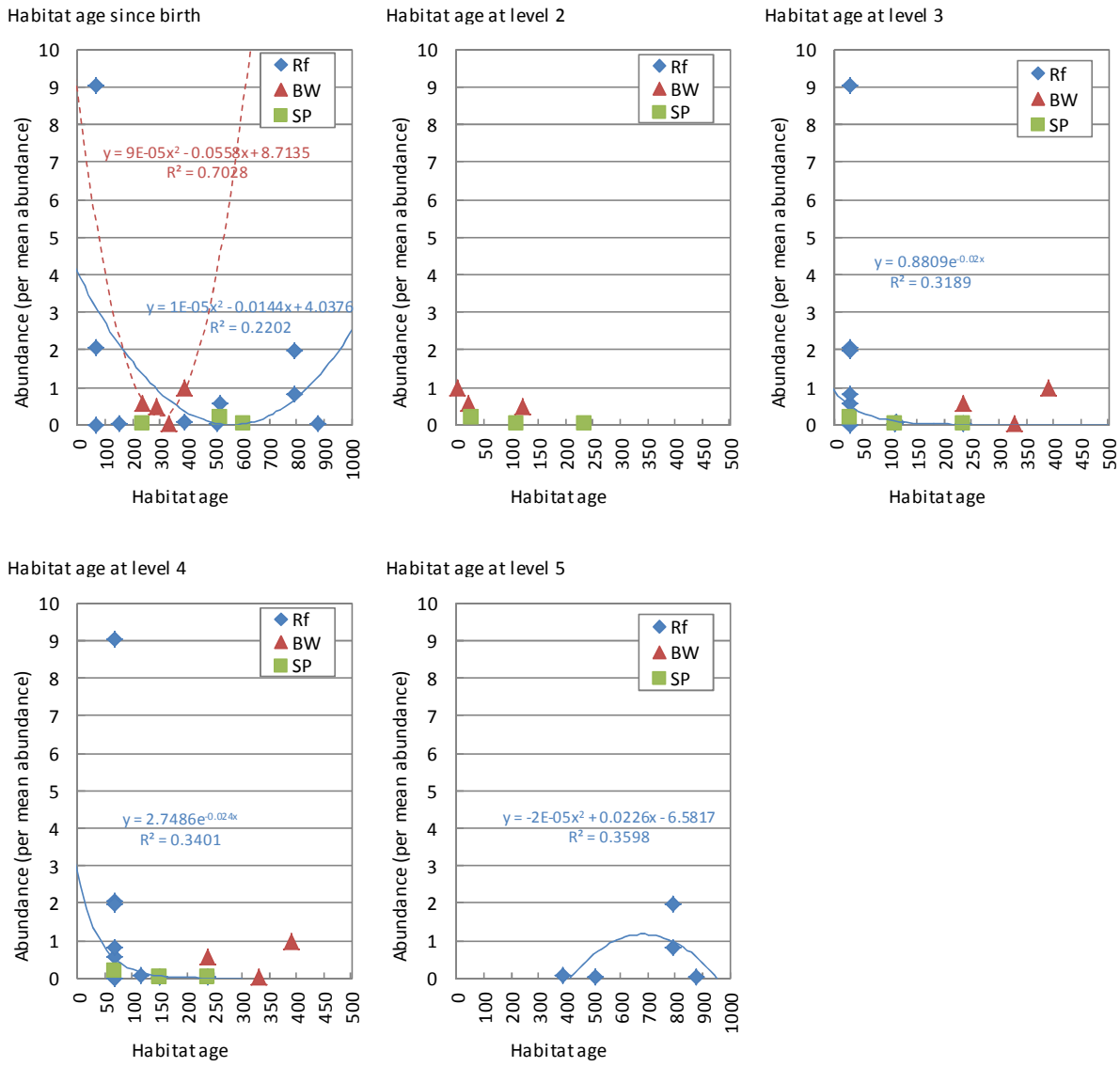


Figure 5.3.6 Correspondence between habitat age and species abundance.

2 Hoplonemertea Prostoma sp.

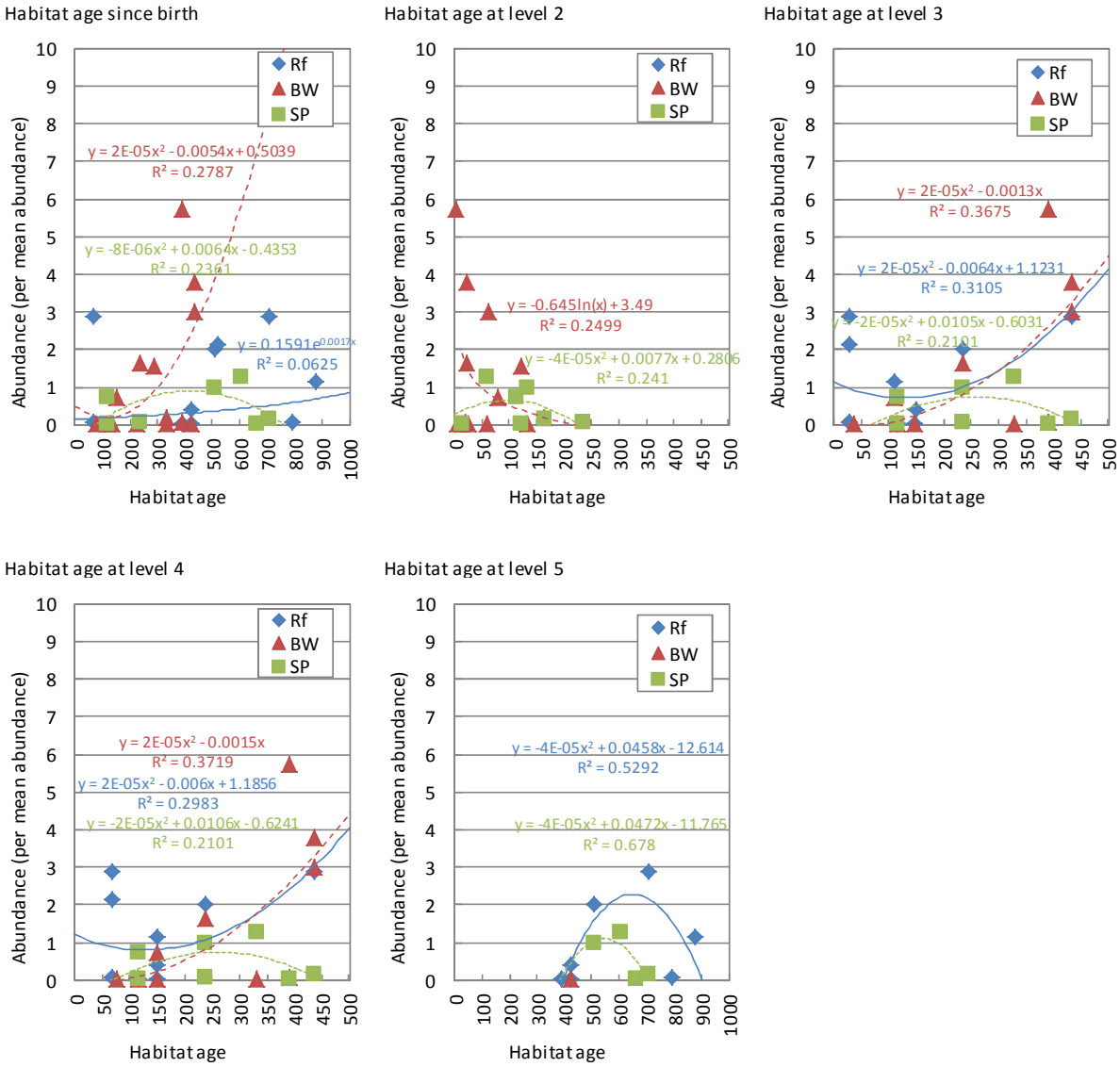


Figure 5.3.6 (2) Correspondence between habitat age and species abundance.

3 Basommatophora Physa acuta

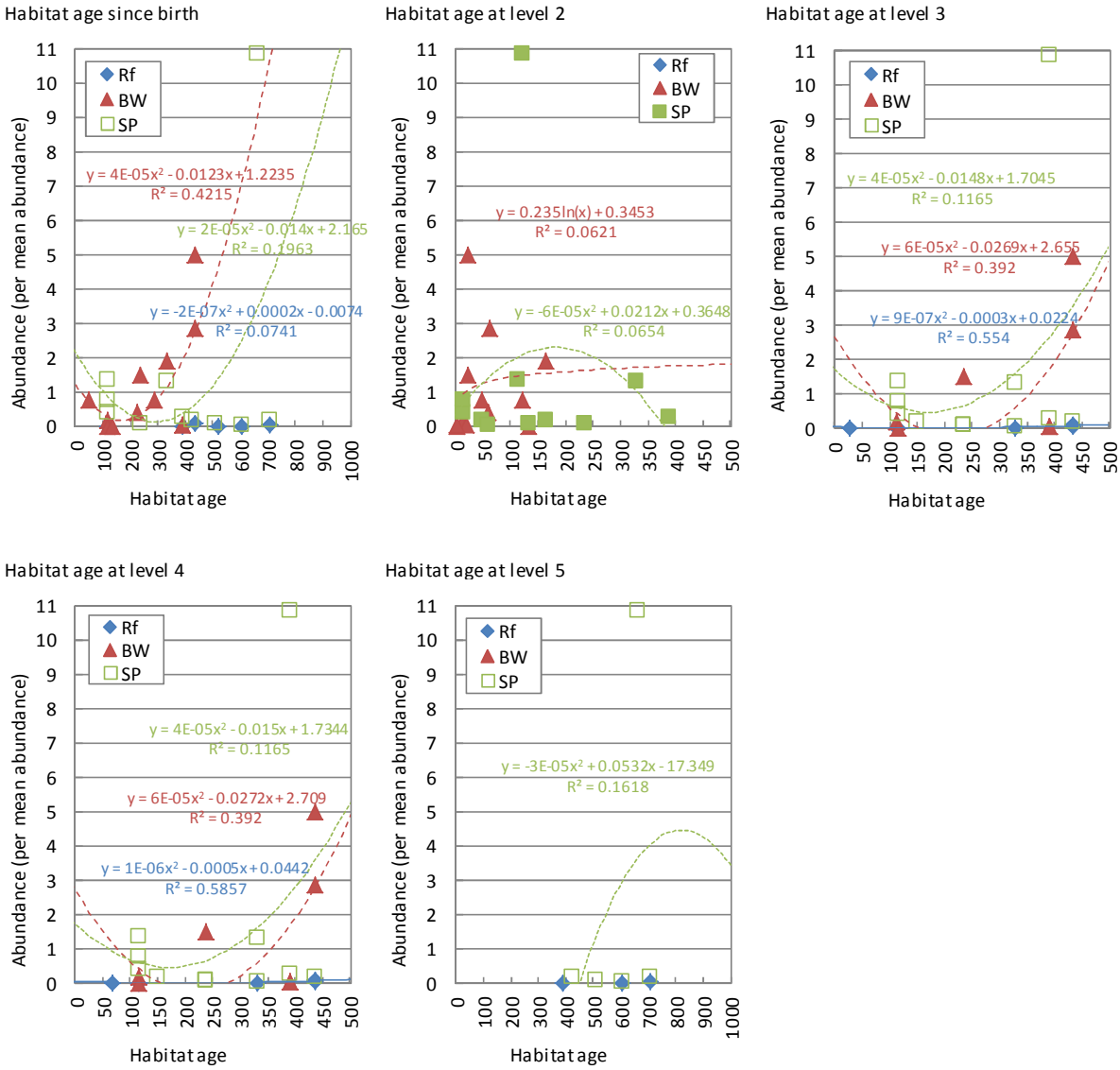


Figure 5.3.6 (3) Correspondence between habitat age and species abundance.

4 Mytiloida Limnoperna fortunei

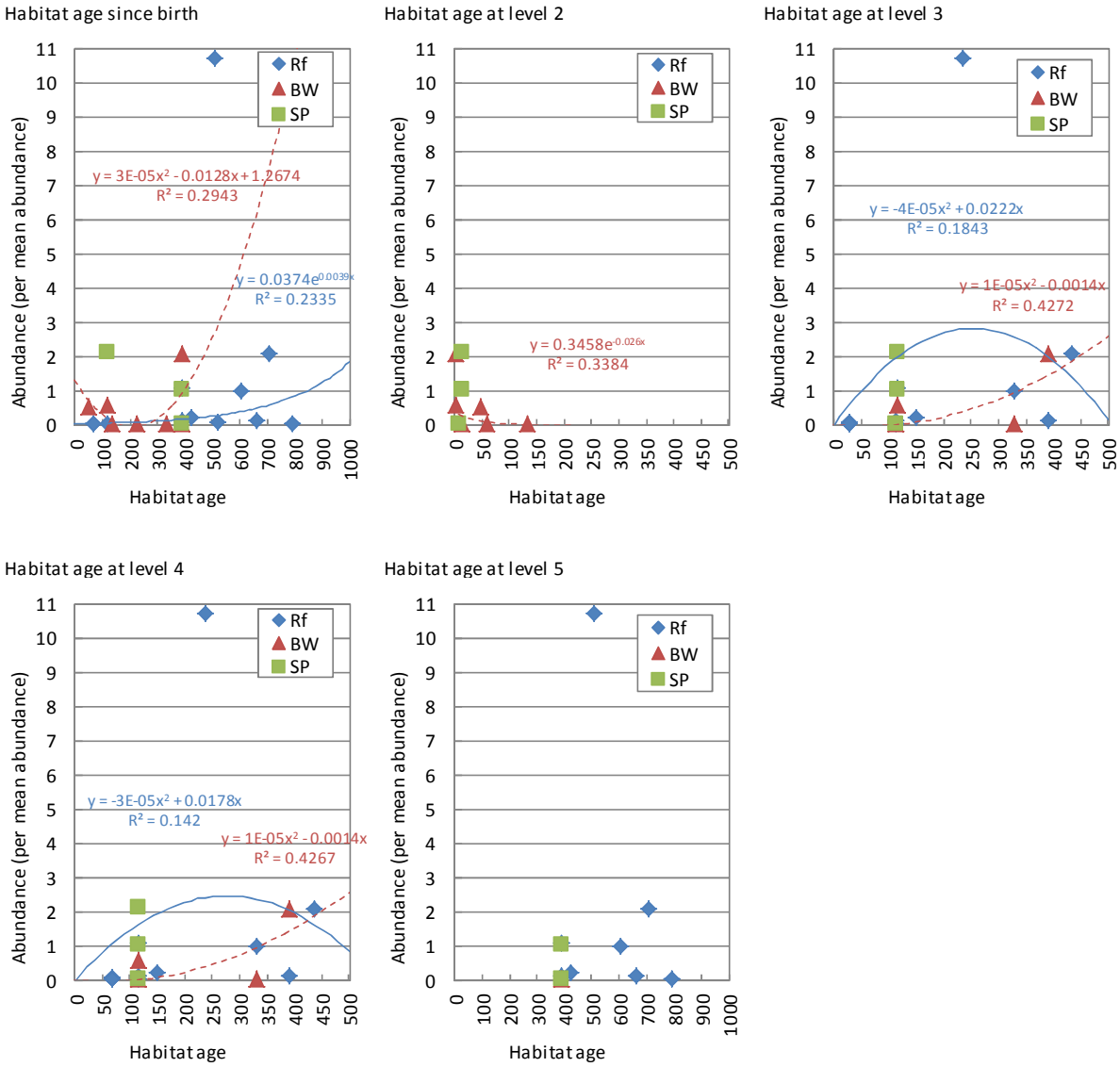


Figure 5.3.6 (4) Correspondence between habitat age and species abundance.

5 Tubificida Nais bretscheri

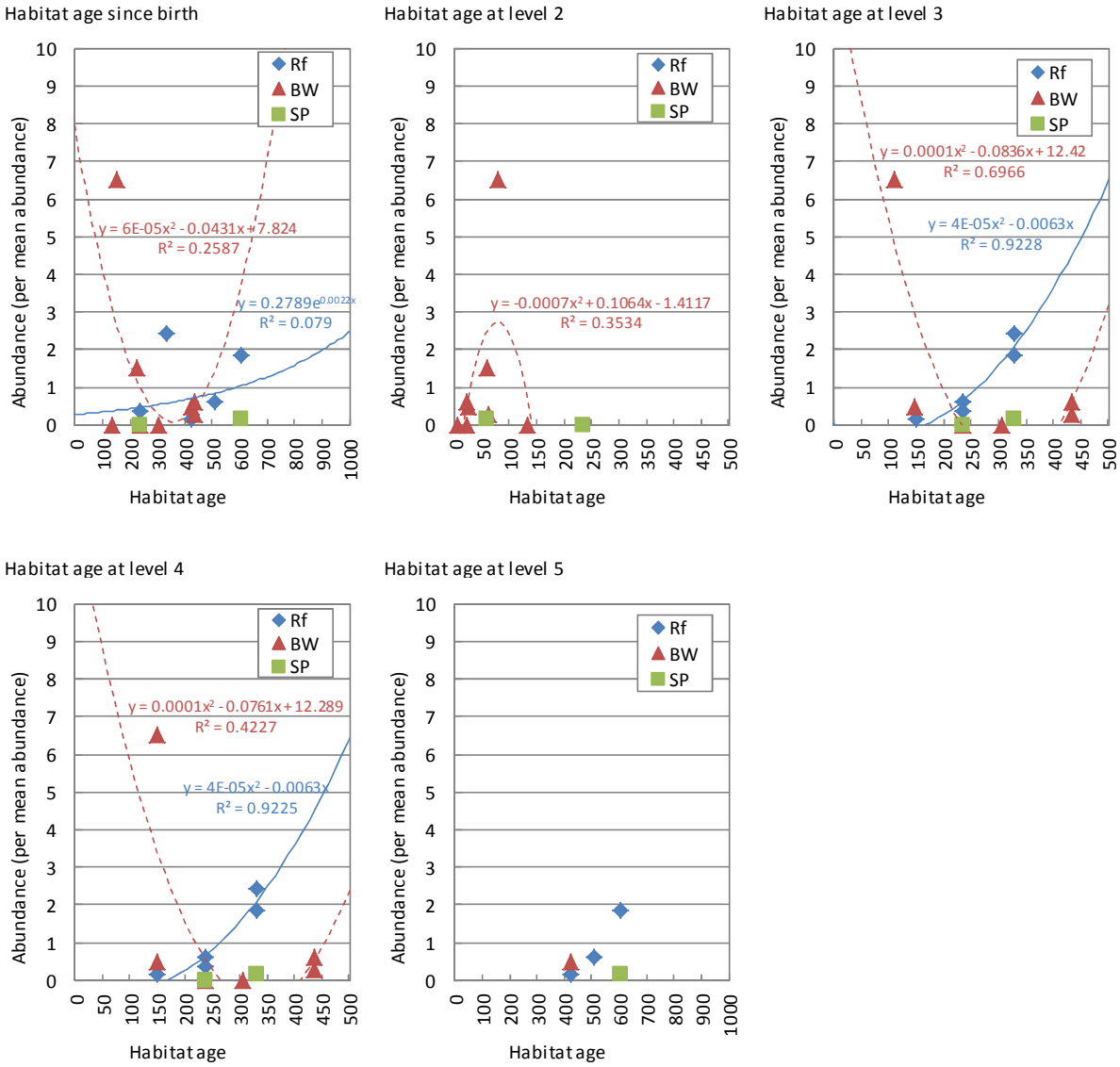


Figure 5.3.6 (5) Correspondence between habitat age and species abundance.

6 Tubificida Slavina appendiculata

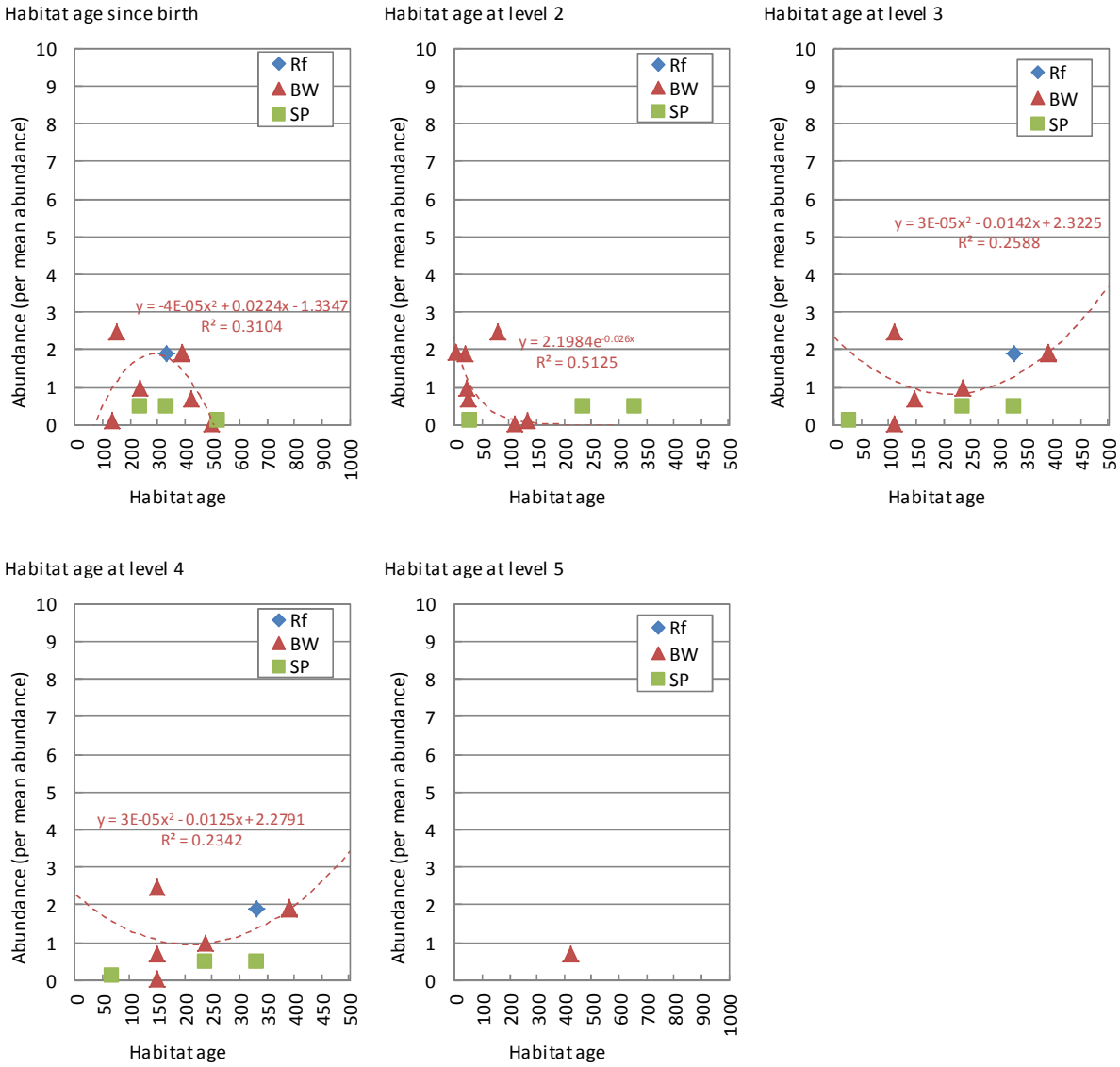


Figure 5.3.6 (6) Correspondence between habitat age and species abundance.

7 Acarina Lebertia sp.

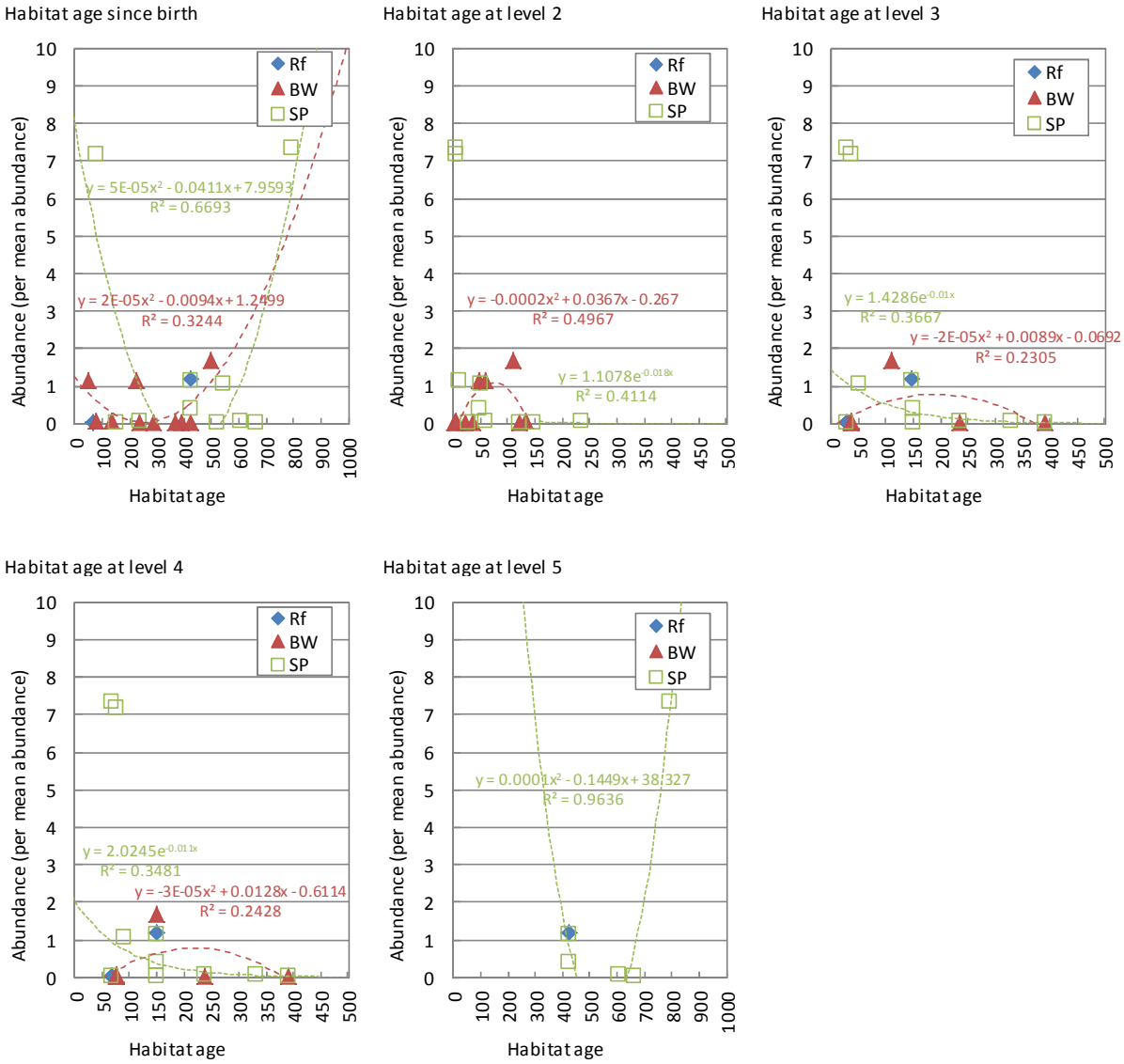


Figure 5.3.6 (7) Correspondence between habitat age and species abundance.

8 Acarina Sperchon sp.

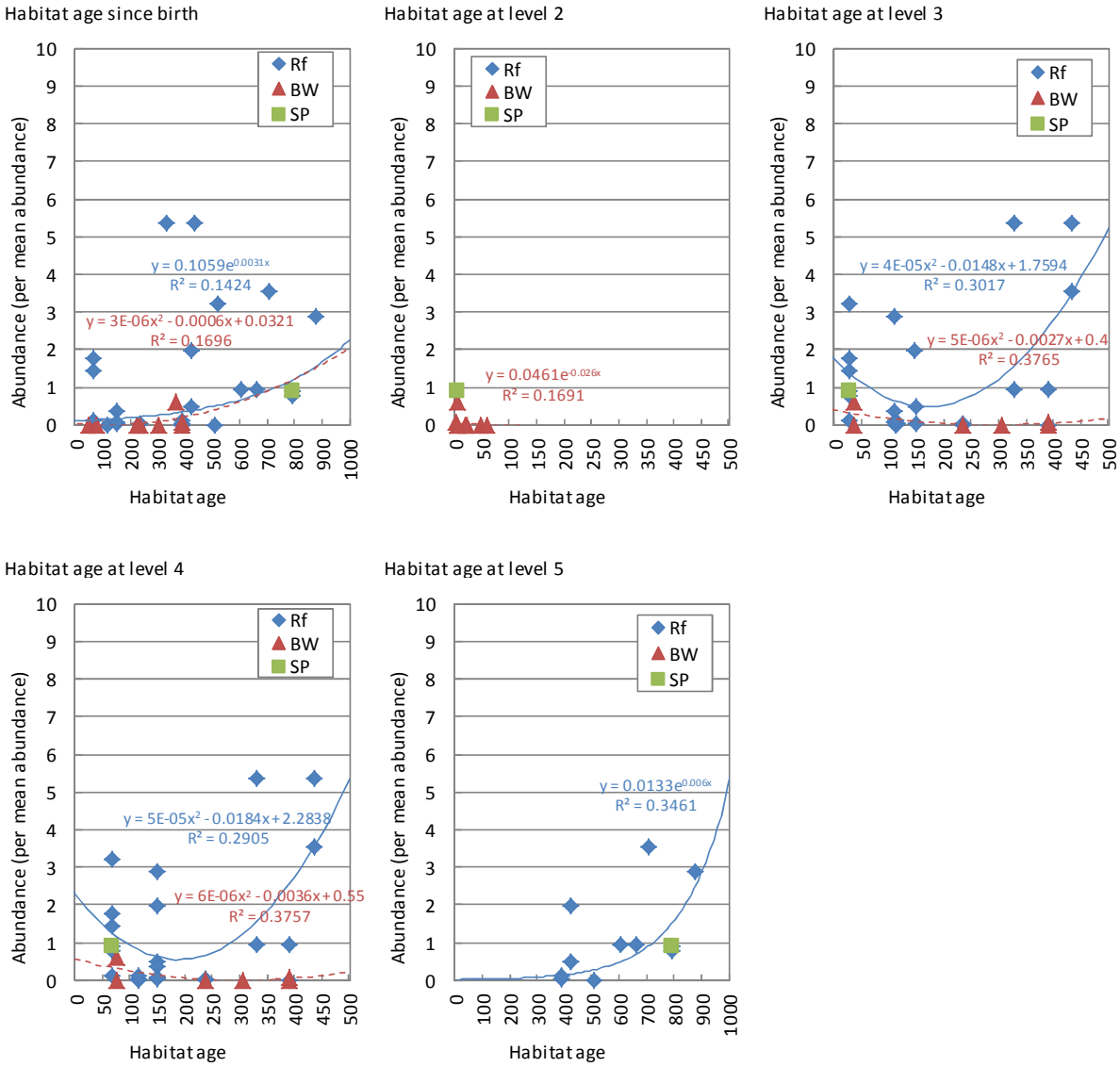


Figure 5.3.6 (8) Correspondence between habitat age and species abundance.

9 Acarina Atractides sp.

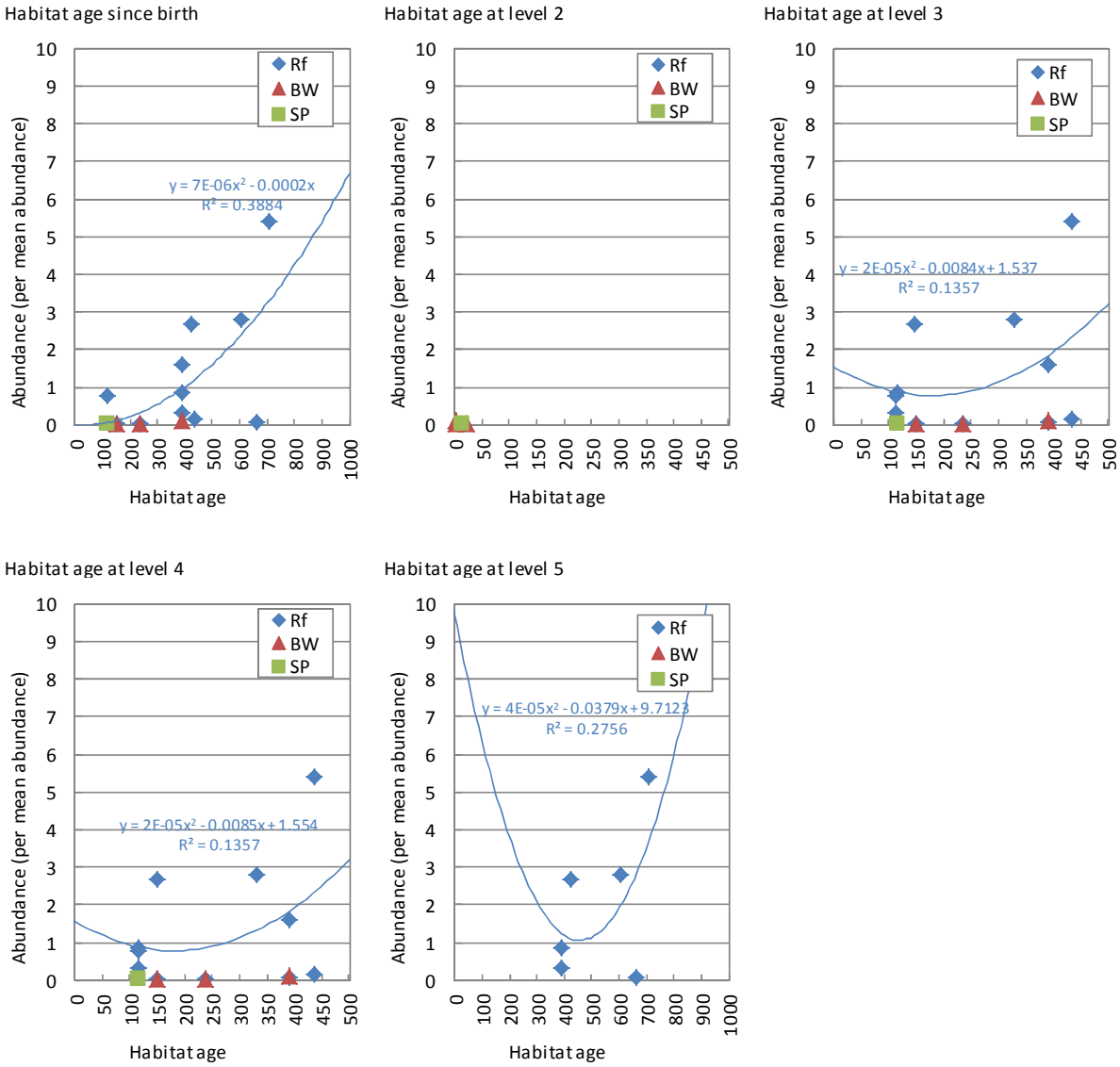


Figure 5.3.6 (9) Correspondence between habitat age and species abundance.

10 Acarina Hygrobates sp.

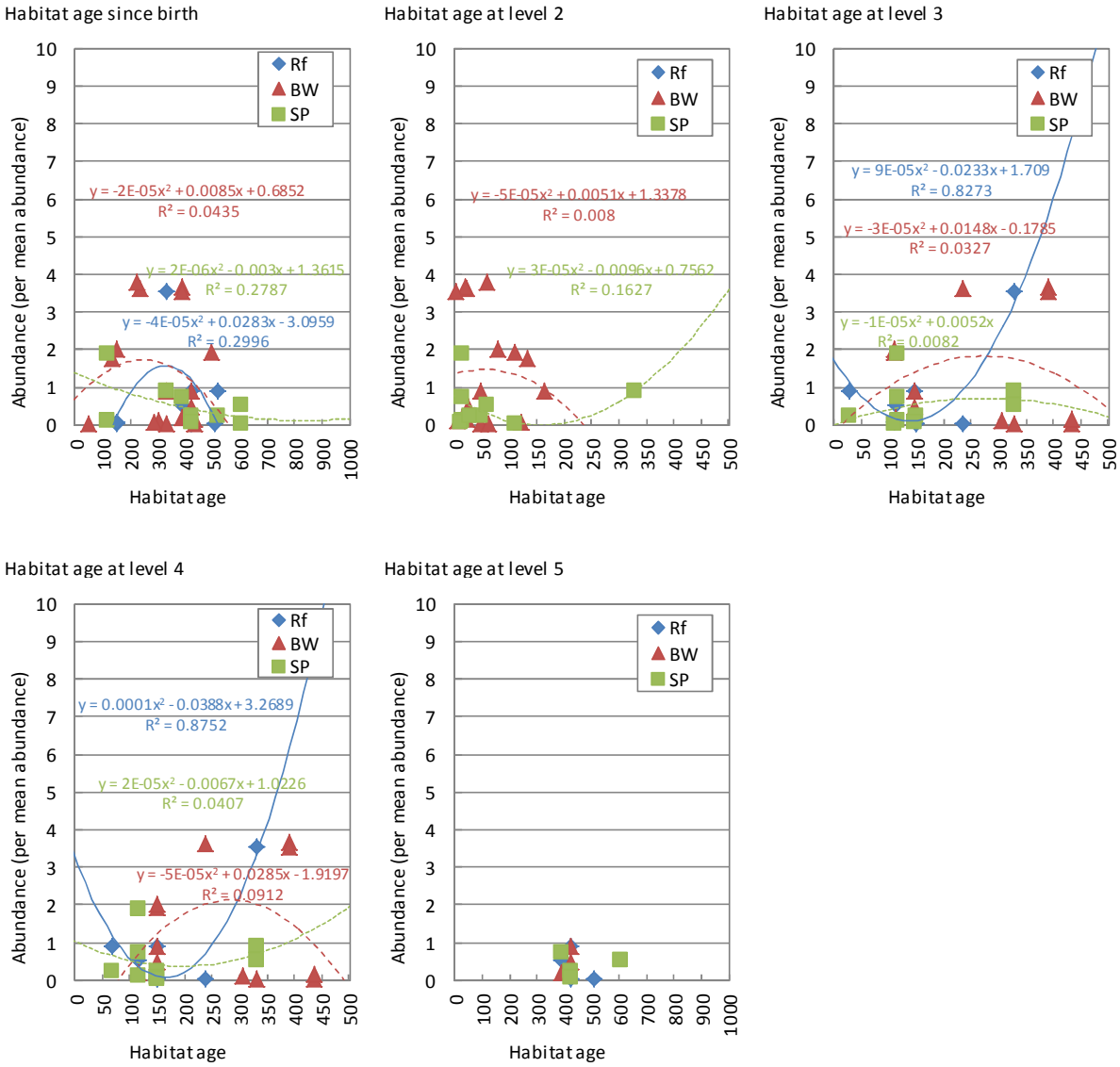


Figure 5.3.6 (10) Correspondence between habitat age and species abundance.

11 Isopoda Asellus hilgendorfi

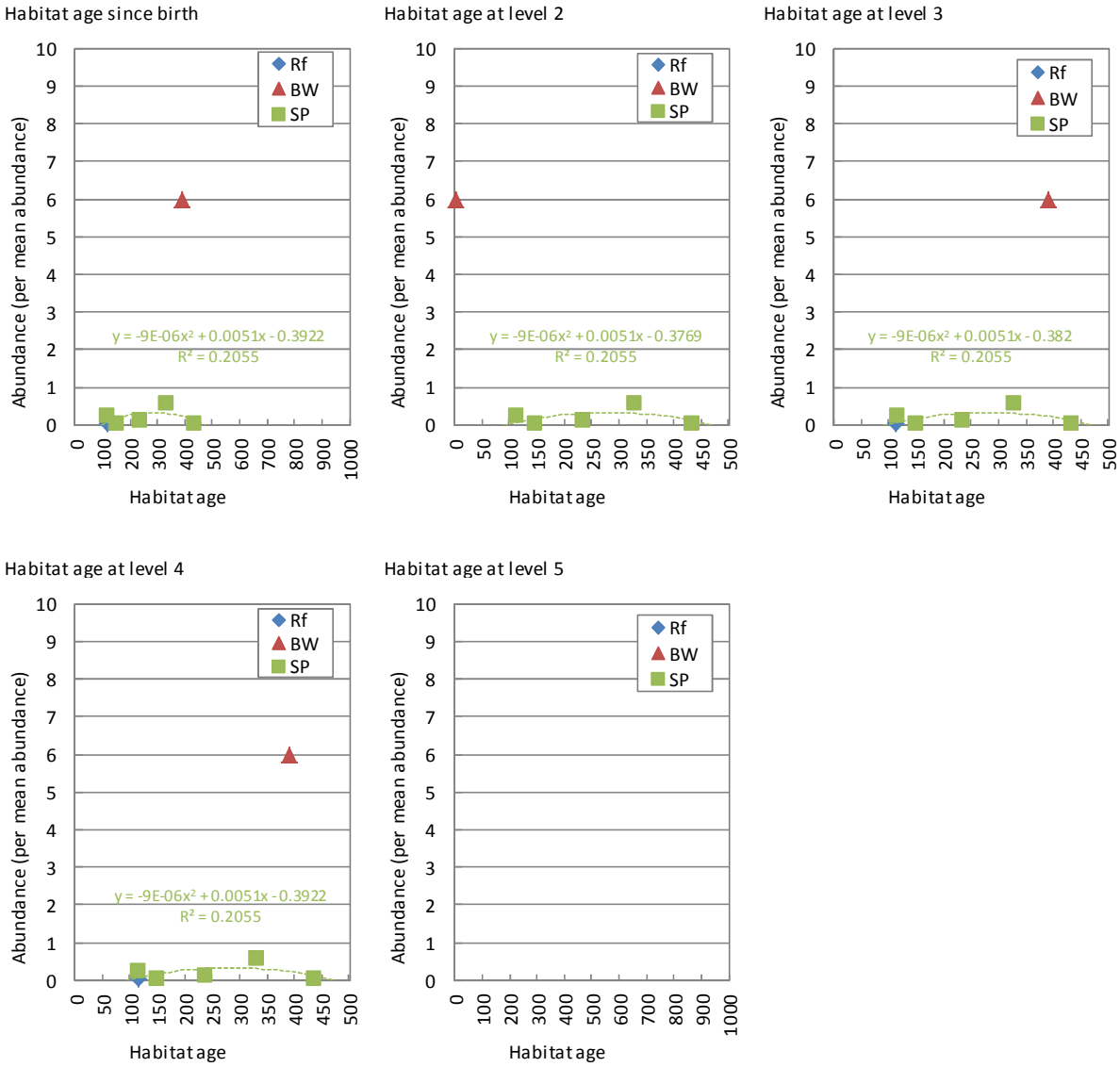


Figure 5.3.6 (11) Correspondence between habitat age and species abundance.

12 Decapoda Paratya improvisa

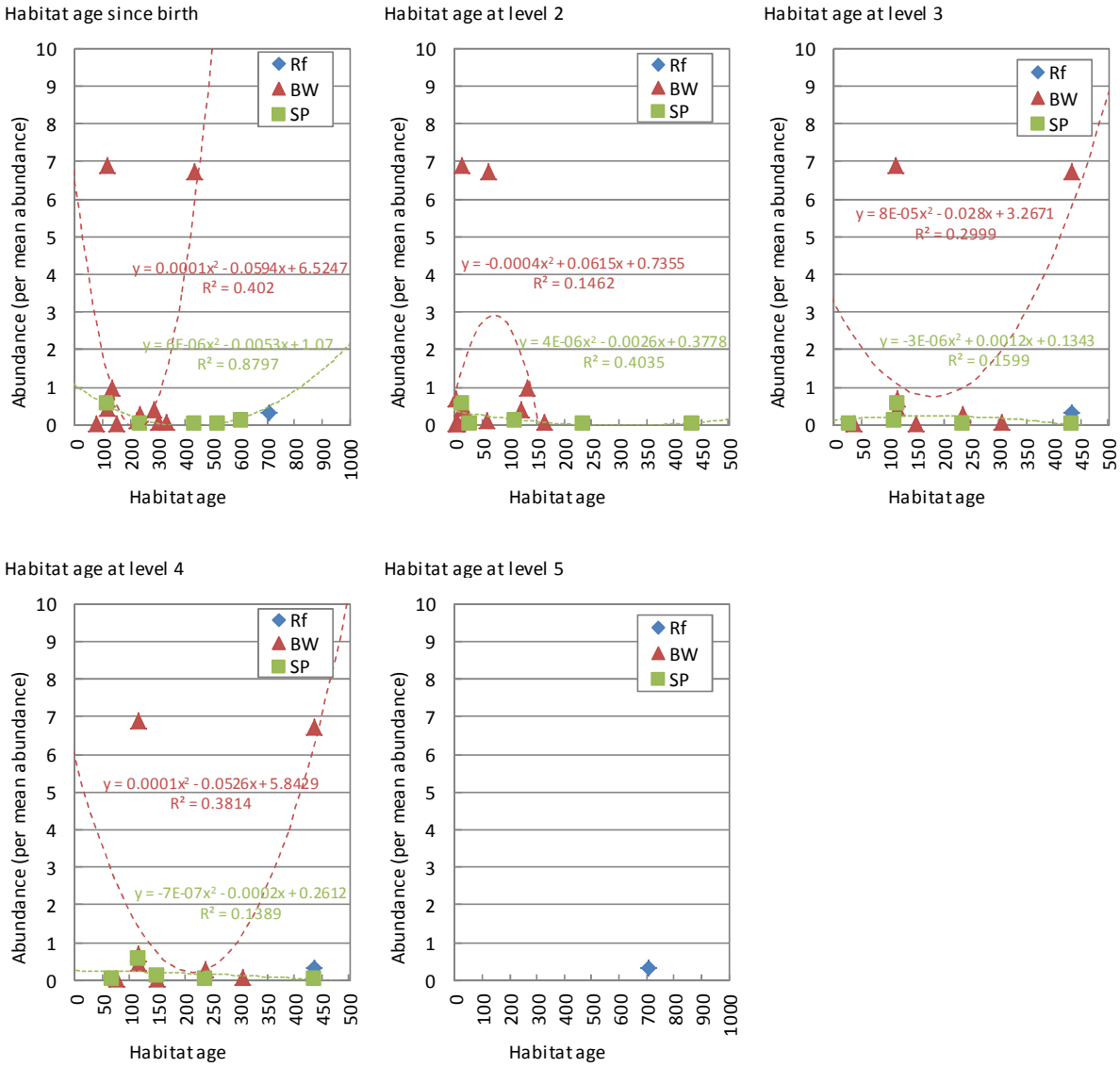


Figure 5.3.6 (12) Correspondence between habitat age and species abundance.

13 Ephemeroptera Baetiella japonica

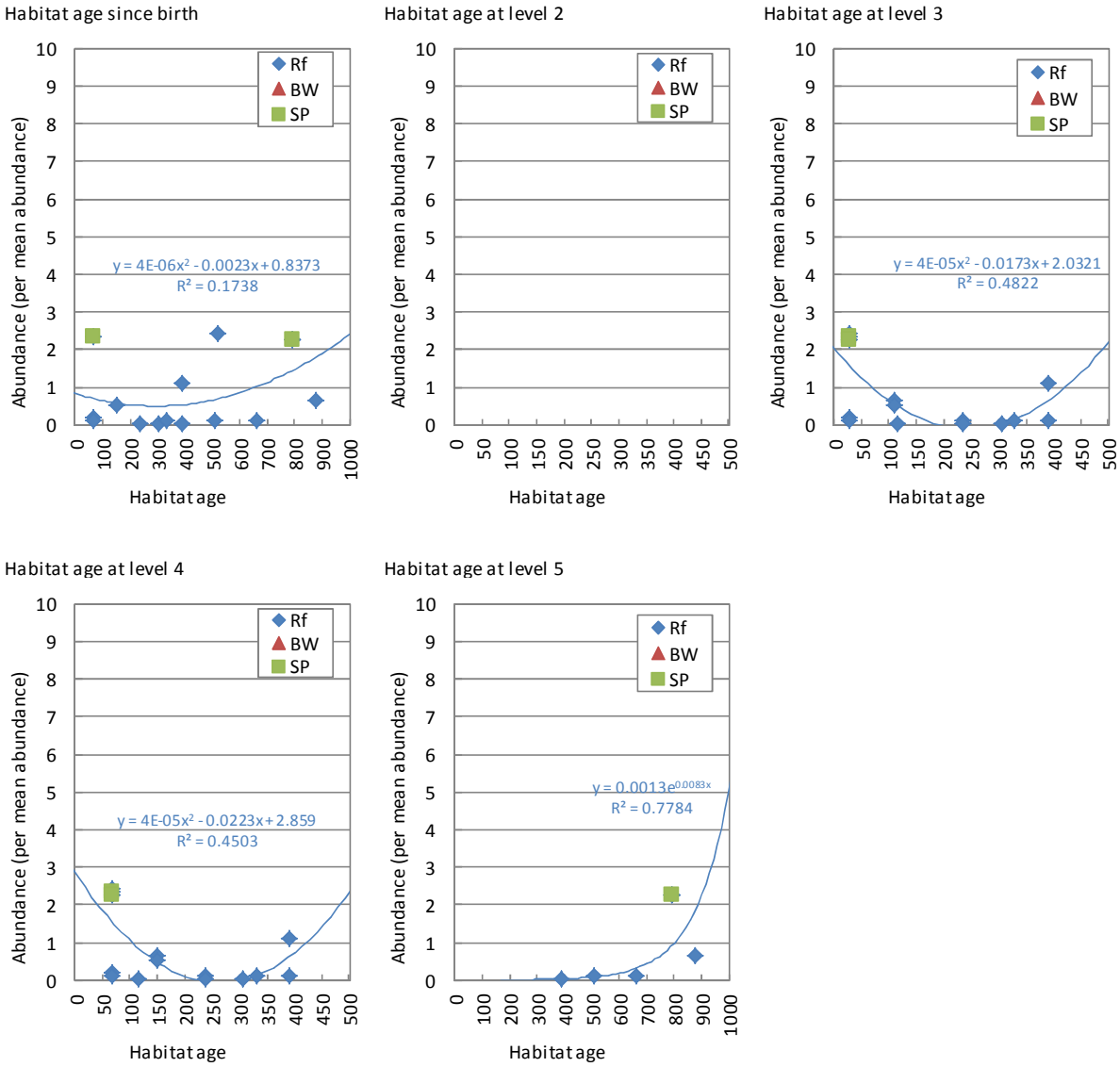


Figure 5.3.6 (13) Correspondence between habitat age and species abundance.

14 Ephemeroptera Baetis taiwanensis

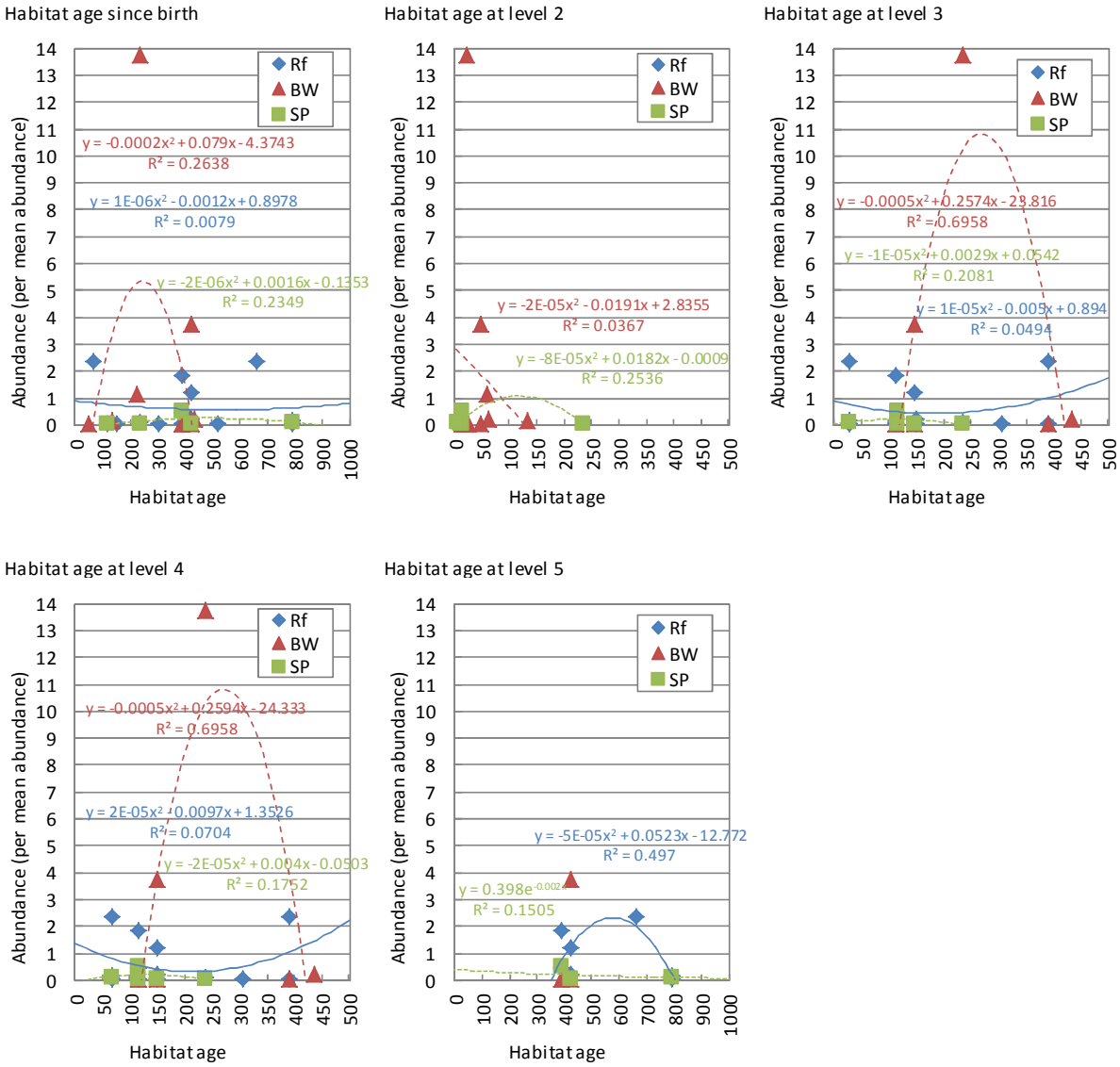


Figure 5.3.6 (14) Correspondence between habitat age and species abundance.

15 Ephemeroptera Tenuibaetis flexifemora

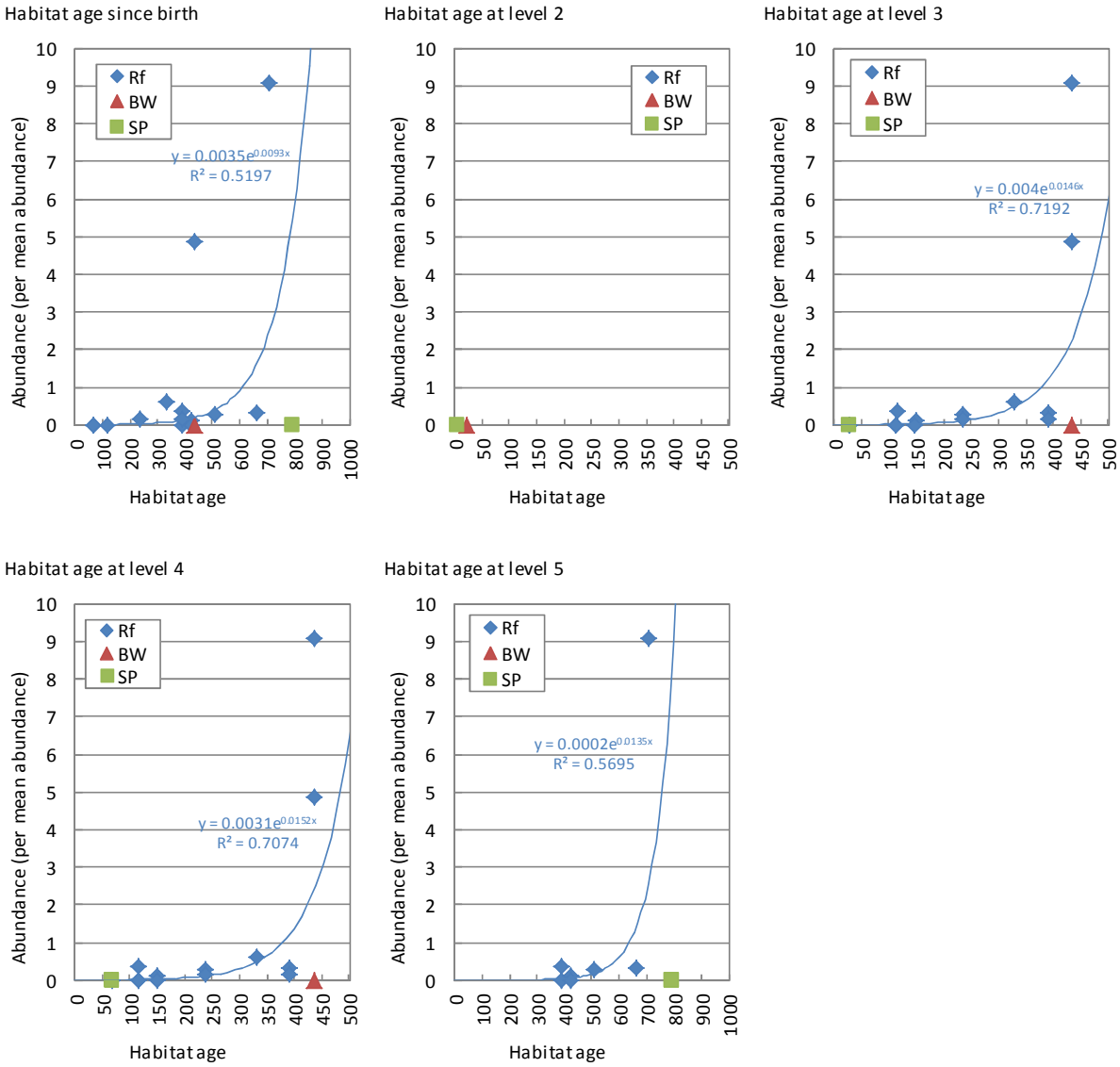


Figure 5.3.6 (15) Correspondence between habitat age and species abundance.

16 Ephemeroptera Ecdyonurus sp.

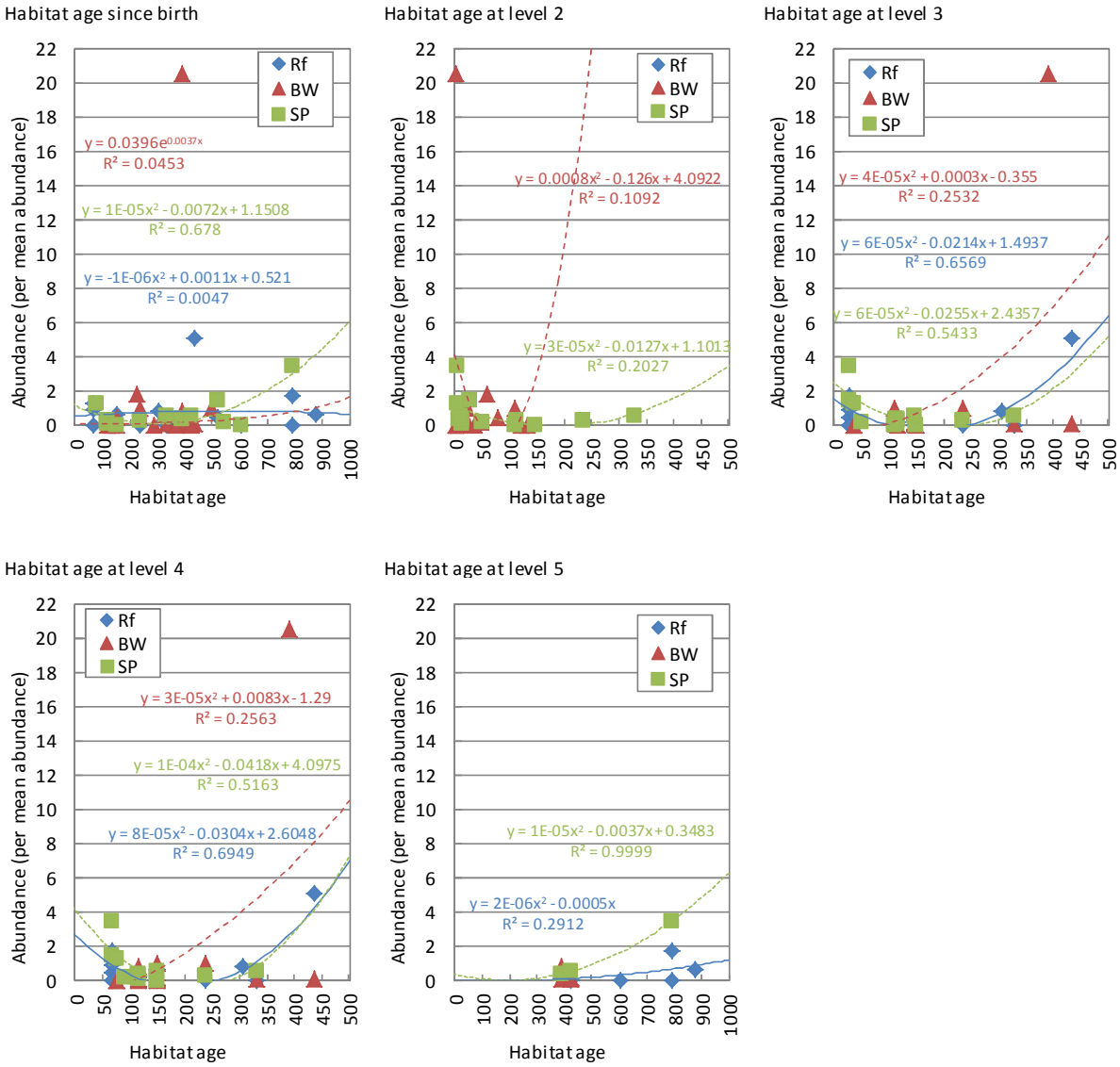


Figure 5.3.6 (16) Correspondence between habitat age and species abundance.

17 Ephemeroptera Rhithrogena sp.

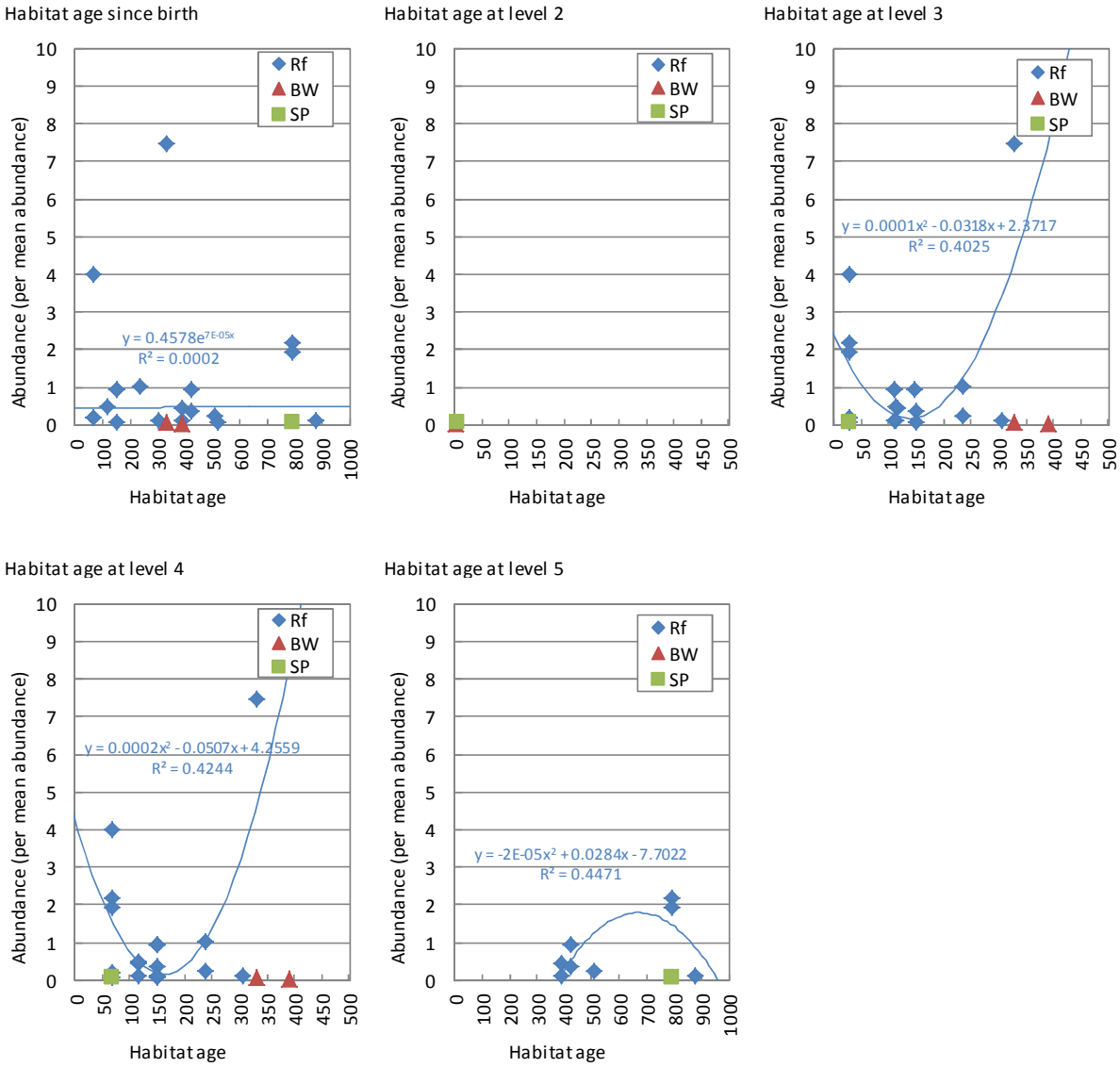


Figure 5.3.6 (17) Correspondence between habitat age and species abundance.

18 Ephemeroptera Isonychia japonica

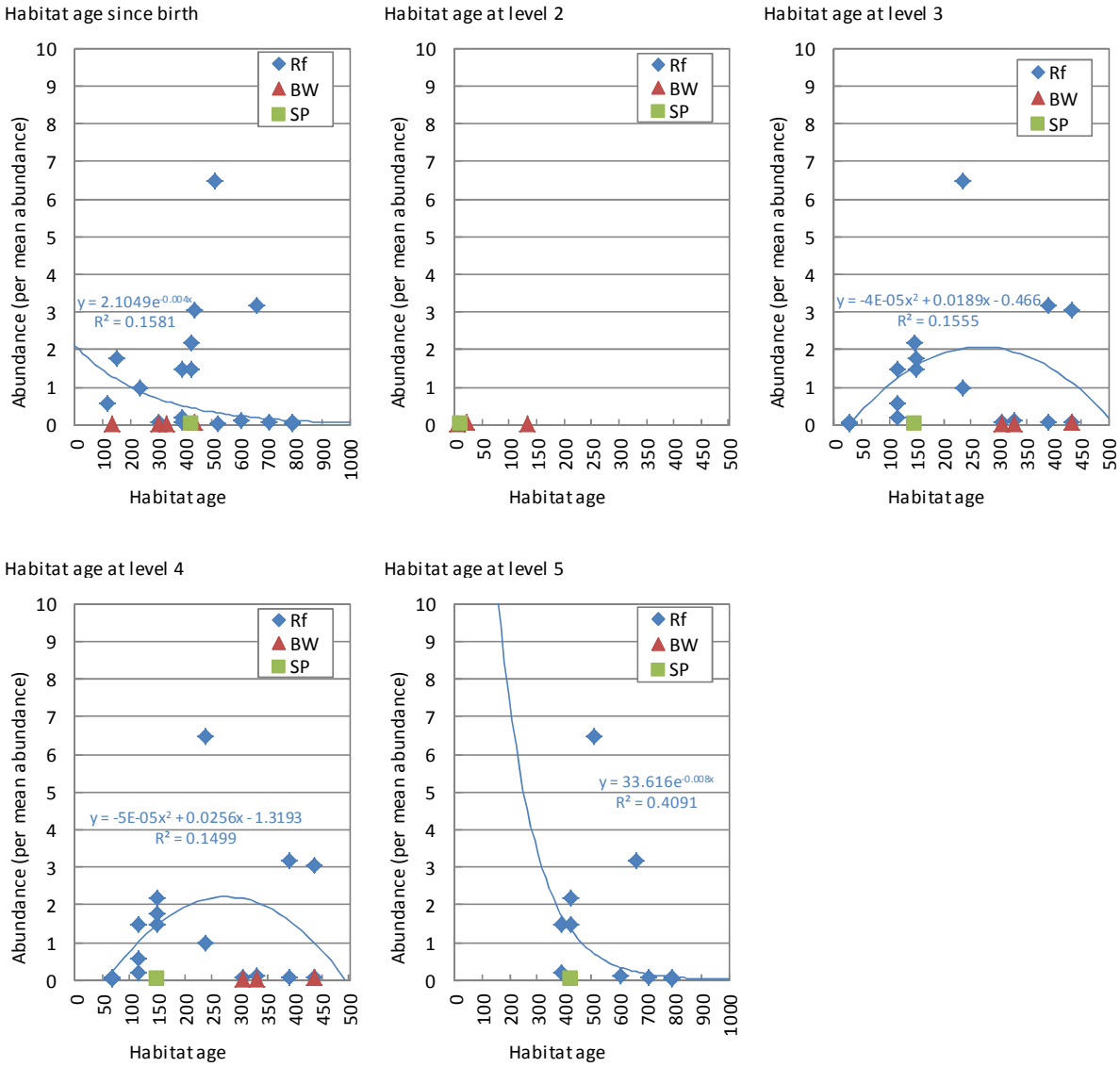


Figure 5.3.6 (18) Correspondence between habitat age and species abundance.

19 Ephemeroptera Ephemera orientalis

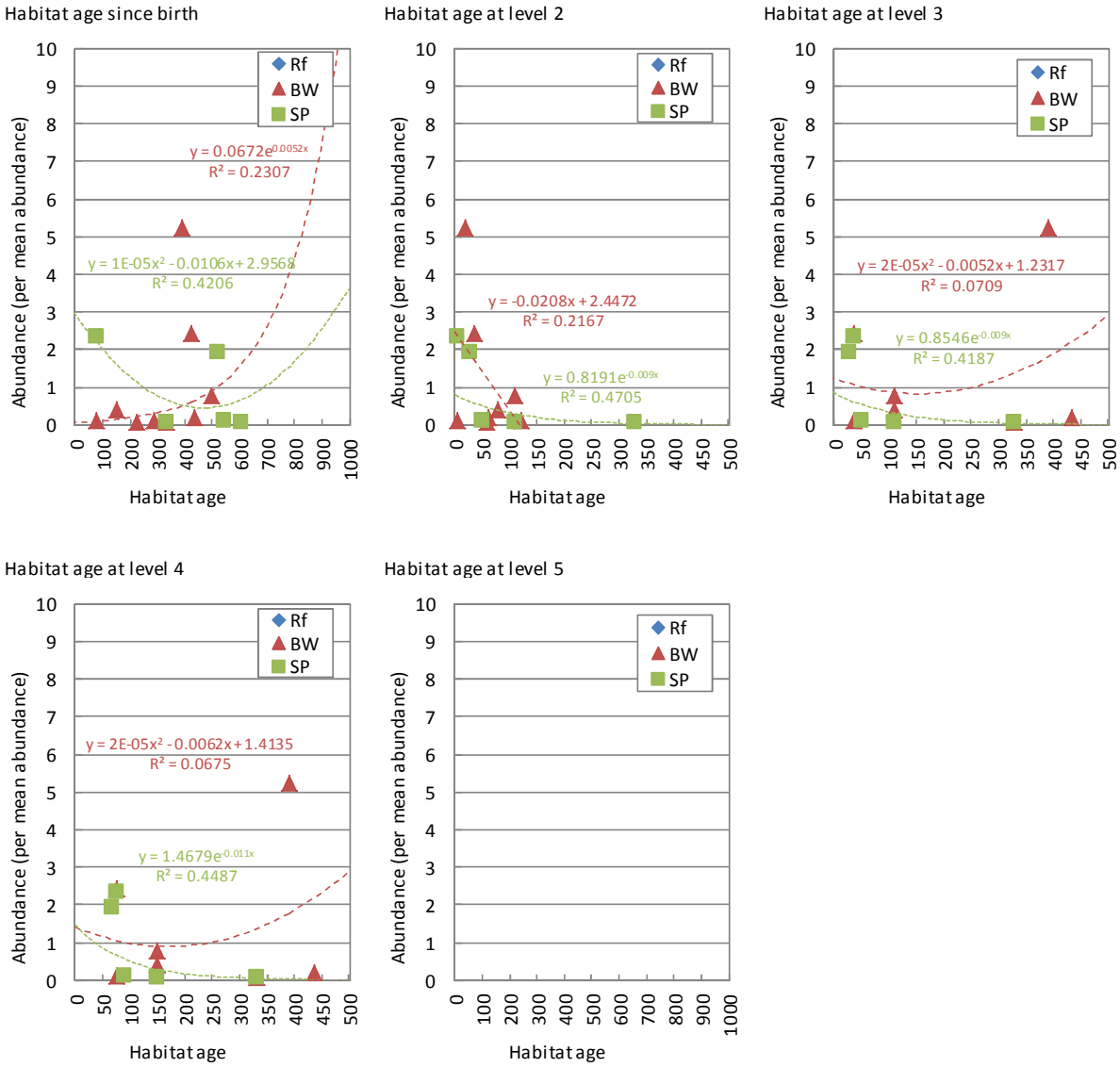


Figure 5.3.6 (19) Correspondence between habitat age and species abundance.

20 Ephemeroptera Potamanthus formosus

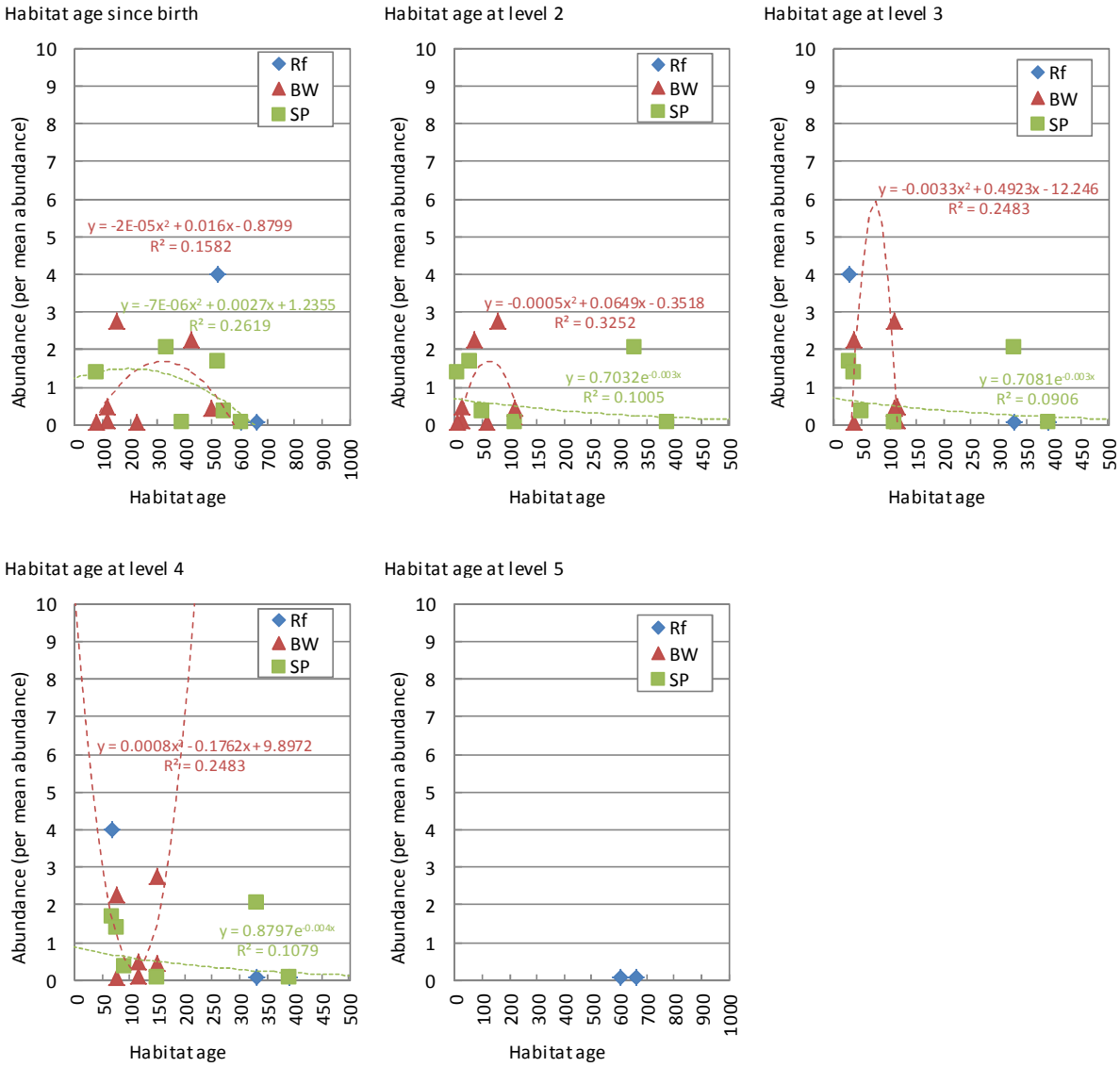


Figure 5.3.6 (20) Correspondence between habitat age and species abundance.

21 Ephemeroptera Torleya japonica

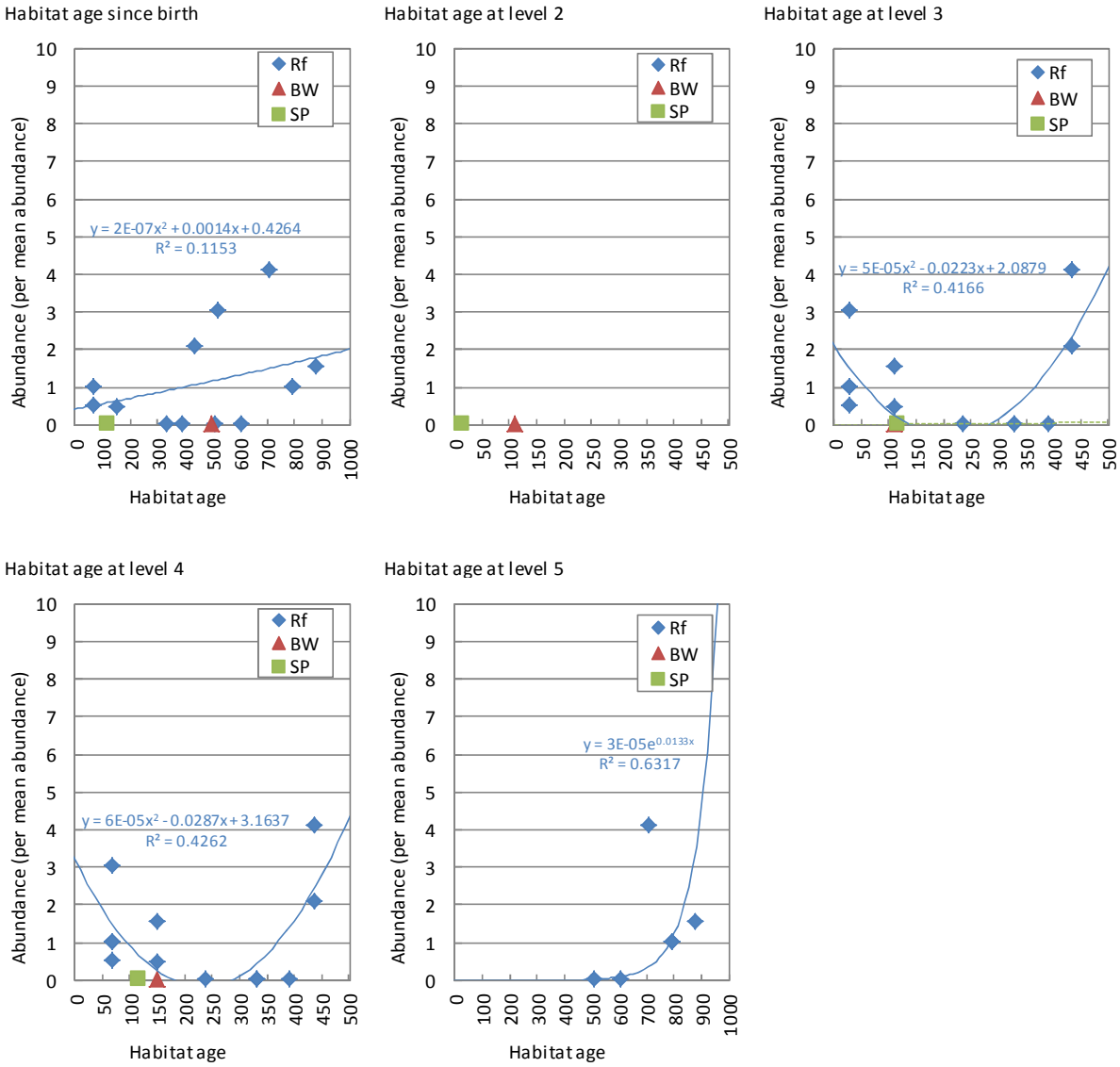


Figure 5.3.6 (21) Correspondence between habitat age and species abundance.

22 Ephemeroptera Uracanthella punctisetae

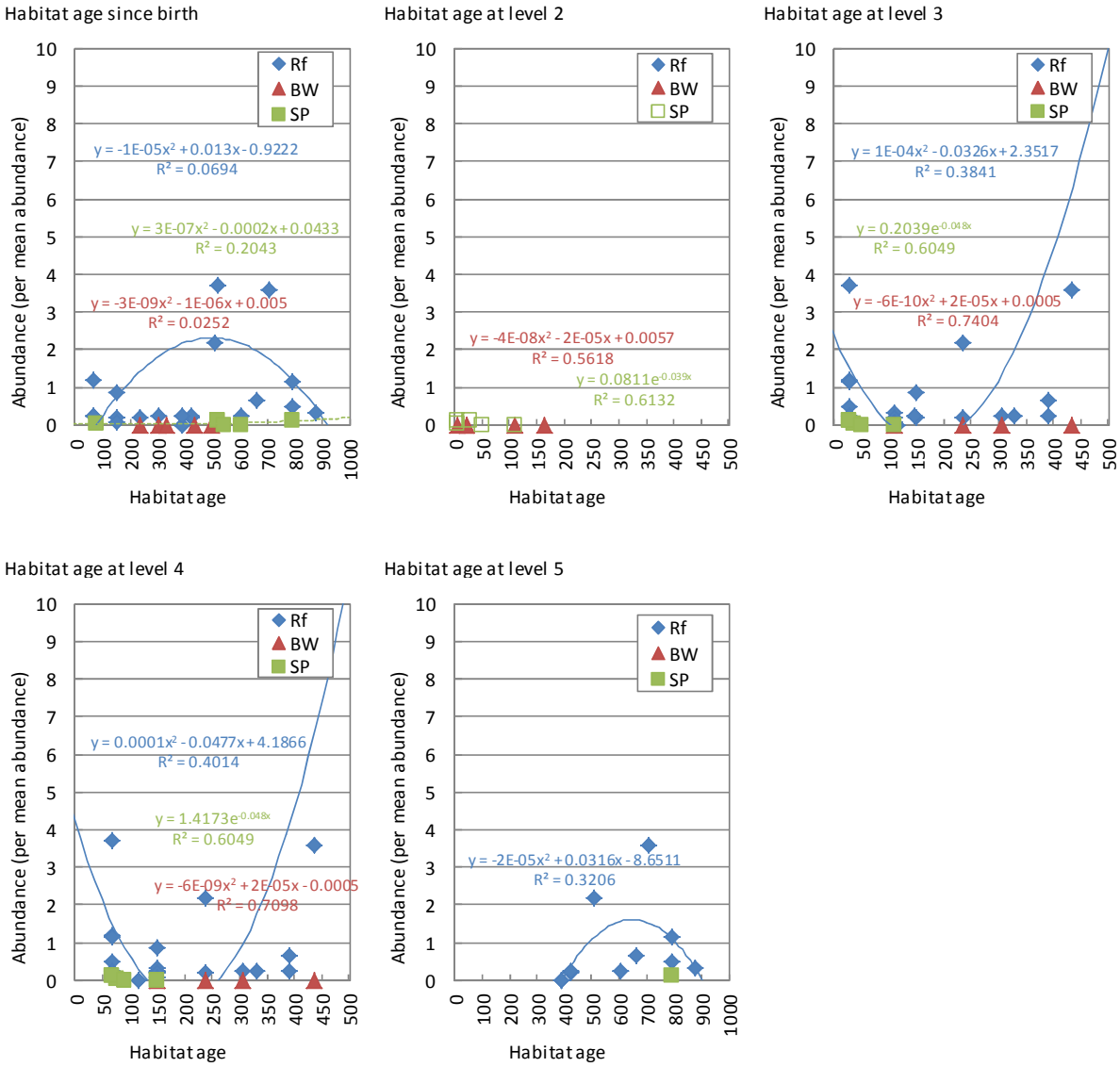


Figure 5.3.6 (22) Correspondence between habitat age and species abundance.

23 Ephemeroptera Caenis sp.

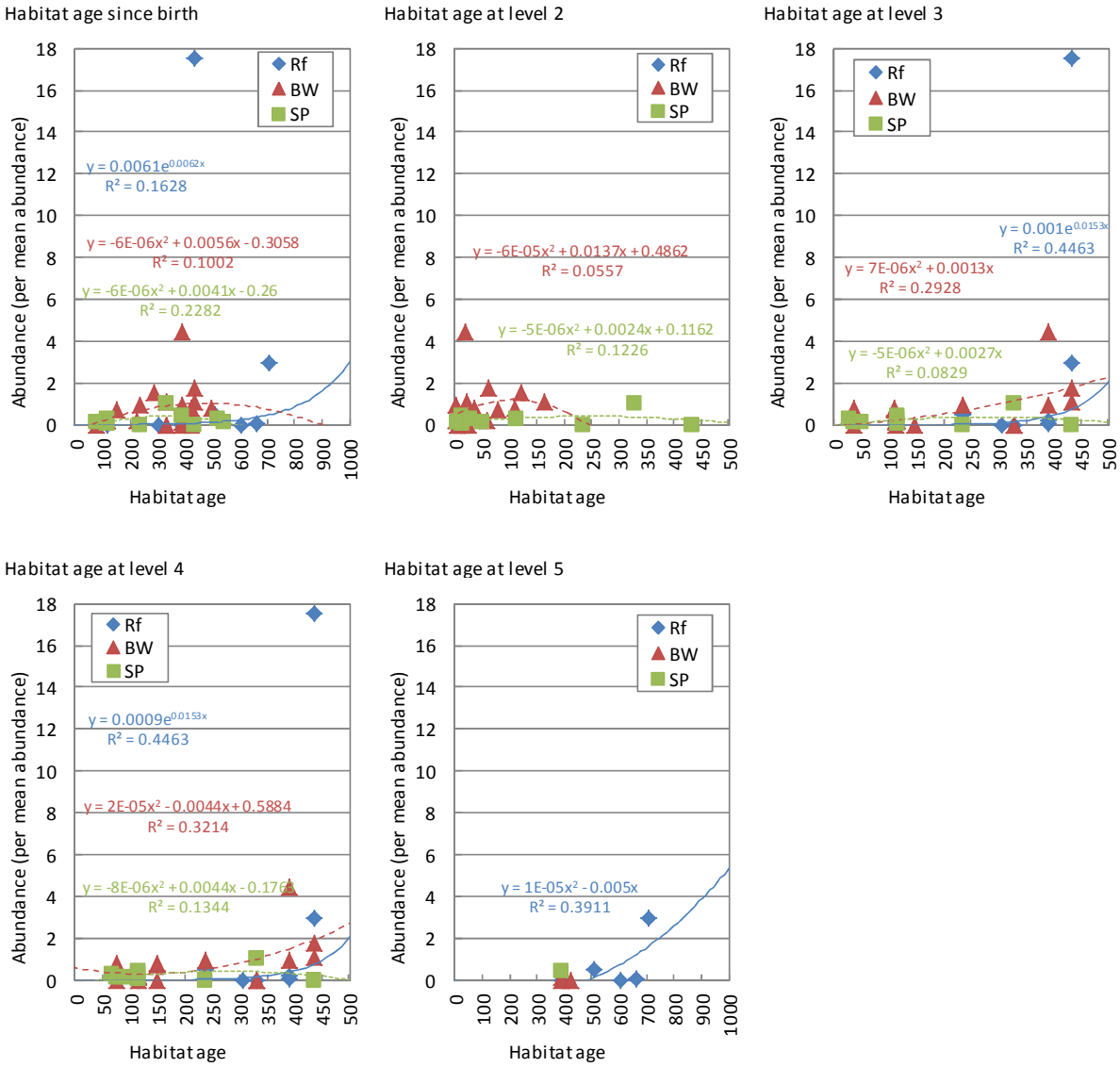


Figure 5.3.6 (23) Correspondence between habitat age and species abundance.

24 Odonata Sinogomphus flavolimbatus

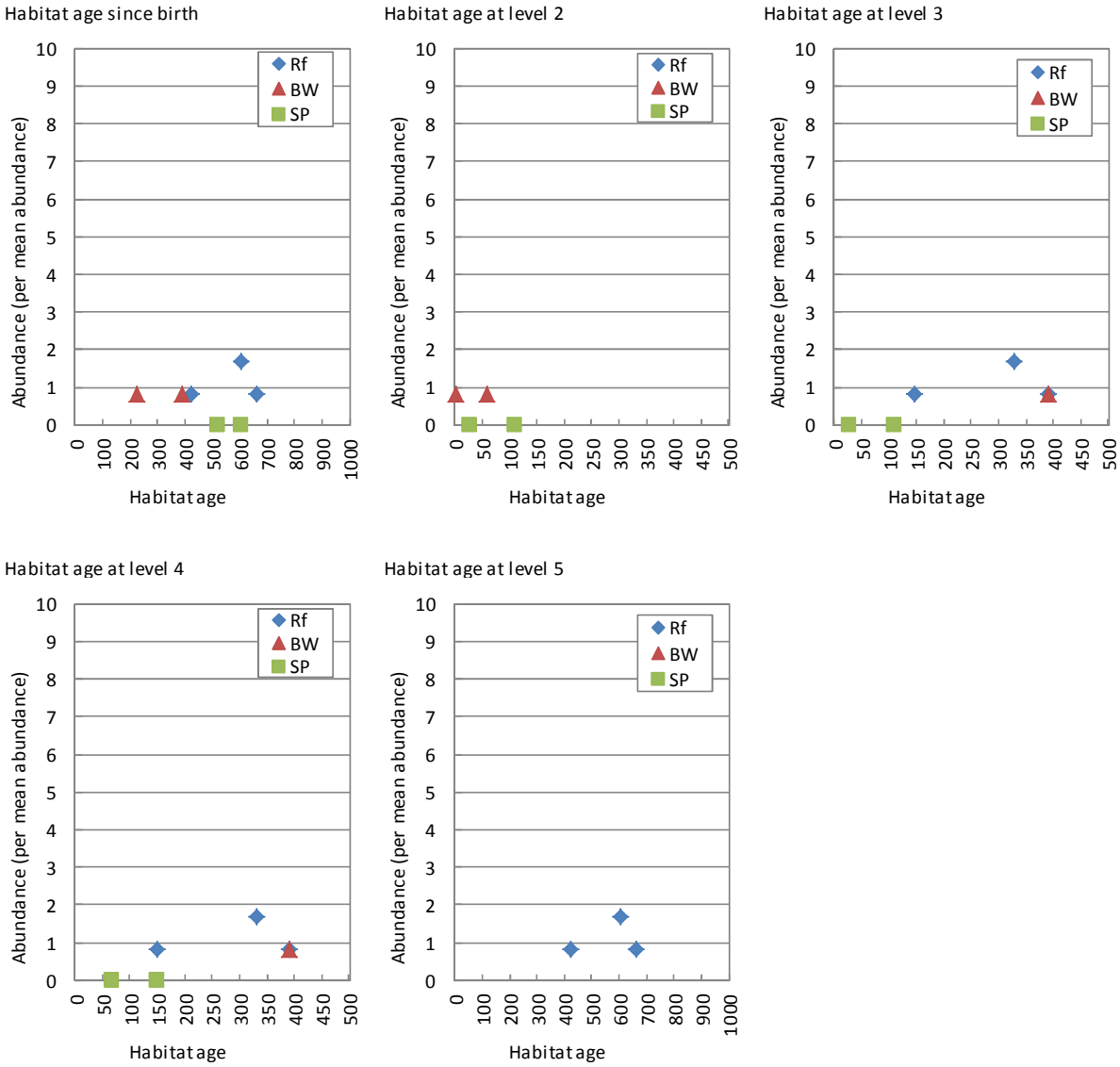


Figure 5.3.6 (24) Correspondence between habitat age and species abundance.

25 Plecoptera Neoperla sp.

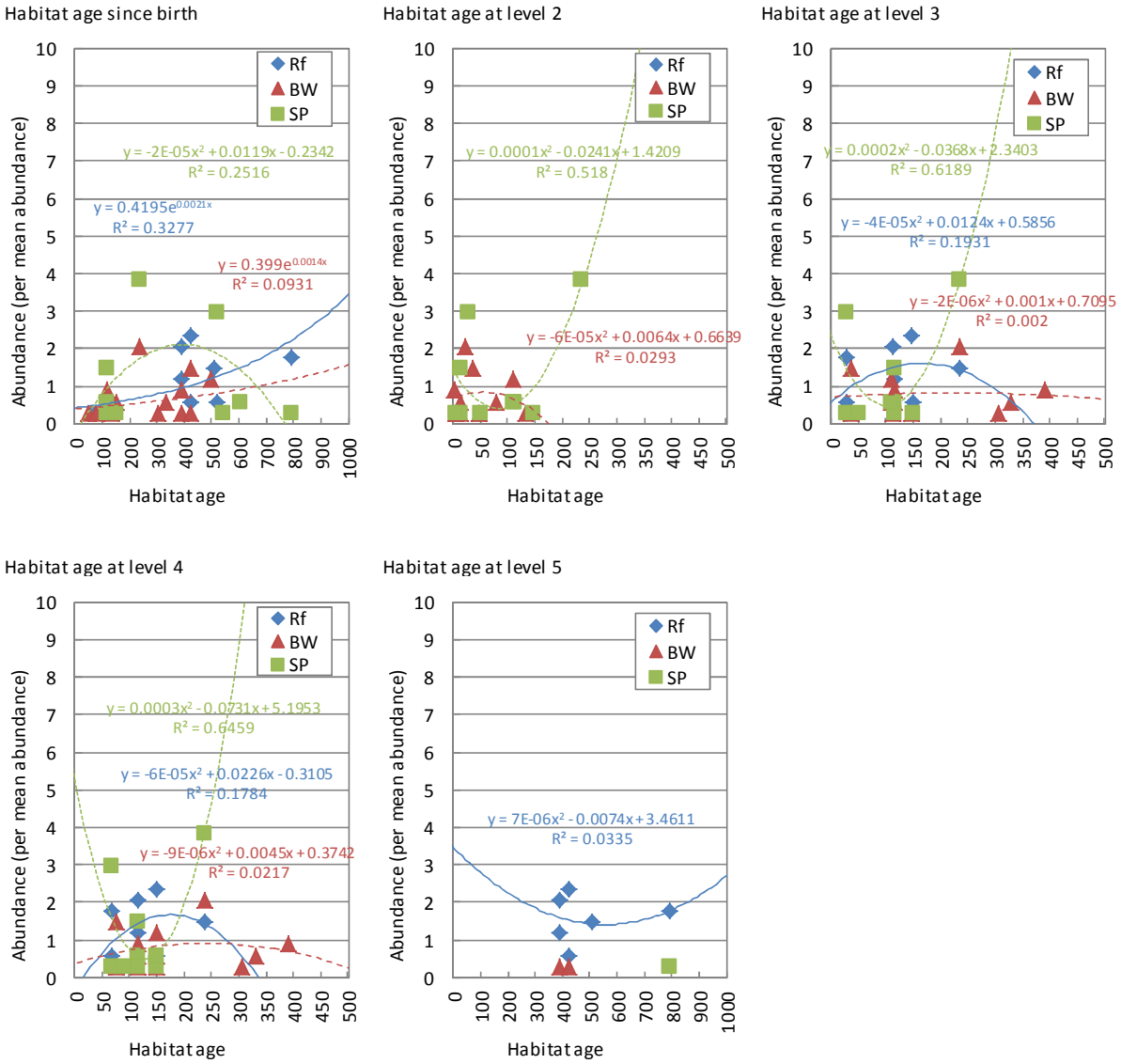


Figure 5.3.6 (25) Correspondence between habitat age and species abundance.

26 Hemiptera Micronecta sp.

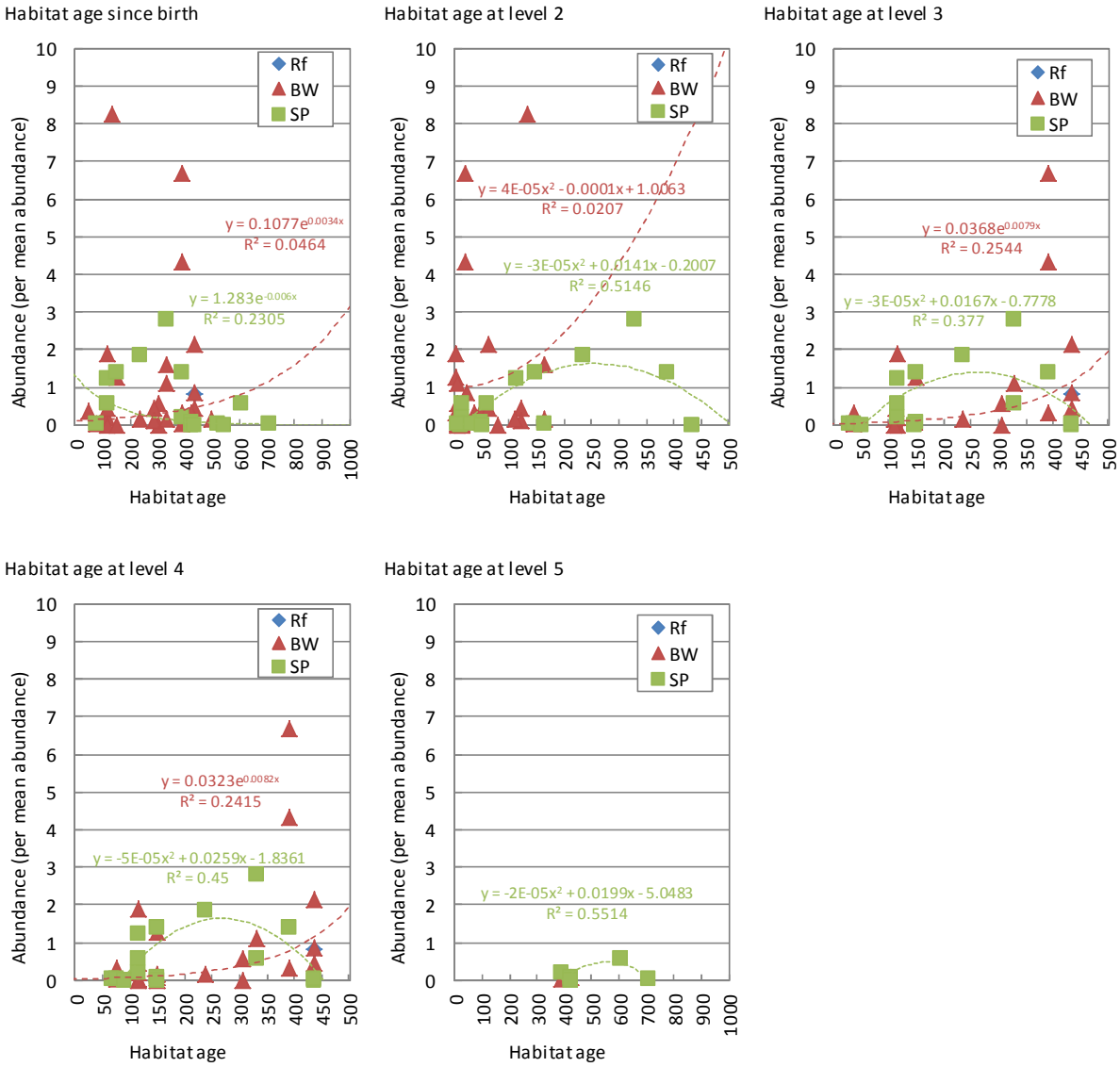


Figure 5.3.6 (26) Correspondence between habitat age and species abundance.

27 Trichoptera Cheumatopsyche brevilineata

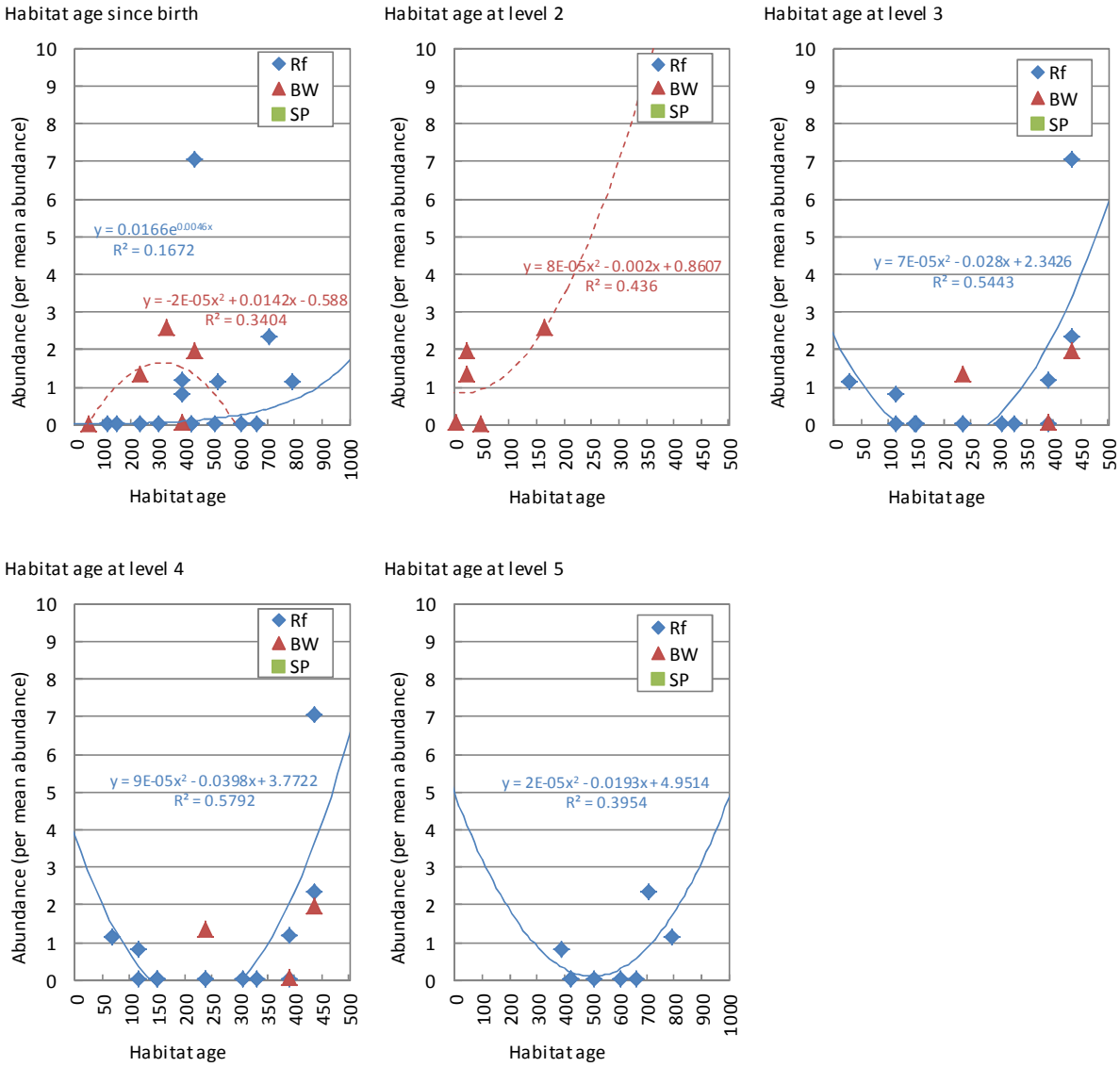


Figure 5.3.6 (27) Correspondence between habitat age and species abundance.

28 Trichoptera Cheumatopsyche infascia

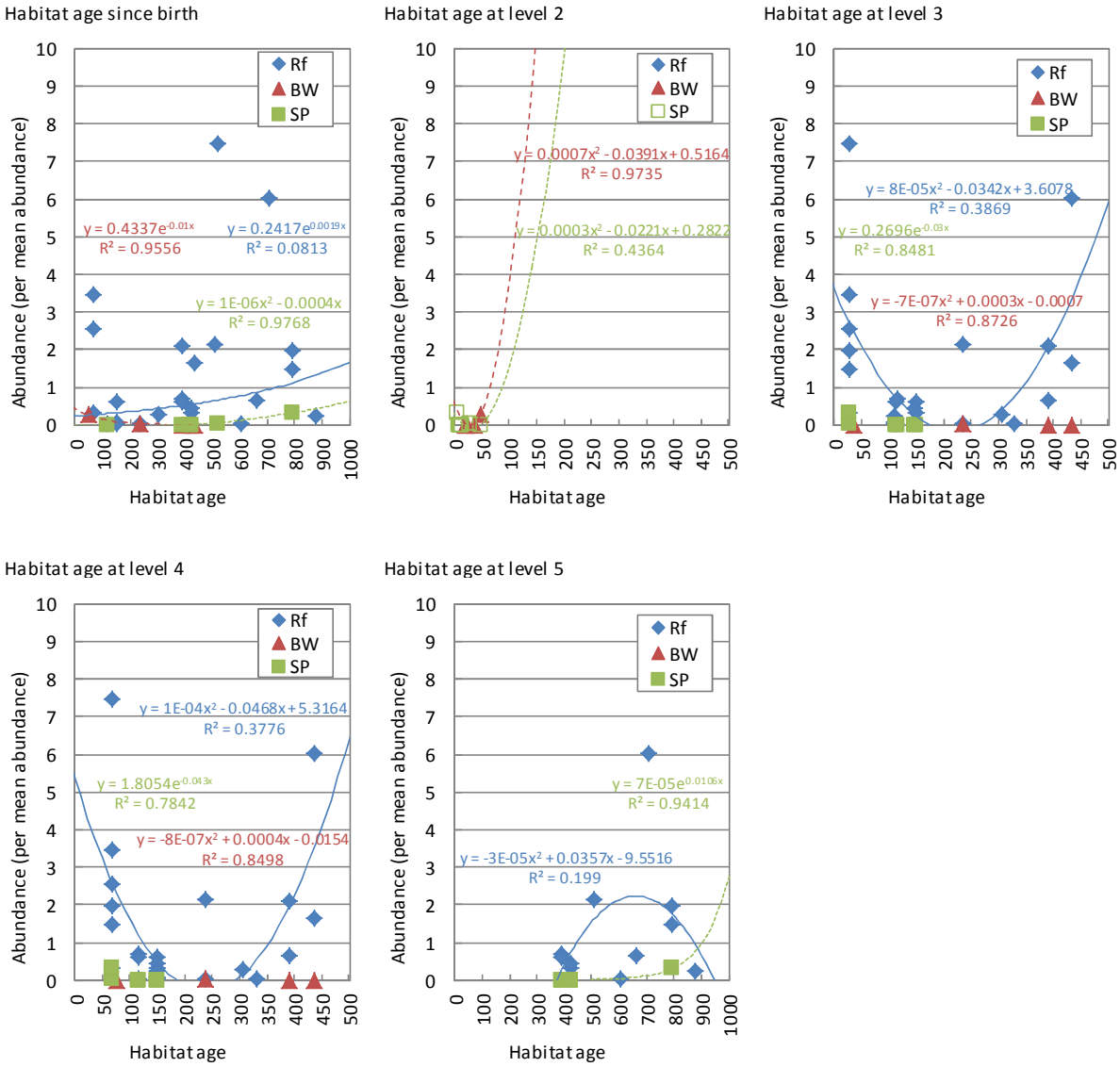


Figure 5.3.6 (28) Correspondence between habitat age and species abundance.

29 Trichoptera Hydropsyche orientalis

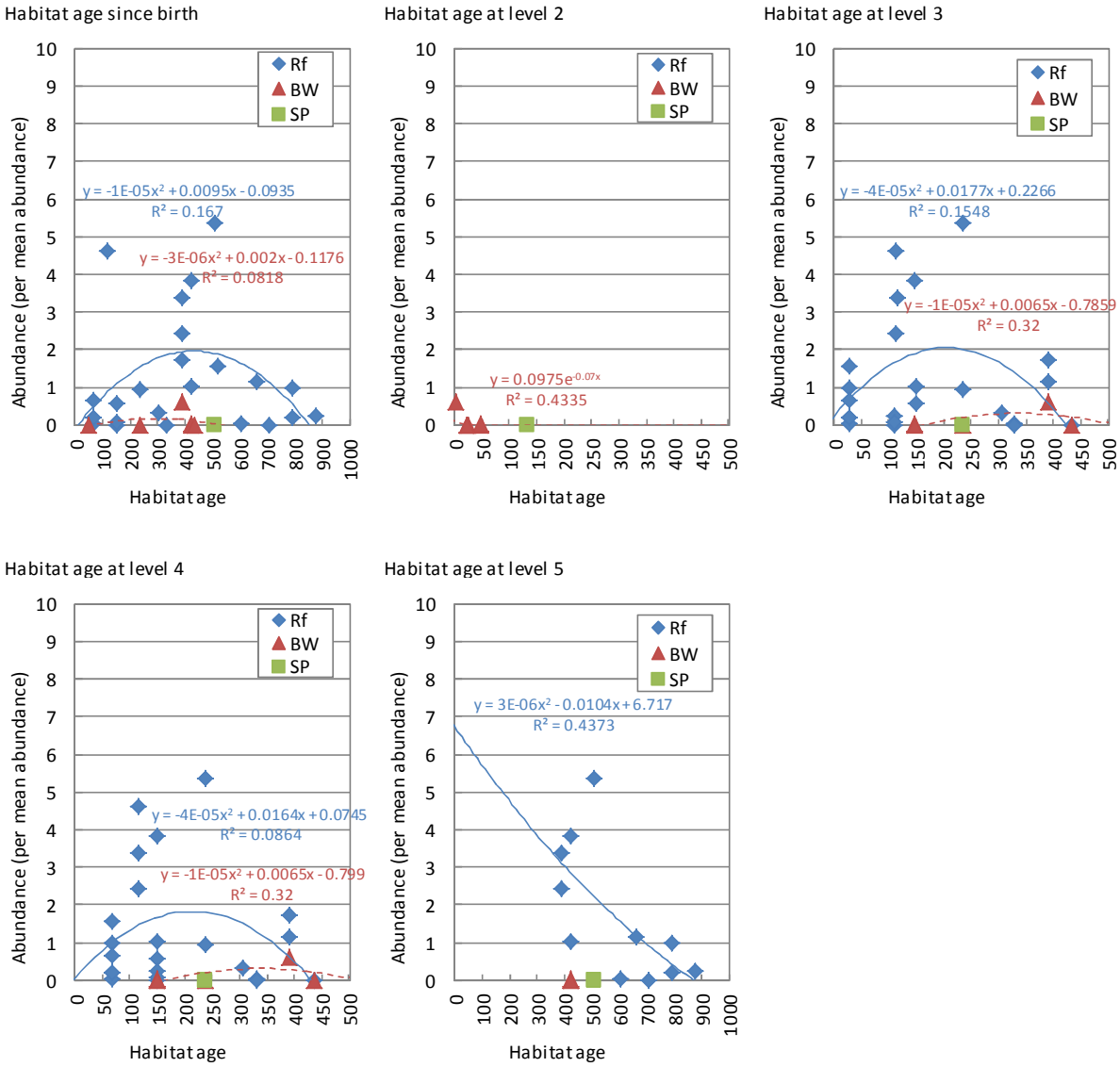


Figure 5.3.6 (29) Correspondence between habitat age and species abundance.

30 Trichoptera Stenopsyche marmorata

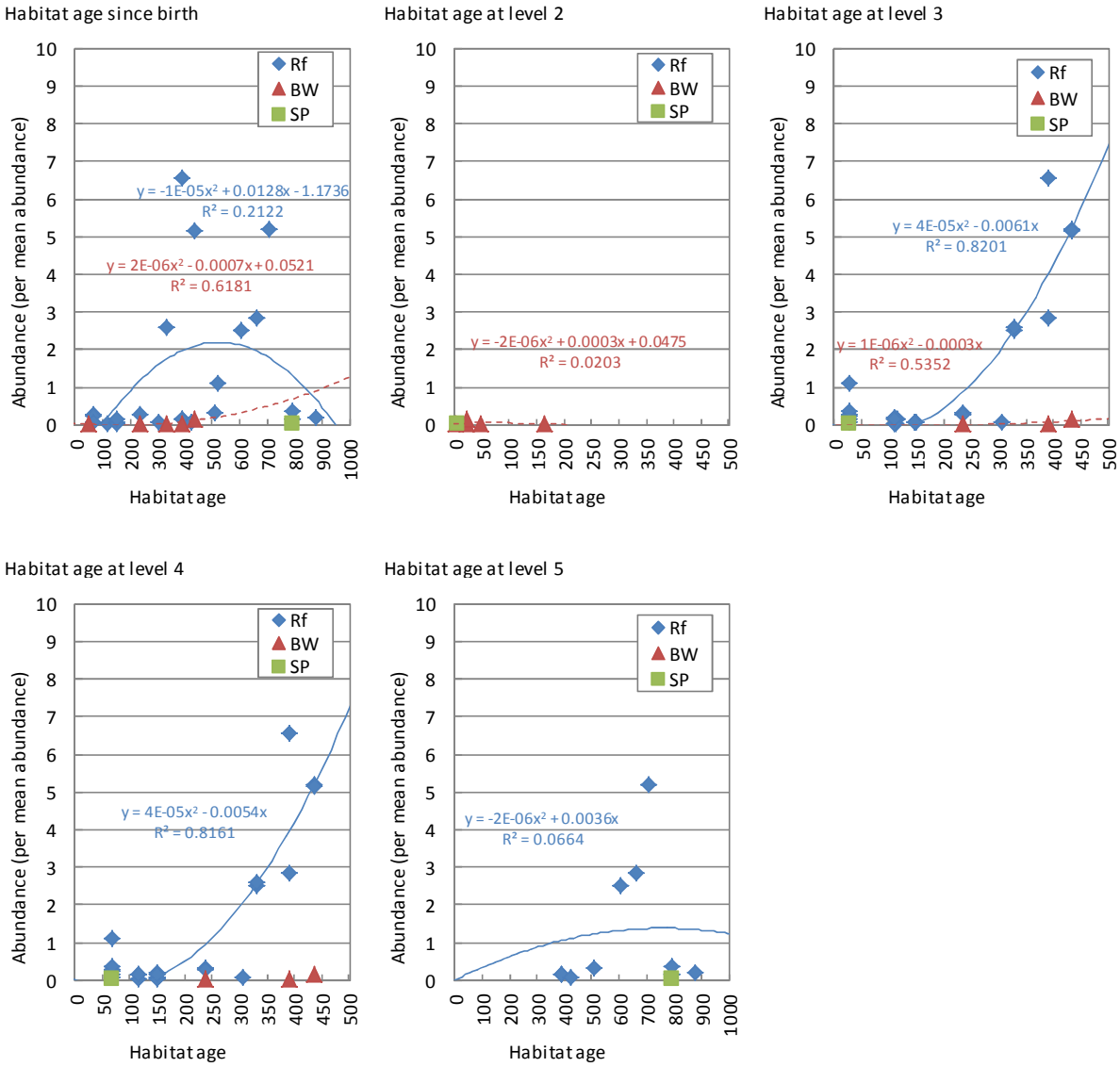


Figure 5.3.6 (30) Correspondence between habitat age and species abundance.

31 Trichoptera Hydroptila sp.

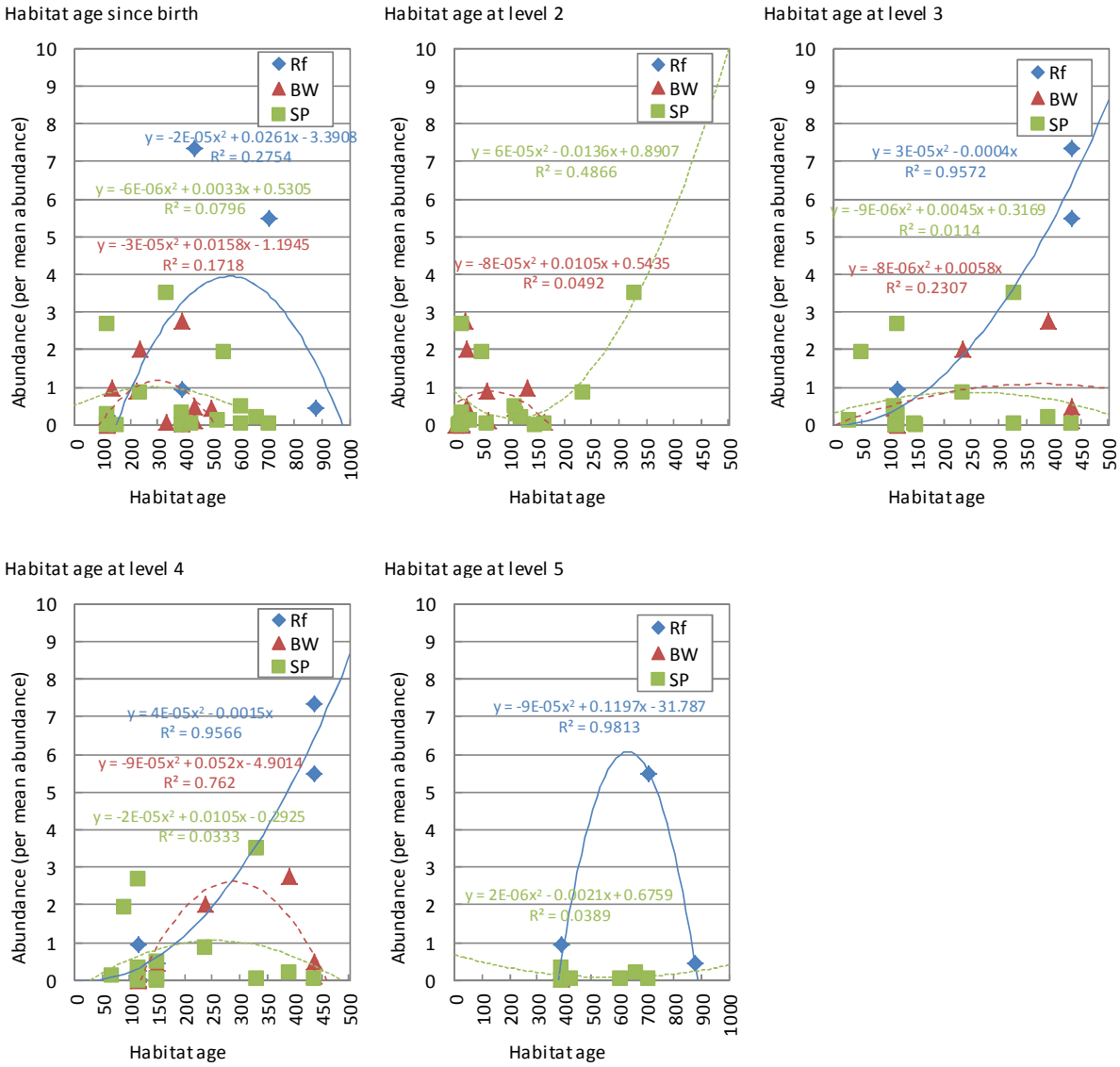


Figure 5.3.6 (31) Correspondence between habitat age and species abundance.

32 Trichoptera Rhyacophila nigrocephala

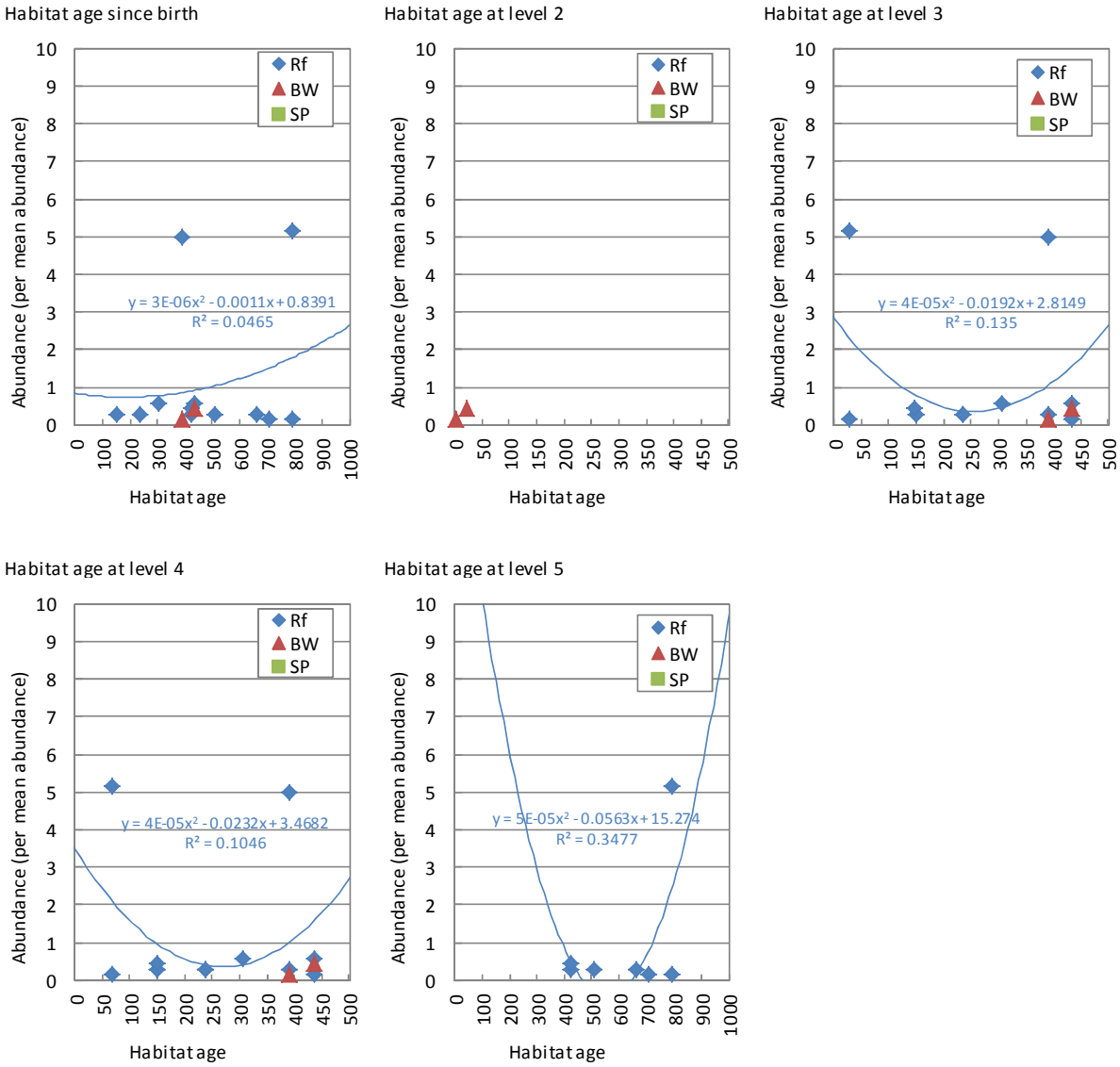


Figure 5.3.6 (32) Correspondence between habitat age and species abundance.

33 Trichoptera Mystacides sp.

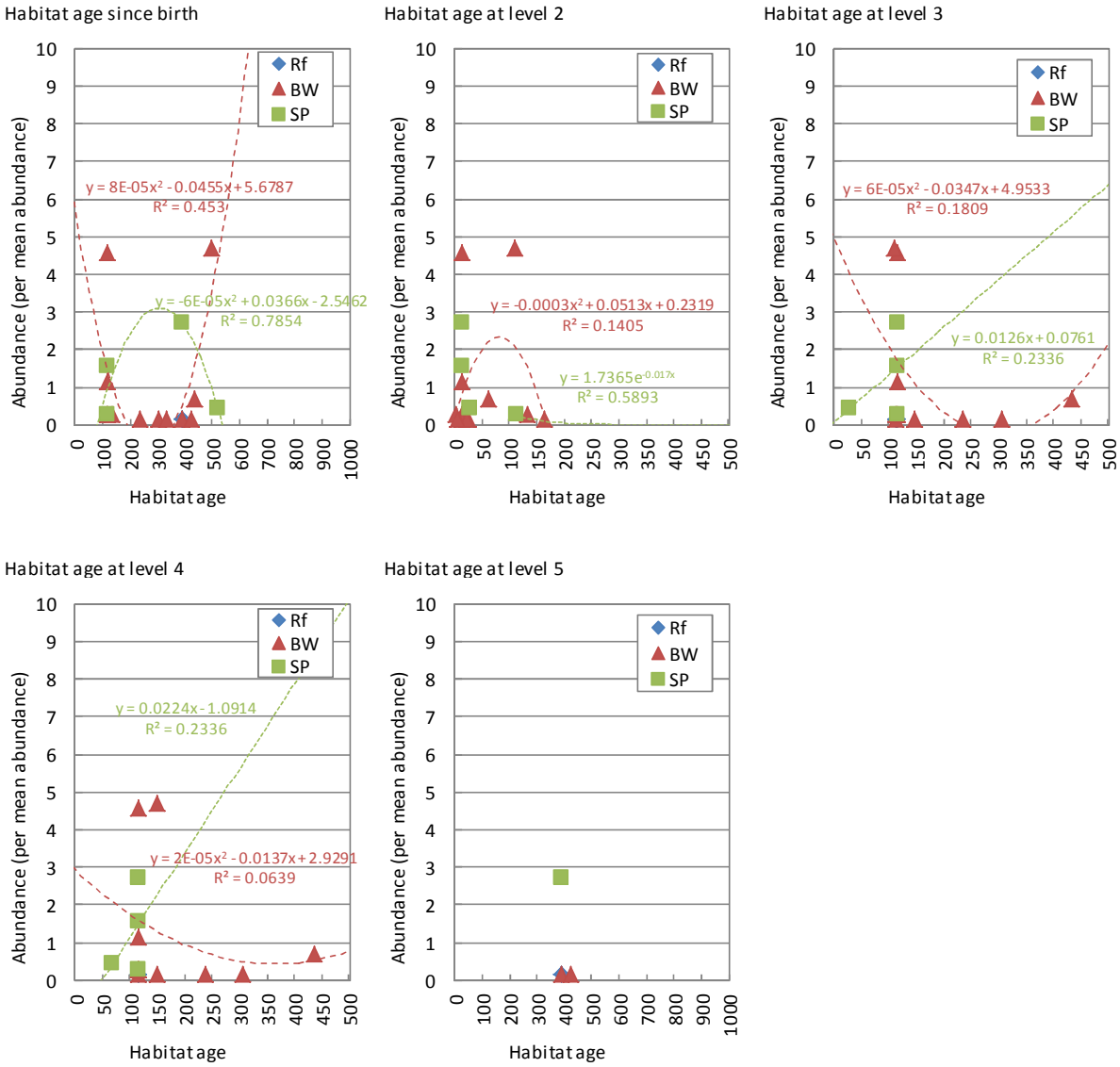


Figure 5.3.6 (33) Correspondence between habitat age and species abundance.

34 Coleoptera Laccobius sp.

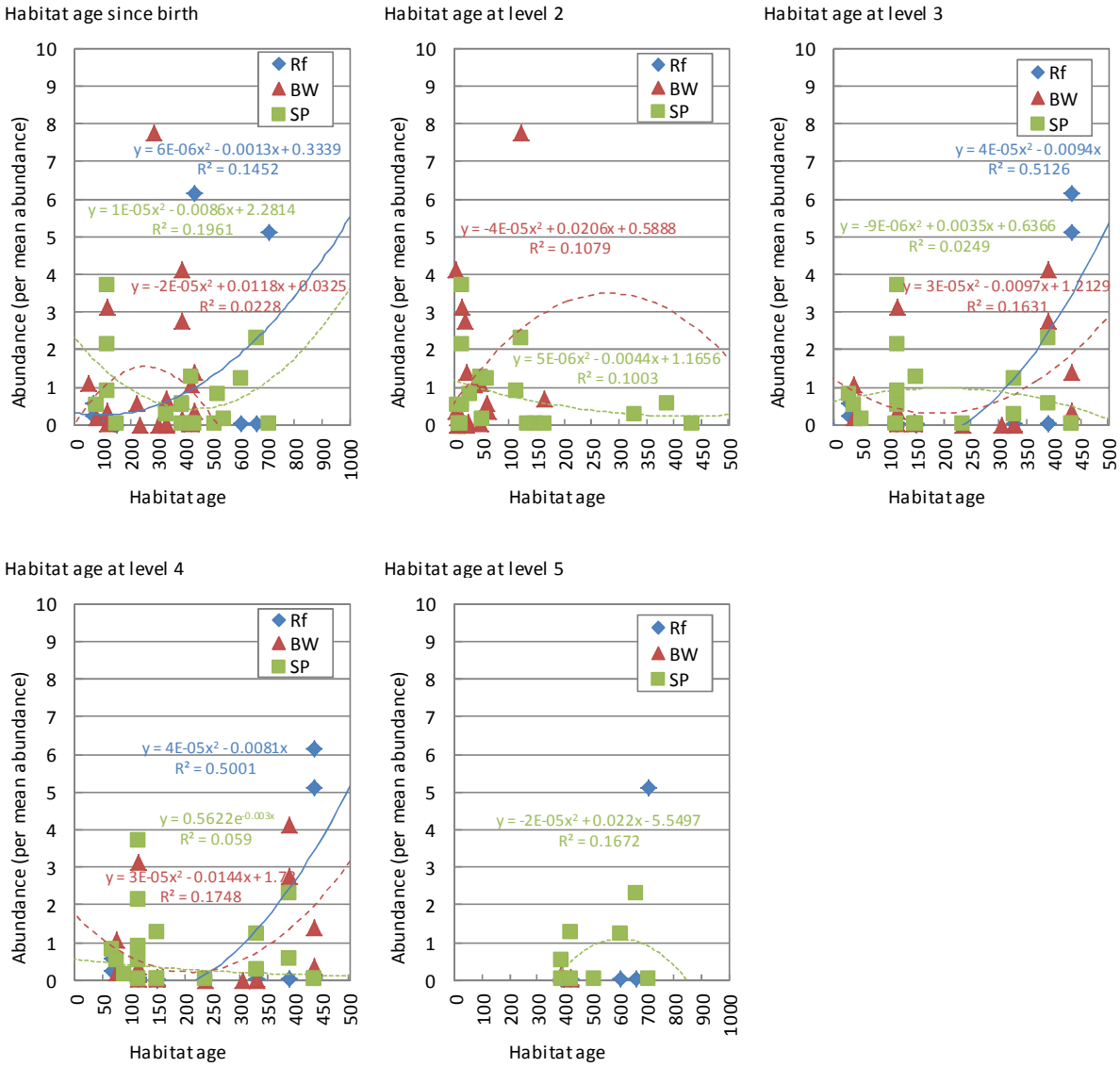


Figure 5.3.6 (34) Correspondence between habitat age and species abundance.

35 Coleoptera Zaitzevia sp.

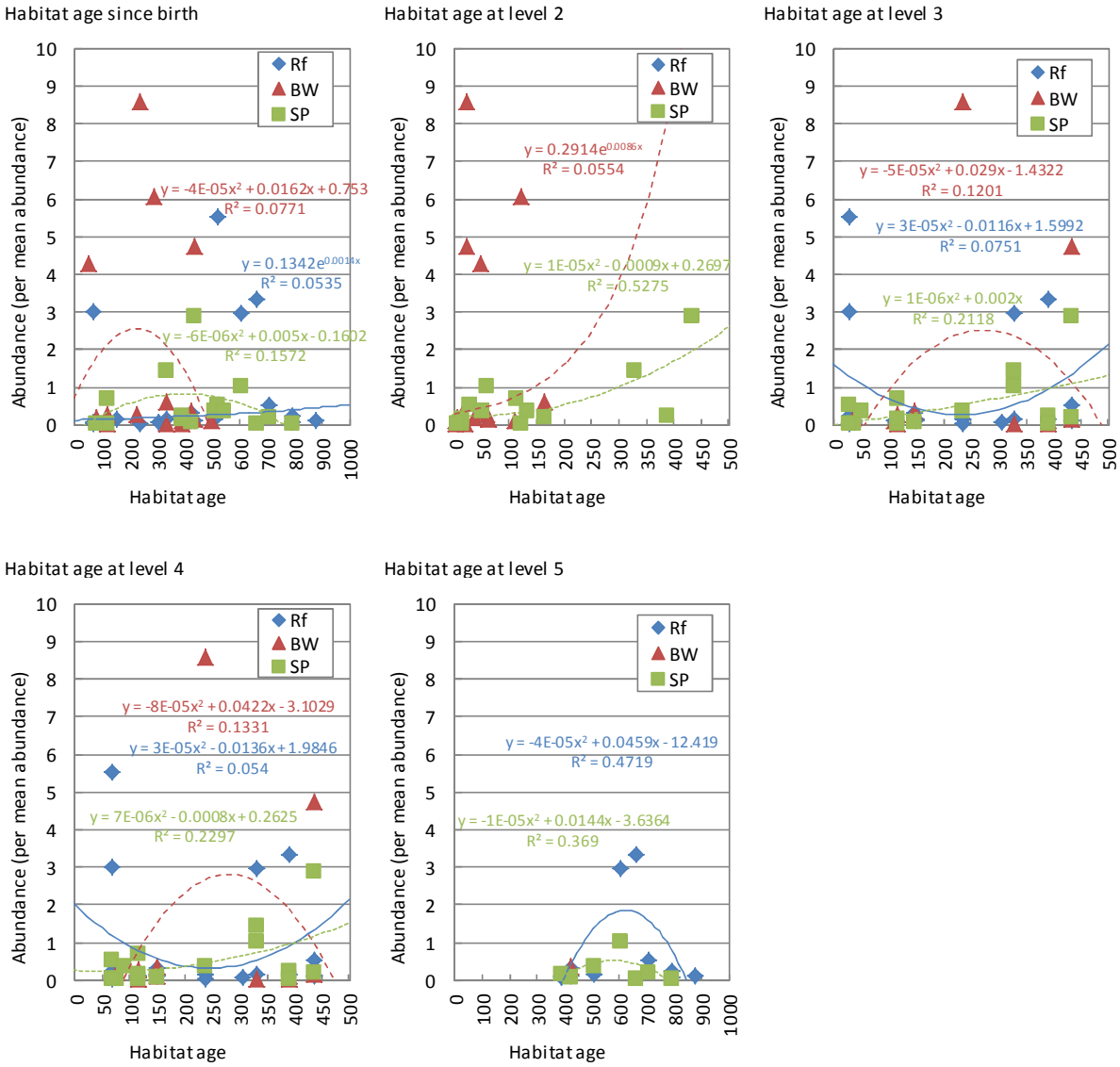


Figure 5.3.6 (35) Correspondence between habitat age and species abundance.

36 Coleoptera Zaitzeviaria sp.

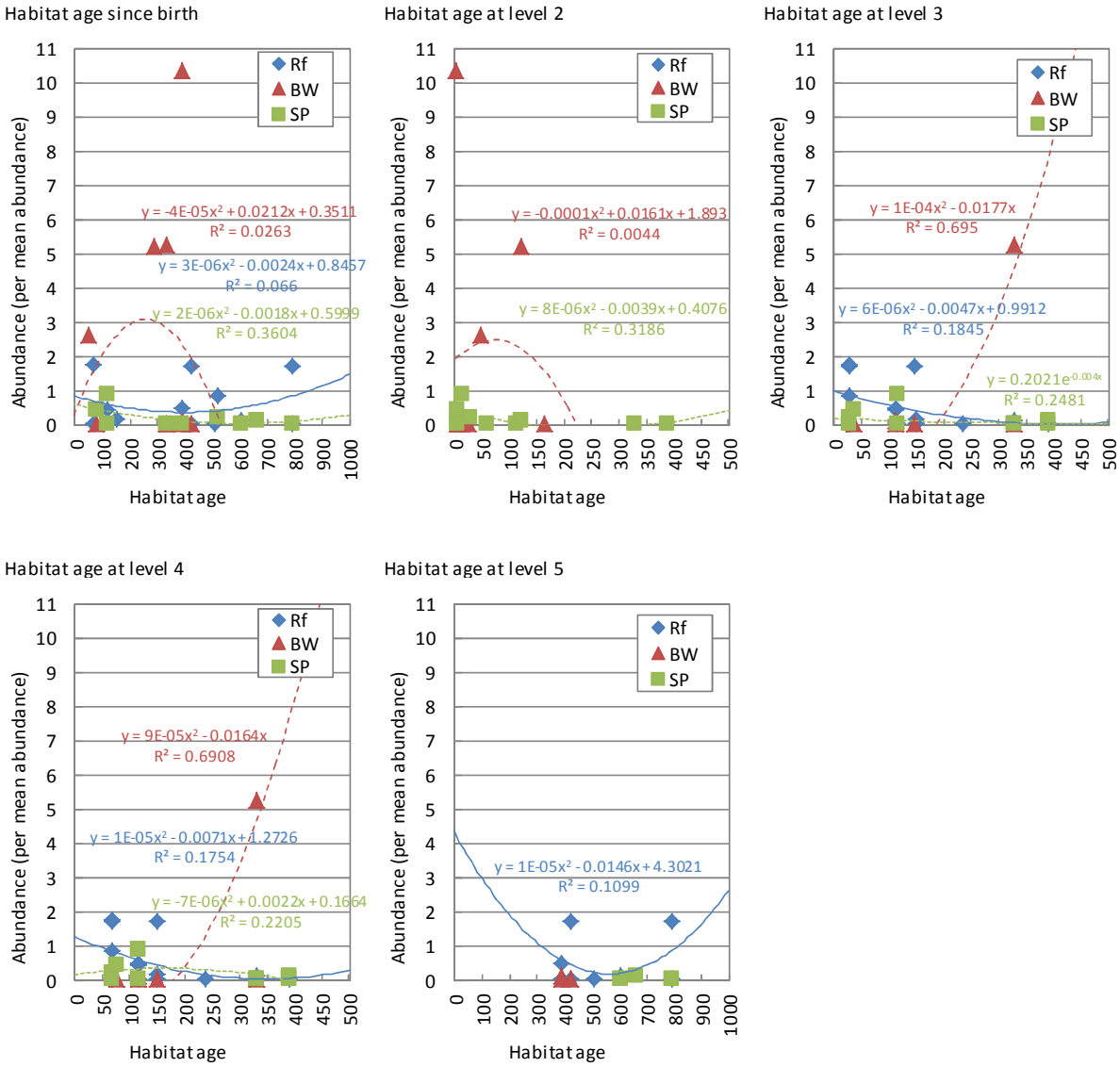


Figure 5.3.6 (36) Correspondence between habitat age and species abundance.

37 Diptera Tipula sp.

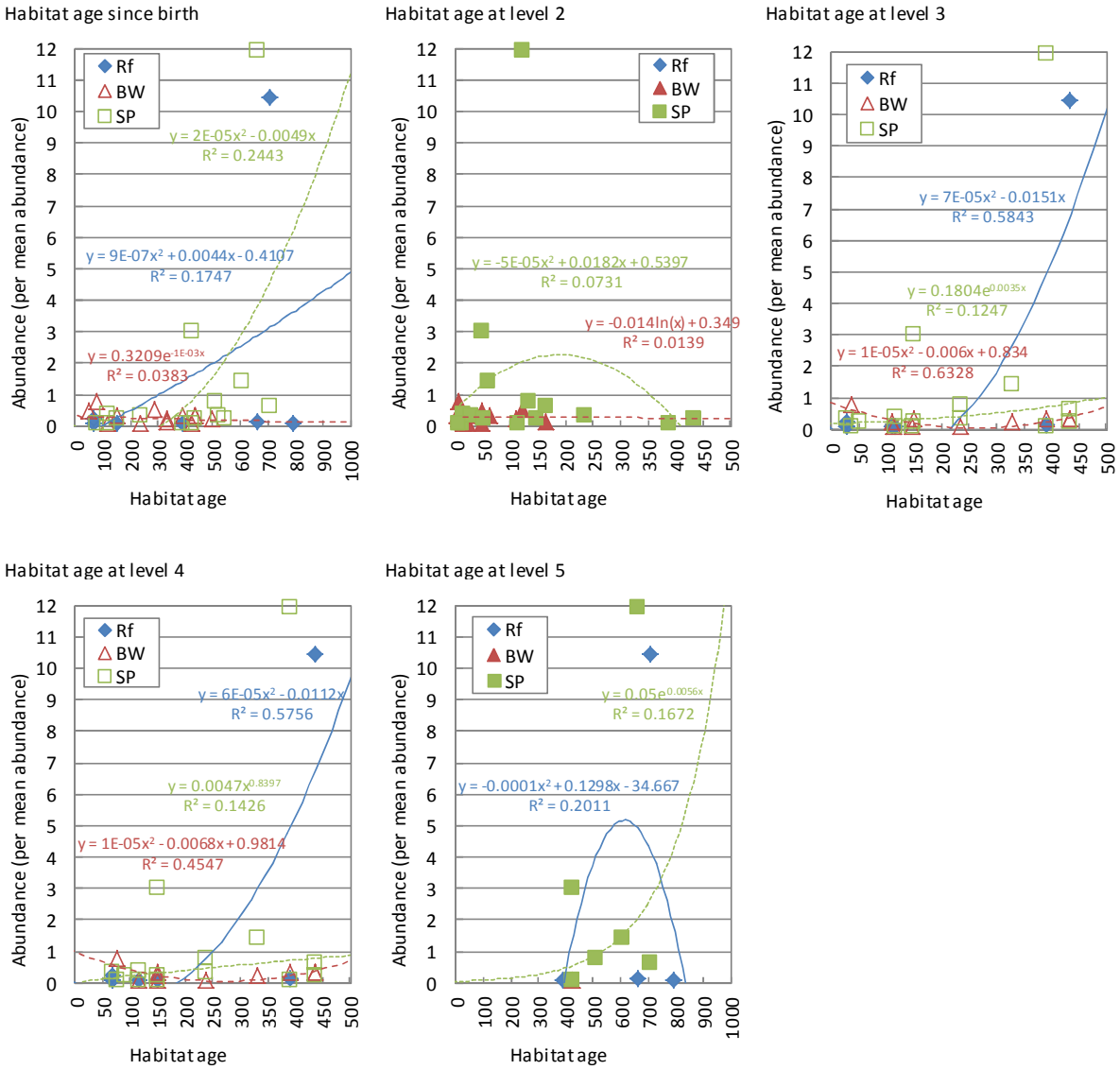


Figure 5.3.6 (37) Correspondence between habitat age and species abundance.

38 Diptera Antocha sp.

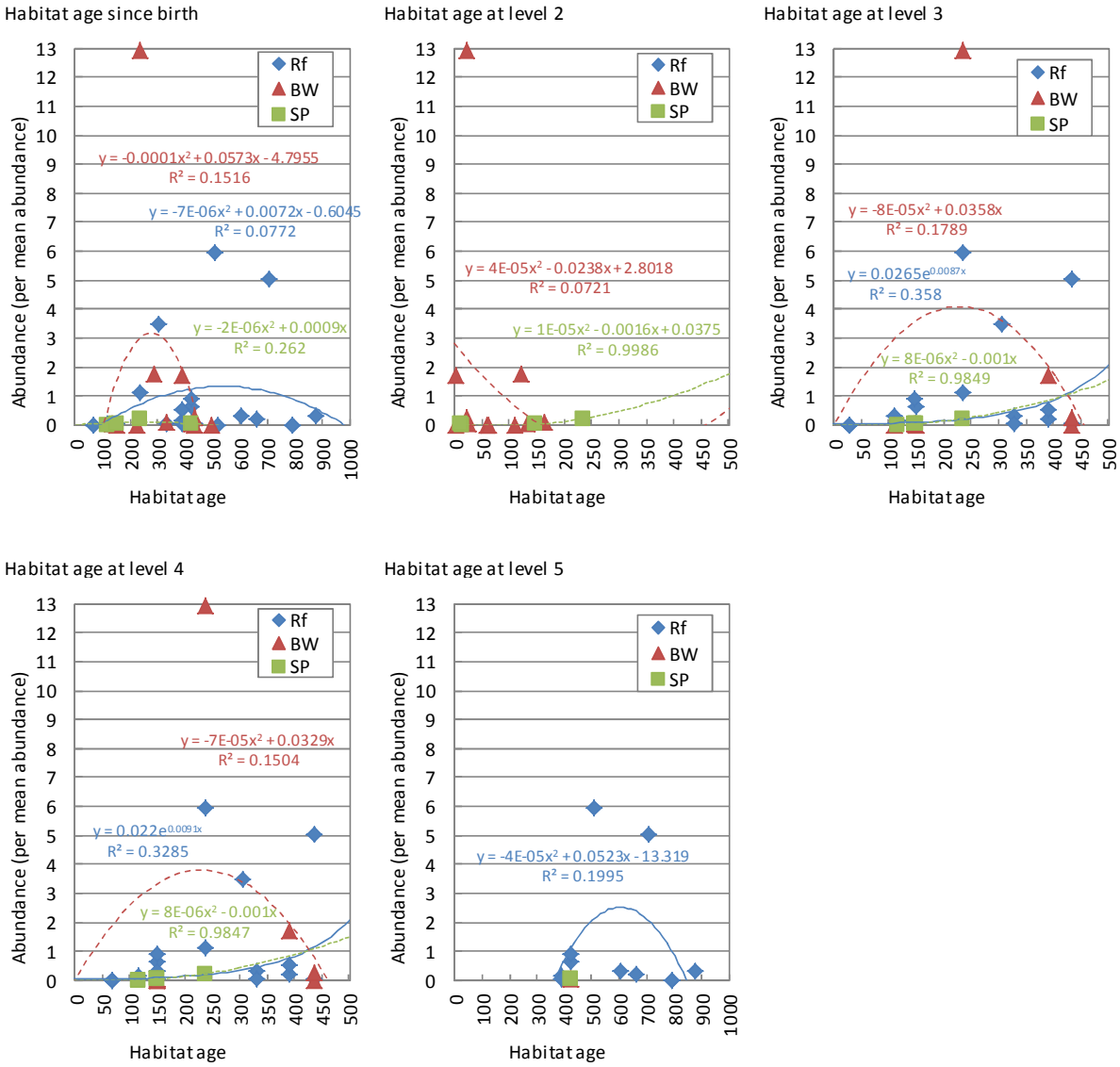


Figure 5.3.6 (38) Correspondence between habitat age and species abundance.

39 Diptera Hexatoma sp.

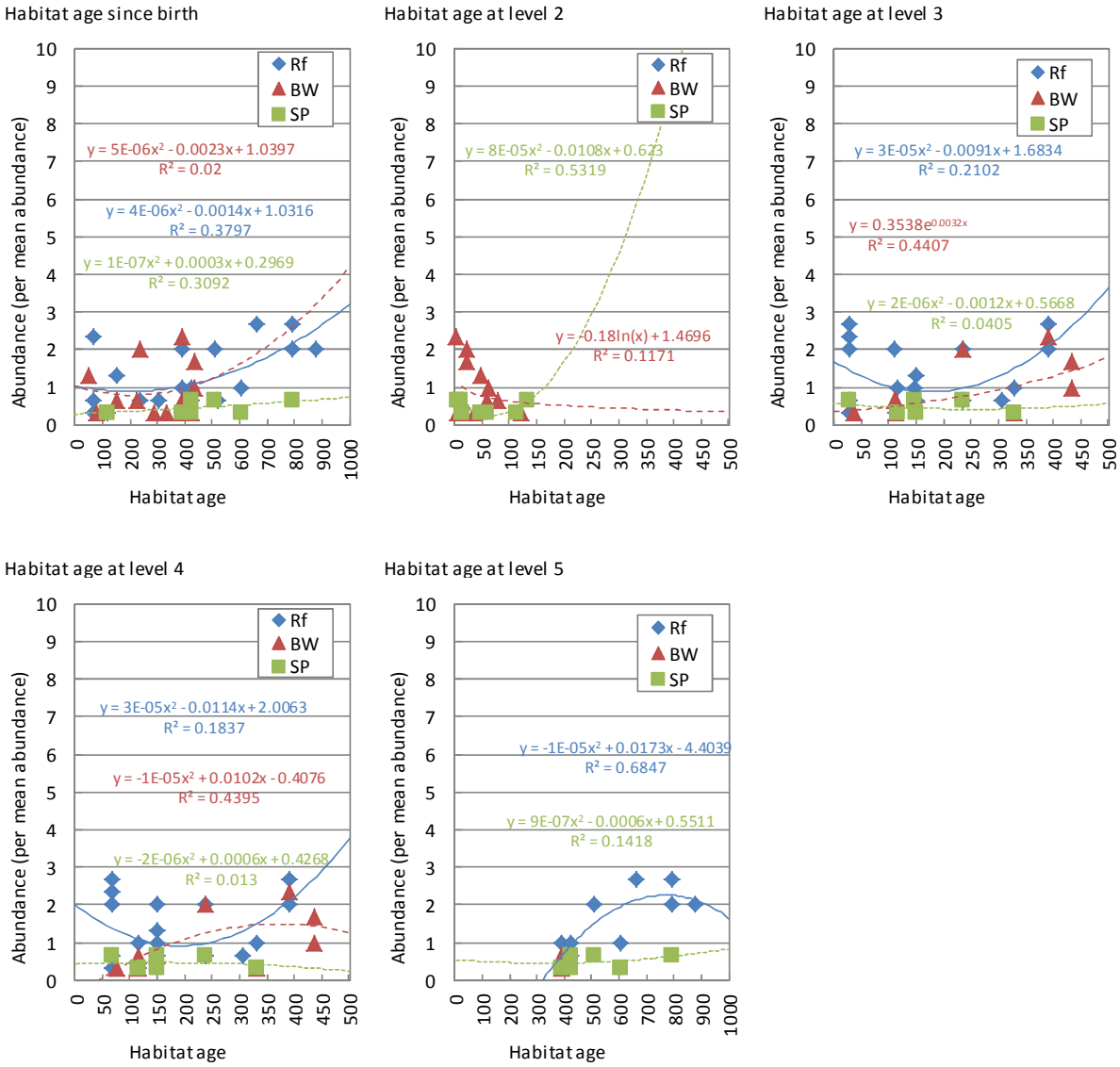


Figure 5.3.6 (39) Correspondence between habitat age and species abundance.

40 Diptera Ceratopogonidae

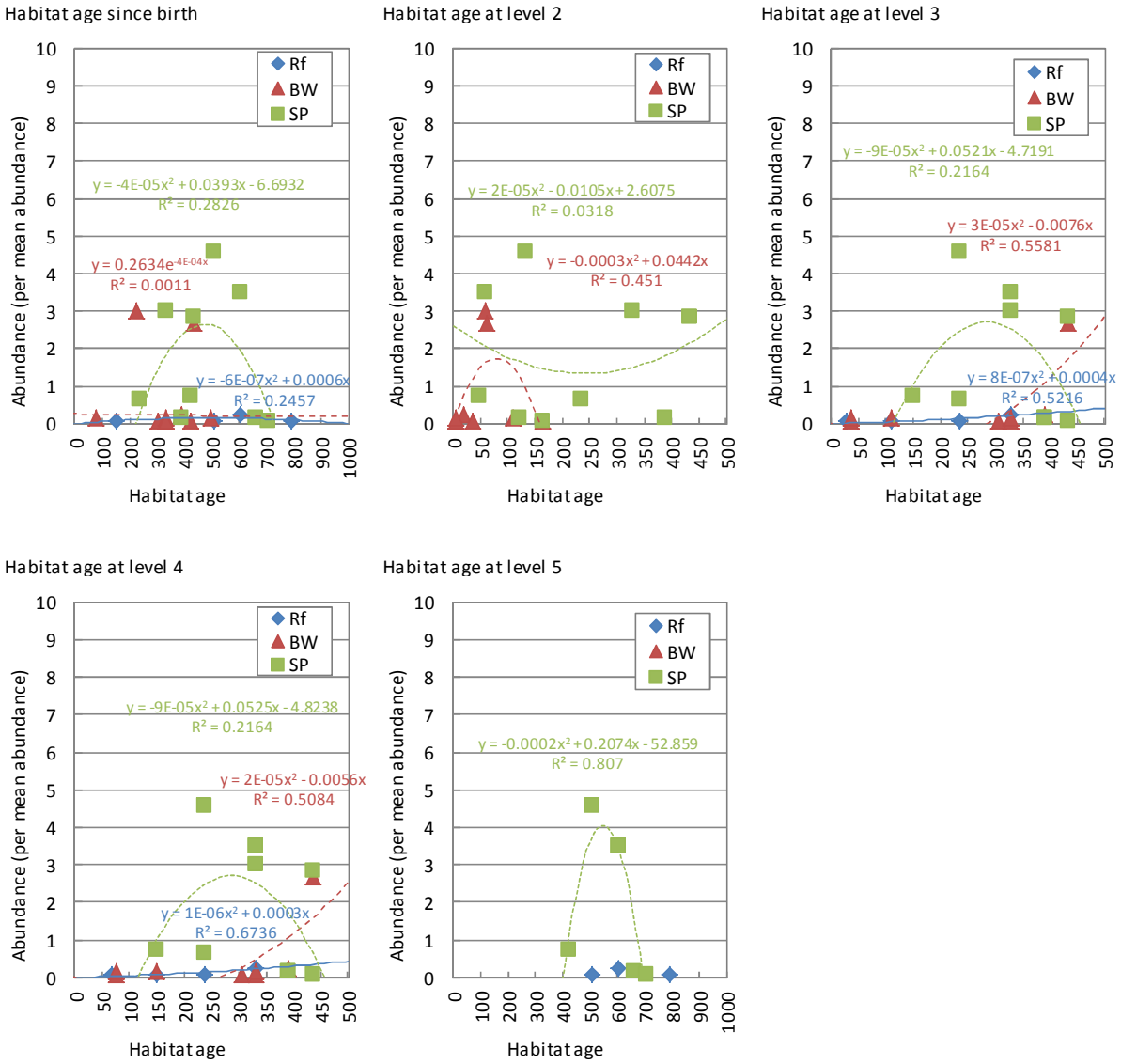


Figure 5.3.6 (40) Correspondence between habitat age and species abundance.

41 Diptera Tanypodinae

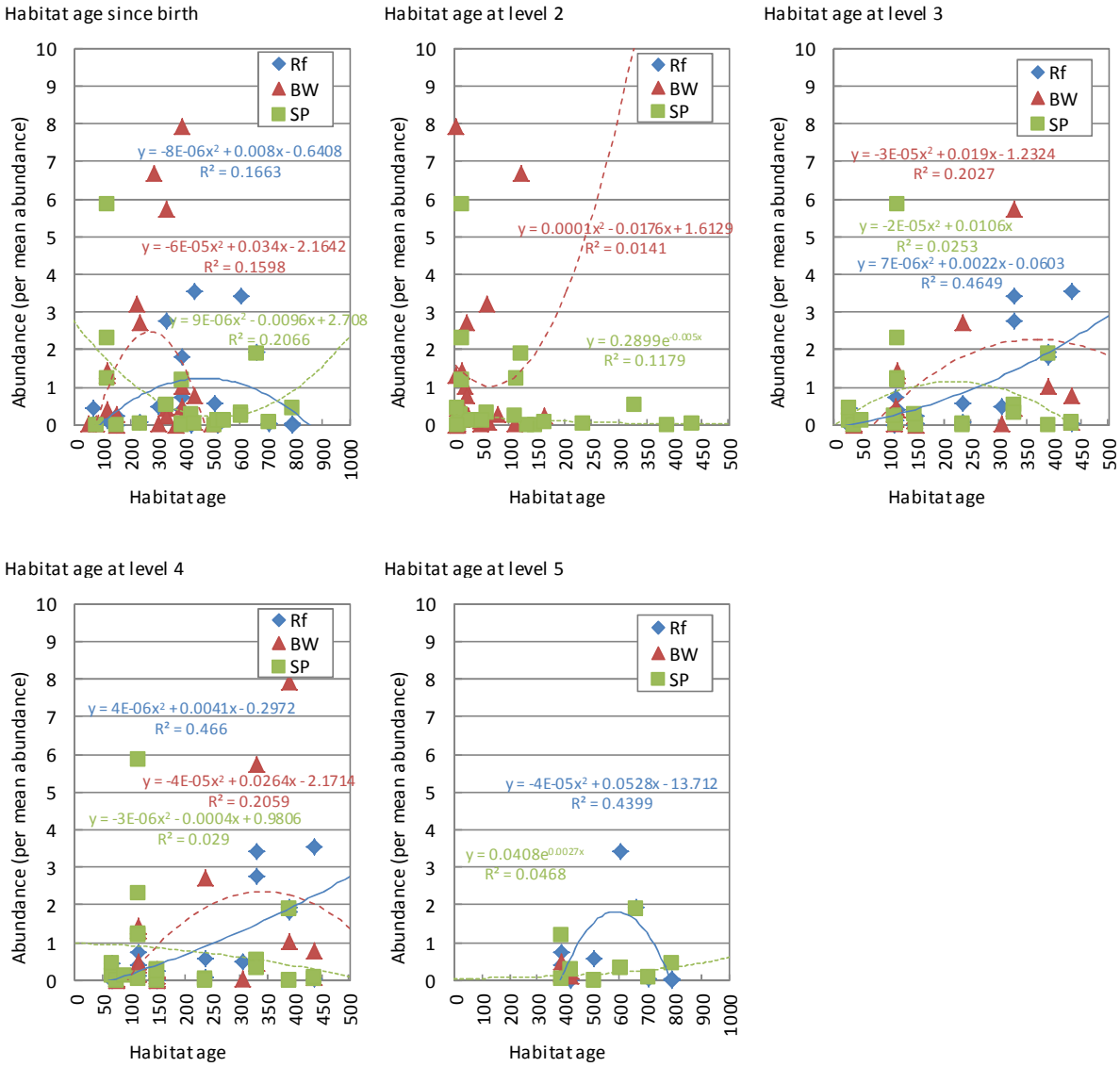


Figure 5.3.6 (41) Correspondence between habitat age and species abundance.

42 Diptera Cardiocladius sp.

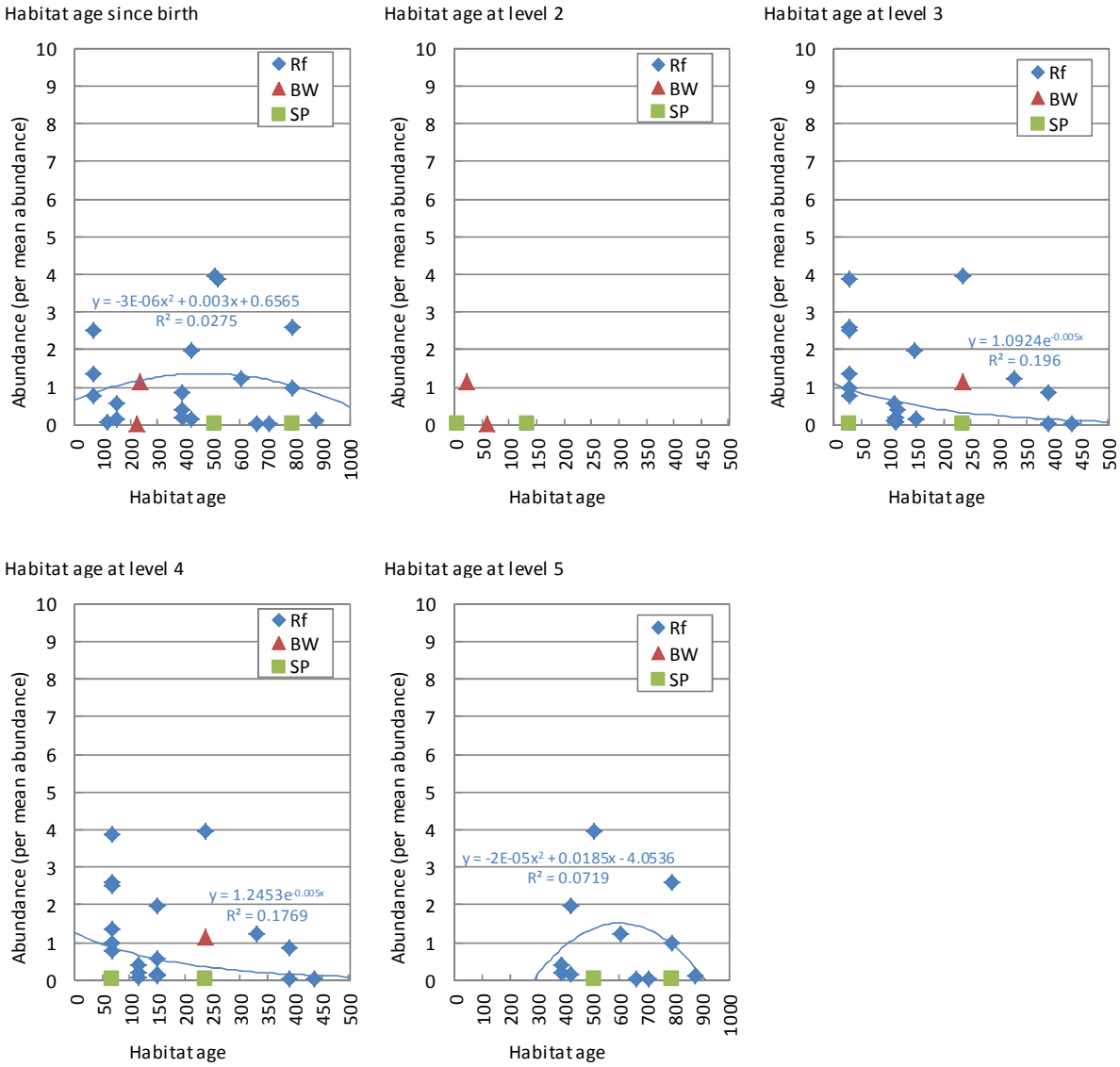


Figure 5.3.6 (42) Correspondence between habitat age and species abundance.

43 Diptera Cricotopus sp.

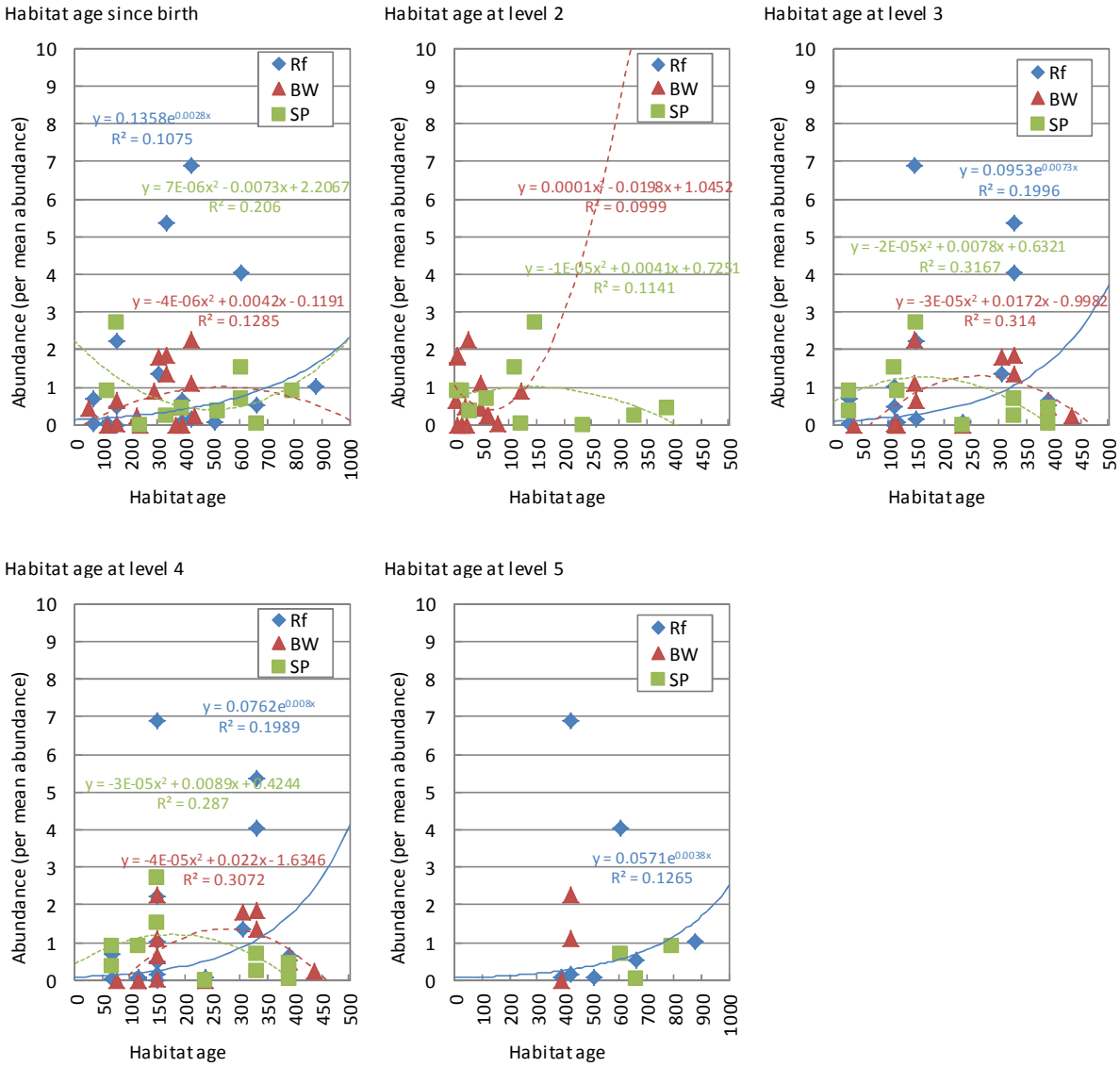


Figure 5.3.6 (43) Correspondence between habitat age and species abundance.

44 Diptera Orthocladius sp.

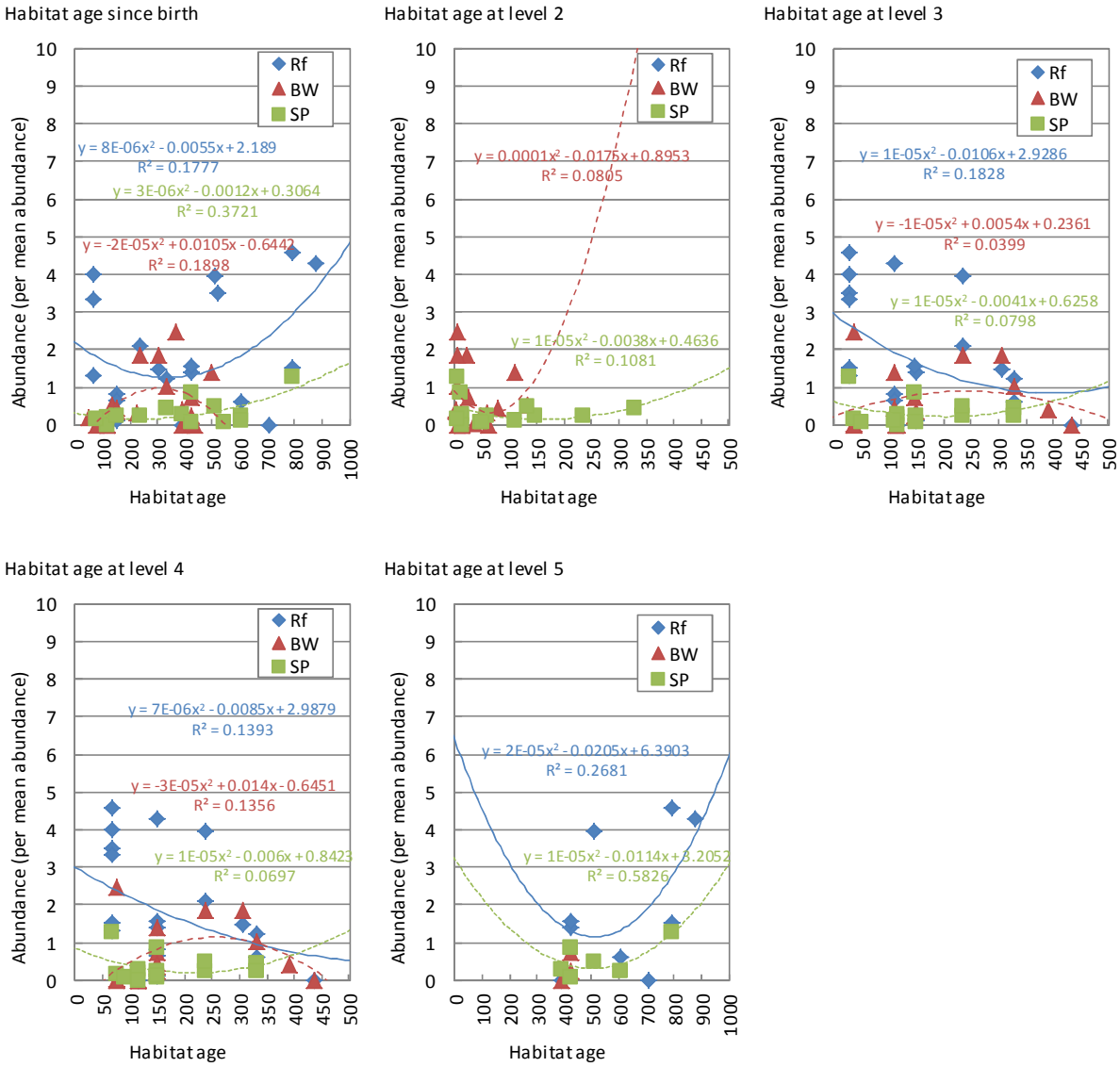


Figure 5.3.6 (44) Correspondence between habitat age and species abundance.

45 Diptera Cryptochironomus sp.

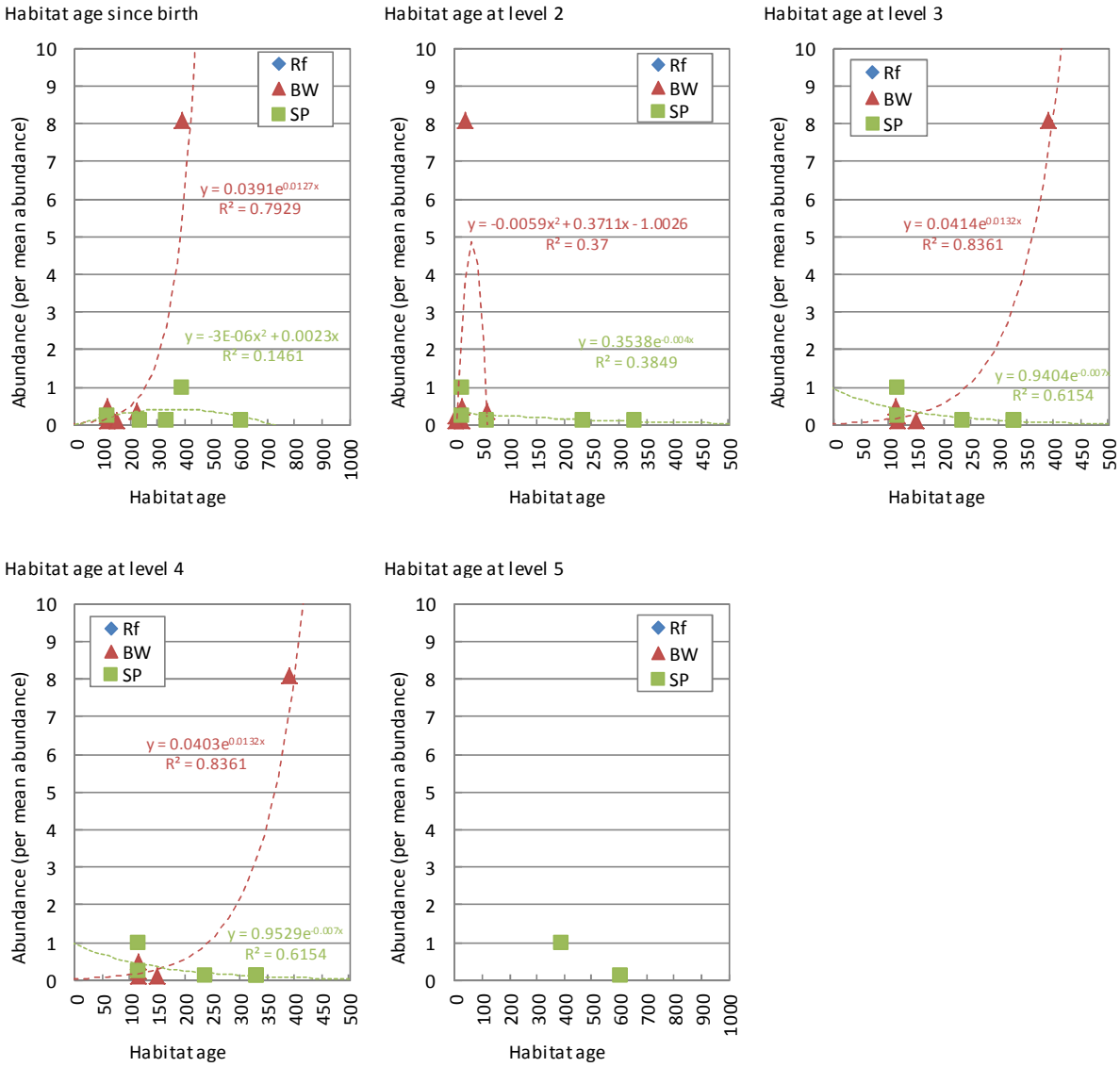


Figure 5.3.6 (45) Correspondence between habitat age and species abundance.

46 Diptera Dicrotendipes sp.

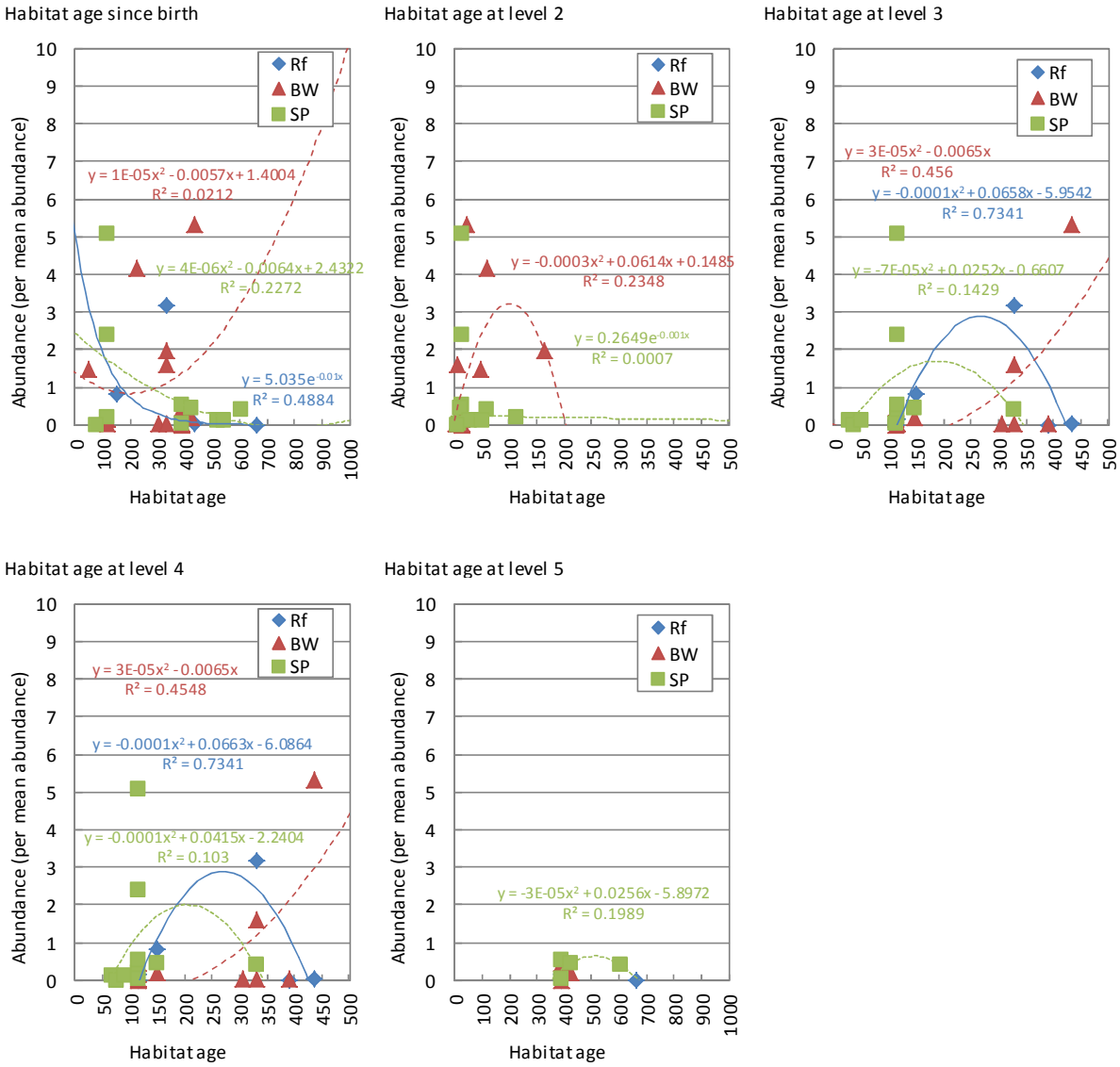


Figure 5.3.6 (46) Correspondence between habitat age and species abundance.

47 Diptera Stictochironomus sp.

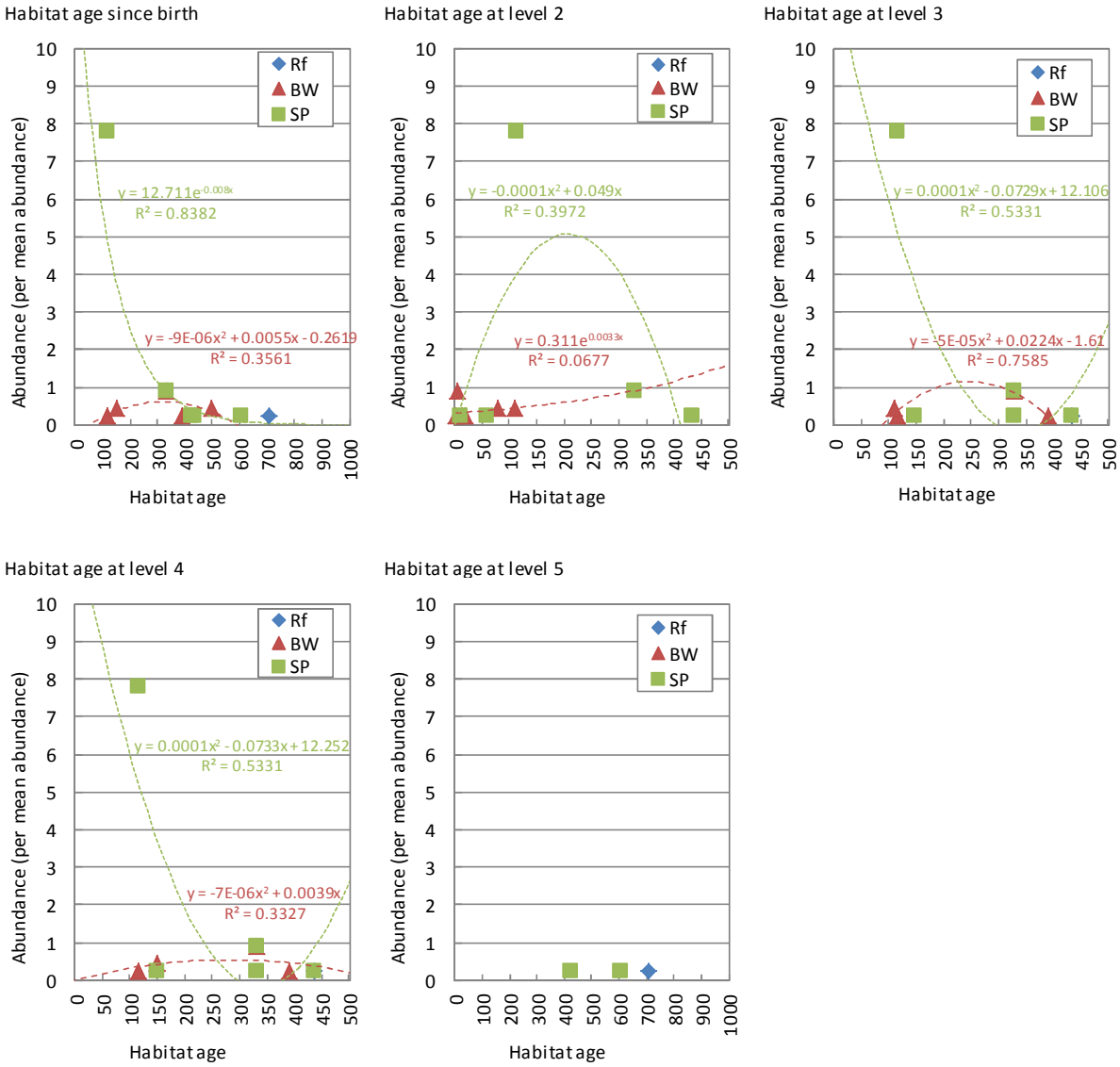


Figure 5.3.6 (47) Correspondence between habitat age and species abundance.

48 Diptera Tanytarsus sp.

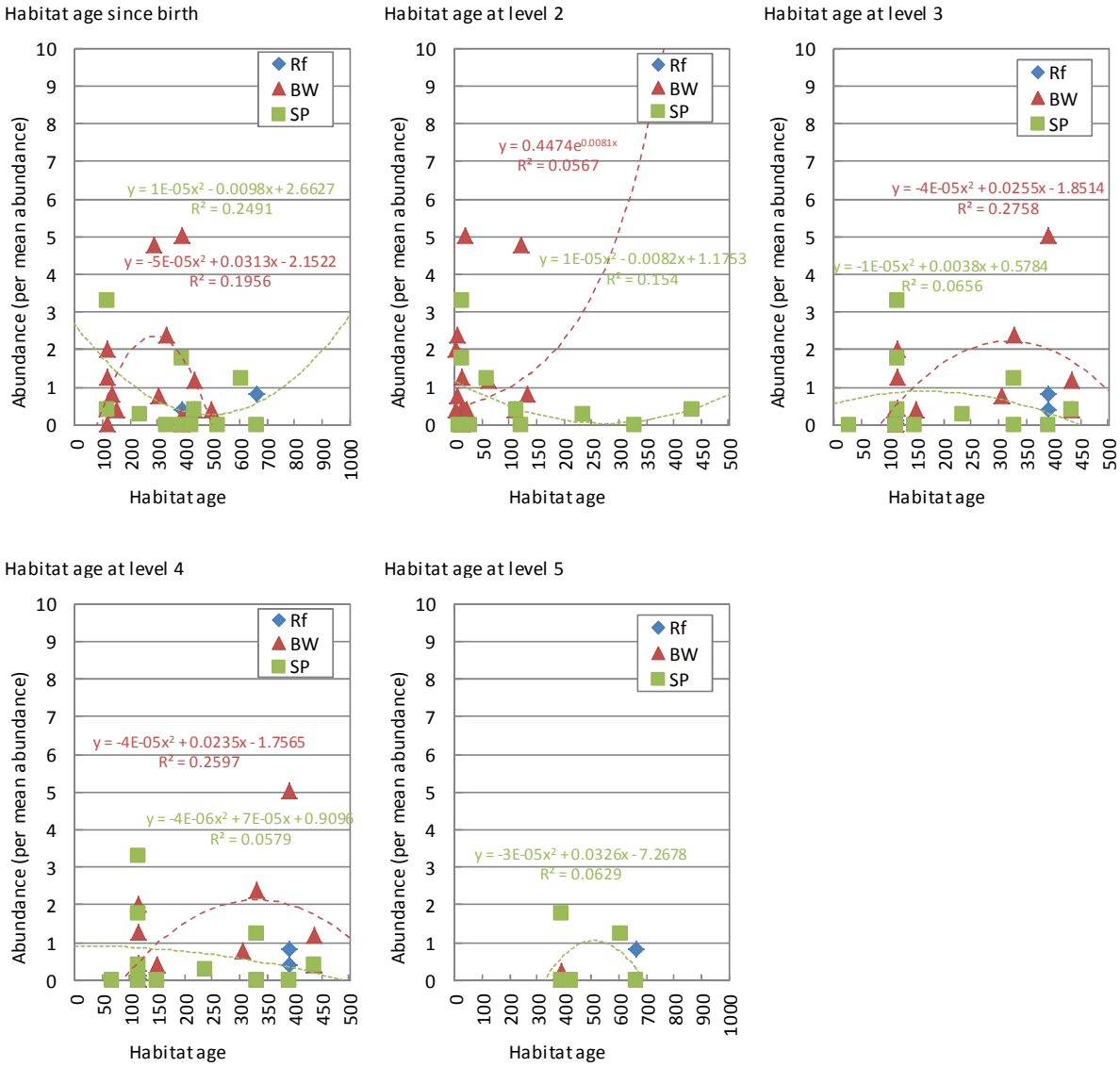


Figure 5.3.6 (48) Correspondence between habitat age and species abundance.

49 Diptera Dolichopodidae

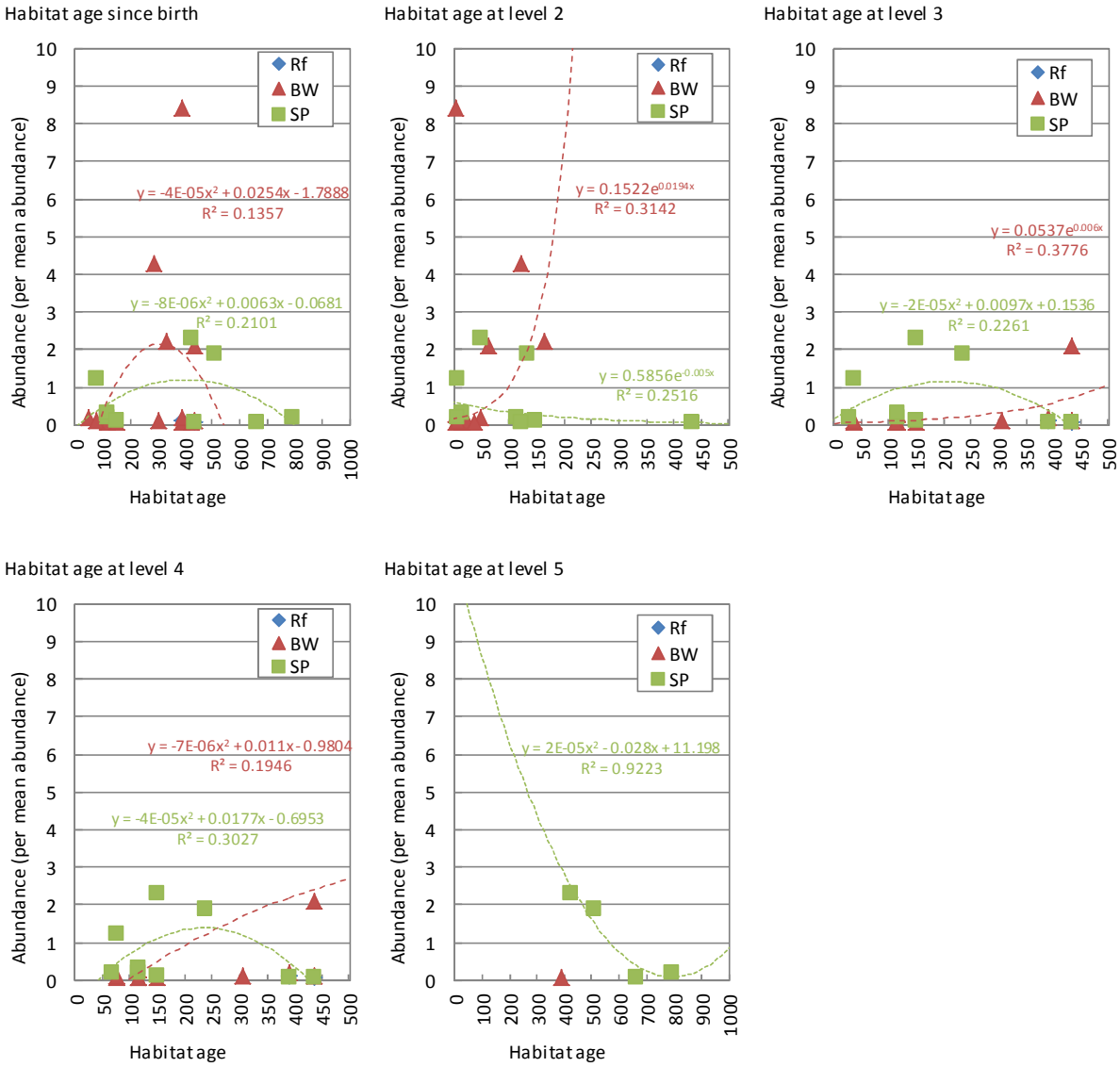


Figure 5.3.6 (49) Correspondence between habitat age and species abundance.

50 Diptera Empididae

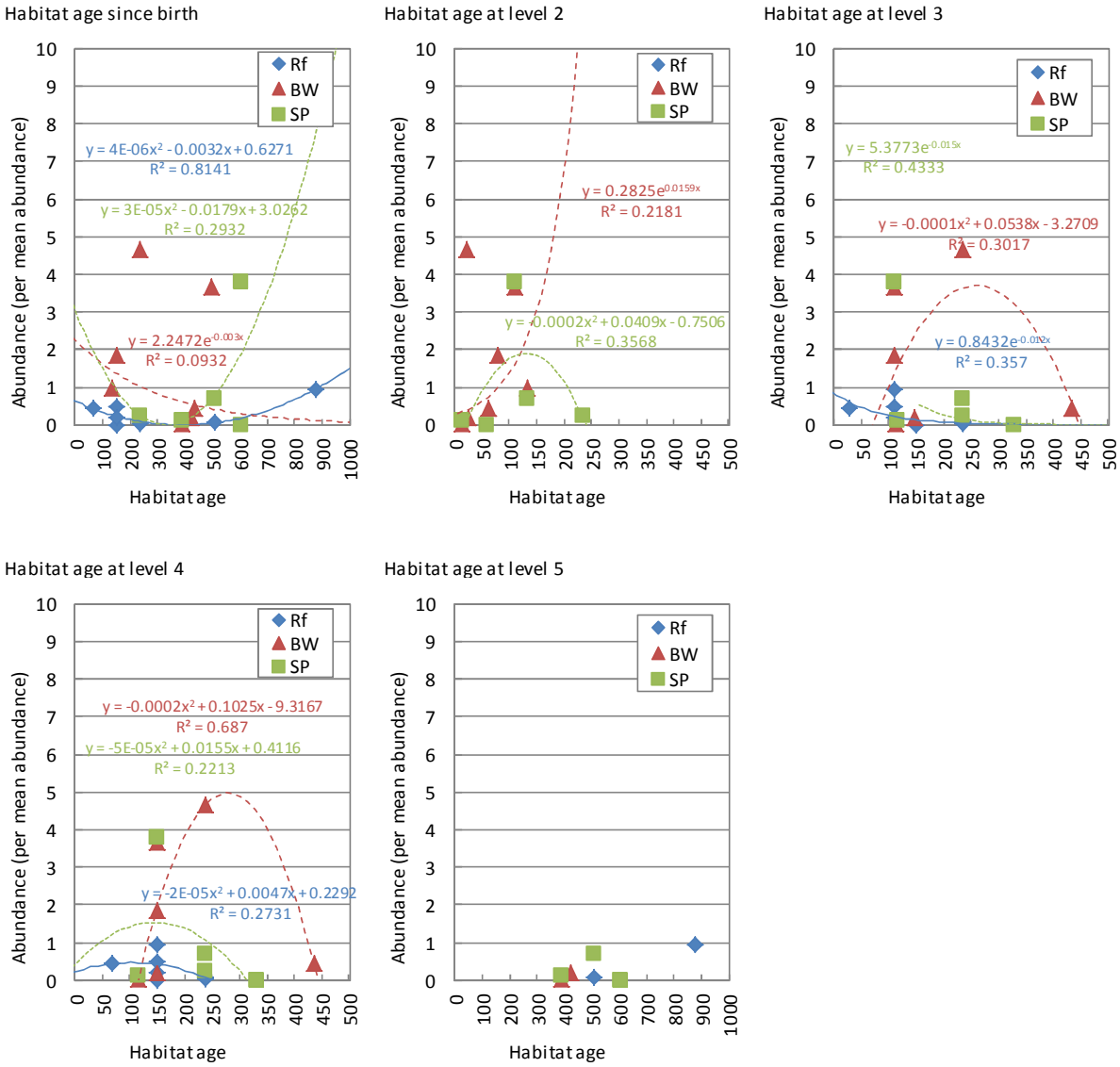


Figure 5.3.6 (50) Correspondence between habitat age and species abundance.

5.3.4 Other factors that may influence biodiversity

Figure 5.3.7 shows correspondence between environmental factors and habitat age at level 4. DO, water temperature, and PH were depicted to show its characteristics. DO in Rfs is decreased but that in BWs and SPs are increased for the habitat age of level 4, assuming that DO is increased in BWs and SPs because primary production due to vegetation. Water temperature has similar trends in Rfs, BWs, and SPs, which changes like a convex function, since disturbances at the level 4 occurred in June 2012 and September 2013. This means that temperature is getting low because after the disturbances it comes to autumn and winter and then it subsequently comes to spring and summer. Other relevant trends were not found. This explains that there were few relevant factors that influence responses of species to disturbance regimes.

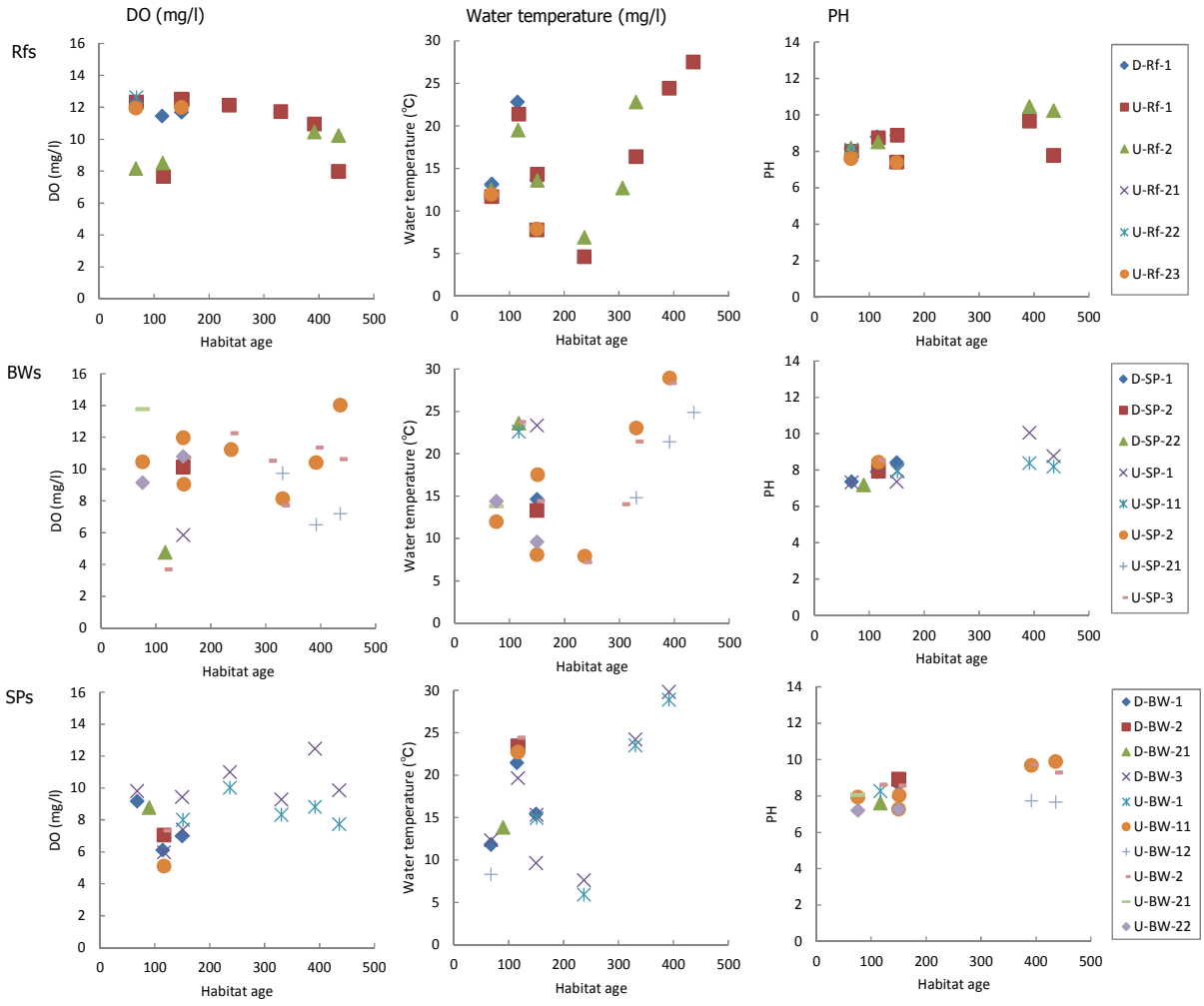


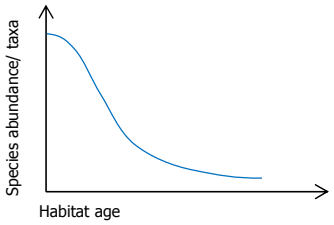
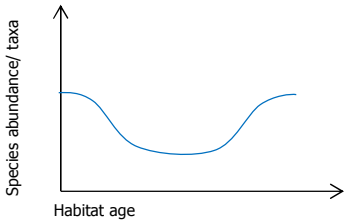
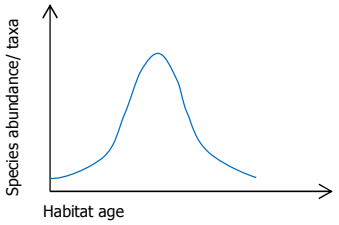
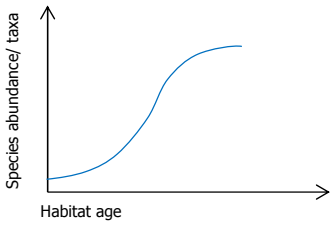
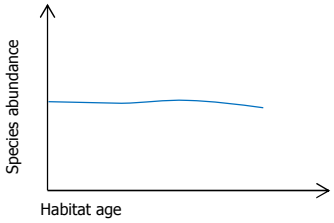
Figure 5.3.7 Correspondence between environmental factors and habitat age at level 4.

5.4 Discussions

5.4.1 Habitat age effects on biodiversity of macro-invertebrates

Based on the correspondence between habitat age and species abundance, we classified its changing patterns with 5 types for each habitat age (i.e., disturbance regimes of since-birth and level 2 to level 5). These are negative exponential type (NE), concave type (CC), convex type (CV), positive exponential type (PE), and stable type (ST) as illustrated in Table 5.4.1.

Table 5.4.1 Classification of habitat age effects on species abundance.

Classification type	Description	Illustration depicting the type
Negative exponential type (NE)	Species appear immediately after disturbance and decrease by time.	
Concave type (CC)	Species start with some abundance and reduce at the middle age.	
Convex type (CV)	Species start with nearly zero immediately after disturbances, and increase and decrease like convex functions by time.	
Positive exponential type (PE)	Species start with zero immediately after disturbances and gradually increase by time.	
Stable type (ST)	Species exist all the period in no relevant relation to disturbance regimes.	

For classification, we also extracted habitat ages (days) at which species reached to peak abundance for the analysis. Table 5.4.2 shows a list of the classified results, together with correlation coefficients of R values, and extracted habitat ages reached to peak abundance. Information on principal habitats, habitats used immediately after a middle flood, life types were also included in this table. Characteristics of each classification type are depicted in the following with the focus on habitat age of since-birth for simplifying discussions.

Negative exponential type (NE): In lotic systems of riffles (Rfs), species of this type are *Isonychia japonica* (18, Ephemeroptera) and *Dicrotendipes* sp. (46, Diptera). In lentic systems of back waters (BWs) and side pools (SPs), they are *Hygrobates* sp. (10, Acarina), *Potamanthus formosus* (20, Ephemeroptera), *Micronecta* sp. (26, Hemiptera), *Cheumatopsyche infascia* (28, Trichoptera), *Dicrotendipes* sp. (46, Diptera), and *Stictochironomus* sp. (47, Diptera). Basically, they cannot survive under a certain disturbance regime, but they can increase abundance at an earlier stage of habitat age as compared with other species, thus classified as the NE type.

Concave type (CC): Most of these species are found in lentic systems of BWs and SPs, which are *Physa acuta* (3, Basommatophora), *Lebertia* sp. (7, Acarina), *Paratya improvisa* (12, Decapoda), and *Ephemera orientalis* (19, Ephemeroptera). They respond to a middle flood as (a) disappearing and (b) migrating to habitats of lower disturbance regimes, as classified in Table 5.3.3. They exist stably in most stages of habitat age, but reduce abundance at the middle habitat age.

Convex type (CV): More than half of selected 50 species are classified to this type. In lotic systems of Rfs, species of this type are *Sperchon* sp. (8, Acarina), *Uracanthella punctisetae* (22, Ephemeroptera), *Hydropsyche orientalis* (29, Trichoptera), *Stenopsyche marmorata* (30, Trichoptera), and *Cardiocladius* sp. (42, Diptera). They respond to a middle flood as (a) disappearing, (b) migrating to habitats of lower disturbance regimes, and (e) disturbance-tolerant, indicating that abundance are reduced under a certain disturbance regime, but then increased at a middle stage of habitat age.

In lentic systems of BWs and SPs, species of this type are *Physa acuta* (3, Basommatophora), *Lebertia* sp. (7, Acarina), and *Paratya improvisa* (12, Decapoda). They respond to a middle flood as (a) disappearing and (b) migrating to habitats of lower disturbance regimes, indicating the same characteristics as above in Rfs.

Positive exponential type (PE): In lotic systems of Rfs, species of this type are *Baetiella japonica* (13, Ephemeroptera), *Torleya japonica* (21, Ephemeroptera), *Cheumatopsyche brevilineata* (27, Trichoptera), *Cheumatopsyche infascia* (28, Trichoptera), and *Rhyacophila nigrocephala* (32, Trichoptera), of which most of them are (e) disturbance-tolerant. They can survive and increase abundance under disturbance regimes, since their characteristics explained by life types are net-spinners (27 and 28), creepers (21 and 32) who are also capable of burrowing, and swimmers (13) who are capable of intermittently evacuate

from higher disturbance regimes to lower ones.

In lentic systems of BWs and SPs, species of this type are *Prostoma* sp. (2, Hoplonemertea), *Limnoperna fortunei* (4, Mytiloida), *Ephemera orientalis* (19, Ephemeroptera), *Neoperla* sp. (25, Plecoptera), *Micronecta* sp. (26, Hemiptera), *Tipula* sp. (37, Diptera), *Orthocladius* sp. (44, Diptera), and *Cryptochironomus* sp. (45, Diptera). They have all the response to a middle flood.

Stable type (ST): In lotic systems of Rfs, species of this type is *Rhithrogena* sp. (17, Ephemeroptera), which is classified as (e) disturbance-tolerant. In lentic systems of BWs and SPs, they are *Caenis* sp. (23, Ephemeroptera), *Zaitzeviaria* sp. (36, Coleoptera), *Tipula* sp. (37, Diptera), and *Hexatoma* sp. (39, Diptera). Even though they intermittently migrate to habitats of lower and higher disturbances regimes, abundance is kept relatively stable.

Table 5.4.2 A list of classified results of habitat age effects on species abundance.

Species information				Life Type categolization by:			Response of species to a middle flood (see Table 5.3.3 for definition and details)			Classification according to habitat age								
										Since-bitrh								
SP. No.	Order	Family	Species name	Merrit & Cummins (1996)	Takemon (2005)		Classification	Principal habitat species live	Habitat immediately after a middle flood	Rf			BW			SP		
										Type	Peak age	R	Type	Peak age	R	Type	Peak age	R
8	Acarina	Spercontidae	Sperchon sp.	Creepers	Crawlers	Crawlers	b	**Rfs**	SPs	**CV**	700	0.14	**PE**	300	0.17	-	-	-
9	Acarina	Hygrobatidae	Atractides sp.	Creepers	Crawlers	Crawlers	a	**Rfs**	-	**PE**	700	0.39	-	-	-	-	-	-
13	Ephemeroptera	Baetidae	Baetiella japonica	Swimmers	Attachers	Exposed attachers	e	**Rfs**	SPs	**PE**	800	0.17	-	-	-	-	-	-
15	Ephemeroptera	Baetidae	Tenuibaetis flexifemora	Swimmers	Swimmers	Swimmers	f	**Rfs**	-	**PE**	700	0.52	-	-	-	-	-	-
17	Ephemeroptera	Heptageniidae	Rhithrogena sp.	Creepers	Crawlers	Gliders	e	**Rfs**	SPs	**ST**	300	0.00	-	-	-	-	-	-
18	Ephemeroptera	Isonychiidae	Isonychia japonica	Swimmers	Swimmers	Swimmers	a	**Rfs**	Rfs	**NE**	400	0.16	-	-	-	-	-	-
21	Ephemeroptera	Ephemerellidae	Torleya japonica	Creepers	Crawlers	Crawlers	e	**Rfs**	Rfs	**PE**	800	0.12	-	-	-	-	-	-
22	Ephemeroptera	Ephemerellidae	Uracanthella punctisetae	Creepers	Crawlers	Crawlers	b	**Rfs**	SPs	**CV**	500	0.07	**ST**	400	0.03	**ST**	500	0.20
27	Trichoptera	Hydropsychidae	Cheumatopsyche brevilineata	Net-spinners	Attachers	Net-spinners	e	**Rfs**	Rfs	**PE**	700	0.17	**CV**	300	0.34	-	-	-
28	Trichoptera	Hydropsychidae	Cheumatopsyche infascia	Net-spinners	Attachers	Net-spinners	e	**Rfs**	Rfs	**PE**	700	0.08	**NE**	0	0.96	**PE**	700	0.98
29	Trichoptera	Hydropsychidae	Hydropsyche orientalis	Net-spinners	Attachers	Net-spinners	e	**Rfs**	Rfs	**CV**	400	0.17	**ST**	300	0.08	-	-	-
30	Trichoptera	Stenopsychidae	Stenopsyche marmorata	Net-spinners	Attachers	Net-spinners	a	**Rfs**	SPs	**CV**	500	0.21	**PE**	400	0.62	-	-	-
32	Trichoptera	Rhyacophilidae	Rhyacophila nigrocephala	Creepers	Crawlers	Crawlers	e	**Rfs**	Rfs	**PE**	700	0.05	-	-	-	-	-	-
42	Diptera	Chironomidae	Cardiocladius sp.	Burrowers	Burrowers	Free burrowers	e	**Rfs**	SPs	**CV**	400	0.03	-	-	-	-	-	-
3	Basommatophora	Physidae	Physa acuta	Creepers	Crawlers	Creepers	a	**BWs & SPs**	-	ST	400	0.07	CC	400	0.42	CC	700	0.20
7	Acarina	Lebertiidae	Lebertia sp.	Creepers	Crawlers	Crawlers	b	**BWs & SPs**	SPs	-	-	-	CC	500	0.32	CC	700	0.67
11	Isopoda	Asellidae	Asellus hilgendorfi	Creepers	Crawlers	Crawlers	a	**BWs & SPs**	-	-	-	-	-	-	-	CV	200	0.21
12	Decapoda	Atyidae	Paratya improvisa	Swimmers	Swimmers	Swimmers	b	**BWs & SPs**	SPs	-	-	-	CC	400	0.40	CC	100	0.88
19	Ephemeroptera	Ephemeridae	Ephemera orientalis	Burrowers	Burrowers	Free burrowers	b	**BWs & SPs**	SPs	-	-	-	PE	400	0.23	CC	0	0.42
26	Hemiptera	Corixidae	Micronecta sp.	Swimmers	Swimmers	Swimmers	f	**BWs & SPs**	SPs	-	-	-	PE	400	0.05	NE	100	0.23
40	Diptera	Ceratopogonidae	Ceratopogonidae	Burrowers	Burrowers	Free burrowers	a	**BWs & SPs**	-	CV	500	0.25	ST	200	0.00	ST	500	0.28
45	Diptera	Chironomidae	Cryptochironomus sp.	Burrowers	Burrowers	Free burrowers	a	**BWs & SPs**	-	-	-	-	PE	300	0.79	CV	300	0.15
47	Diptera	Chironomidae	Stictochironomus sp.	Burrowers	Burrowers	Free burrowers	a	**BWs & SPs**	-	-	-	-	CV	300	0.36	NE	0	0.84
49	Diptera	Dolichopodidae	Dolichopodidae	Burrowers	Burrowers	Free burrowers	b	**BWs & SPs**	SPs	-	-	-	CV	300	0.14	CV	400	0.21
1	Tricladida	Dugesiidae	Dugesia japonica	Creepers	Crawlers	Creepers	d	**Rfs, BWs, & SPs**	Rfs & SPs	CC	0	0.22	CC	300	0.70	-	-	-
2	Hoplonemertea	Tetrastemmatidae	Prostoma sp.	Creepers	Crawlers	Creepers	c	**Rfs, BWs, & SPs**	Rfs	PE	700	0.06	PE	400	0.28	CV	400	0.24
4	Mytiloida	Mytilidae	Limnoperna fortunei	Attachers	Attachers	Case builders	a	**Rfs, BWs, & SPs**	Rfs	CC	400	0.23	PE	300	0.29	-	-	-
6	Tubificida	Naididae	Slavina appendiculata	Burrowers	Burrowers	Free burrowers	f	**Rfs, BWs, & SPs**	SPs	-	-	-	CV	200	0.31	-	-	-
10	Acarina	Hygrobatidae	Hygrobates sp.	Creepers	Crawlers	Crawlers	d	**Rfs, BWs, & SPs**	Rfs & SPs	CV	300	0.30	CV	200	0.04	NE	100	0.28
14	Ephemeroptera	Baetidae	Baetis taiwanensis	Swimmers	Swimmers	Swimmers	d	**Rfs, BWs, & SPs**	Rfs & SPs	ST	0	0.01	CV	200	0.26	CV	400	0.23
16	Ephemeroptera	Heptageniidae	Ecdyonurus sp.	Creepers	Crawlers	Gliders	d	**Rfs, BWs, & SPs**	Rfs & SPs	PE	400	0.00	CV	300	0.05	CC	700	0.68
20	Ephemeroptera	Potamanthidae	Potamanthus formosus	Burrowers	Burrowers	Gliding burrowers	d	**Rfs, BWs, & SPs**	Rfs & SPs	-	-	-	CV	300	0.16	NE	100	0.26
23	Ephemeroptera	Caenidae	Caenis sp.	Creepers	Crawlers	Crawlers	b	**Rfs, BWs, & SPs**	SPs	PE	700	0.16	CV	300	0.10	ST	300	0.23
25	Plecoptera	Perlidae	Neoperla sp.	Creepers	Crawlers	Crawlers	d	**Rfs, BWs, & SPs**	Rfs & SPs	PE	700	0.33	CV	300	0.09	PE	500	0.25
31	Trichoptera	Hydroptilidae	Hydroptila sp.	Case-bearers	Crawlers	Case-bearers	b	**Rfs, BWs, & SPs**	SPs	CV	500	0.28	CV	200	0.17	CV	200	0.08
33	Trichoptera	Leptoceridae	Mystacides sp.	Case-bearers	Crawlers	Case-bearers	b	**Rfs, BWs, & SPs**	SPs	-	-	-	CC	500	0.45	CV	300	0.79
34	Coleoptera	Hydrophilidae	Laccobius sp.	Creepers	Crawlers	Crawlers	d	**Rfs, BWs, & SPs**	Rfs & SPs	ST	700	0.15	CV	200	0.02	CC	100	0.20
35	Coleoptera	Elmidae	Zaitzevia sp.	Creepers	Crawlers	Crawlers	d	**Rfs, BWs, & SPs**	Rfs & SPs	CV	500	0.05	CV	200	0.08	CV	400	0.16
36	Coleoptera	Elmidae	Zaitzeviaria sp.	Creepers	Crawlers	Crawlers	d	**Rfs, BWs, & SPs**	Rfs & SPs	ST	0	0.07	CV	200	0.03	ST	100	0.30
37	Diptera	Tipulidae	Tipula sp.	Burrowers	Burrowers	Free burrowers	d	**Rfs, BWs, & SPs**	Rfs & SPs	PE	700	0.17	ST	0	0.04	PE	700	0.24
38	Diptera	Tipulidae	Antocha sp.	Attachers	Attachers	Net-spinners	a	**Rfs, BWs, & SPs**	Rfs	CV	500	0.08	CV	200	0.15	CV	200	0.26
39	Diptera	Tipulidae	Hexatoma sp.	Burrowers	Burrowers	Free burrowers	d	**Rfs, BWs, & SPs**	Rfs & SPs	PE	800	0.38	PE	400	0.02	ST	700	0.31
41	Diptera	Chironomidae	Tanypodinae	Creepers	Crawlers	Crawlers	d	**Rfs, BWs, & SPs**	Rfs & SPs	CV	400	0.17	CV	200	0.16	CC	100	0.21
43	Diptera	Chironomidae	Cricotopus sp.	Burrowers	Burrowers	Free burrowers	d	**Rfs, BWs, & SPs**	Rfs & SPs	PE	800	0.11	CV	500	0.13	CC	100	0.21
44	Diptera	Chironomidae	Orthocladius sp.	Burrowers	Burrowers	Free burrowers	d	**Rfs, BWs, & SPs**	Rfs & SPs	CC	800	0.18	CV	300	0.19	PE	700	0.37
46	Diptera	Chironomidae	Dicrotendipes sp.	Burrowers	Burrowers	Free burrowers	b	**Rfs, BWs, & SPs**	SPs	NE	100	0.49	CC	400	0.02	NE	100	0.23
48	Diptera	Chironomidae	Tanytarsus sp.	Burrowers	Burrowers	Tube burrowers	a	**Rfs, BWs, & SPs**	SPs	-	-	-	CV	200	0.20	CC	100	0.25
50	Diptera	Empididae	Empididae	Burrowers	Burrowers	Free burrowers	f	**Rfs, BWs, & SPs**	Rfs	CV	800	0.81	NE	100	0.09	CC	600	0.29
5	Tubificida	Naididae	Nais bretscheri	Burrowers	Burrowers	Free burrowers	a	**Rfs & BWs**	-	PE	600	0.08	CC	200	0.26	-	-	-
24	Odonata	Gomphidae	Sinogomphus flavolimbatus	Burrowers	Burrowers	Free burrowers	f	**Rfs & BWs**	SPs	-	-	-	-	-	-	-	-	-

Peak age: habitat age at peak abundance. R: Ccorrelation coefficient between habitat age and species abundance.

Table 5.4.2 A list of classified results of habitat age effects on species abundance. (Continued.)

Species information		Classification according to habitat age (continued)																																	
		Level 2 (lotic)									Level 3 (q2000)									Level 4 (q3500)									Level 5 (q7000)					
SP. No.	Species name	Rf			BW			SP			Rf			BW			SP			Rf			BW			SP			Rf			BW			SP		
		Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R	Type	Peak age	R
8	Sperchon sp.	-	-	-	NE	0	0.17	-	-	-	CC	400	0.30	ST	0	-	-	-	-	CC	400	0.29	ST	50	0.38	-	-	-	PE	800	0.35	-	-	-	-	-	-
9	Atractides sp.	-	-	-	-	-	-	-	-	-	CC	400	0.14	-	-	-	-	-	-	CC	400	0.13	-	-	-	-	-	-	CC	600	0.28	-	-	-	-	-	-
13	Baetiella japonica	-	-	-	-	-	-	-	-	-	CC	0	0.48	-	-	-	-	-	-	CC	50	0.45	-	-	-	-	-	-	PE	800	0.78	-	-	-	-	-	-
15	Tenuibaetis flexifemora	-	-	-	-	-	-	-	-	-	PE	400	0.72	-	-	-	-	-	-	PE	400	0.71	-	-	-	-	-	-	PE	700	0.57	-	-	-	-	-	-
17	Rhithrogena sp.	-	-	-	-	-	-	-	-	-	CC	300	0.40	-	-	-	-	-	-	CC	300	0.42	-	-	-	-	-	-	CV	700	0.45	-	-	-	-	-	-
18	Isonychia japonica	-	-	-	-	-	-	-	-	-	CV	250	0.16	-	-	-	-	-	-	CV	250	0.15	-	-	-	-	-	-	-	-	0.41	-	-	-	-	-	-
21	Torleya japonica	-	-	-	-	-	-	-	-	-	CC	400	0.42	-	-	-	-	-	-	CC	400	0.43	-	-	-	-	-	-	PE	800	0.63	-	-	-	-	-	-
22	Uracanthella punctisetae	-	-	-	ST	0	0.56	NE	0	0.61	CC	0	0.38	ST	400	0.74	NE	0	0.60	CC	400	0.40	ST	400	0.71	NE	50	0.60	CV	600	0.32	-	-	-	-	-	-
27	Cheumatopsyche brevilineata	-	-	-	PE	150	0.44	-	-	-	CC	400	0.54	-	-	-	-	-	-	CC	400	0.58	-	-	-	-	-	-	CC	700	0.40	-	-	-	-	-	-
28	Cheumatopsyche infascia	-	-	-	CC	0	0.97	CC	0	0.28	CC	0	0.39	ST	200	0.87	NE	0	0.85	CC	50	0.38	ST	200	0.85	NE	50	0.78	CV	600	0.20	-	-	-	PE	700	0.94
29	Hydropsyche orientalis	-	-	-	NE	0	0.43	-	-	-	CV	200	0.15	CV	300	0.32	-	-	-	CV	200	0.09	CV	300	0.32	-	-	-	NE	300	0.44	-	-	-	-	-	-
30	Stenopsyche marmorata	-	-	-	ST	0	0.02	-	-	-	PE	400	0.82	ST	400	0.54	-	-	-	PE	400	0.82	-	-	-	-	-	-	-	-	0.07	-	-	-	-	-	-
32	Rhyacophila nigrocephala	-	-	-	-	-	-	-	-	-	CC	0	0.14	-	-	-	-	-	-	CC	50	0.10	-	-	-	-	-	-	CC	700	0.35	-	-	-	-	-	-
42	Cardiocladius sp.	-	-	-	-	-	-	-	-	-	NE	0	0.20	-	-	-	-	-	-	NE	50	0.18	-	-	-	-	-	-	CV	600	0.07	-	-	-	-	-	-
3	Physa acuta	-	-	-	PE	150	0.06	CV	150	0.07	ST	400	0.55	CC	400	0.12	CC	100	0.12	PE	400	0.59	CC	400	0.39	CC	400	0.12	-	-	-	-	-	-	CV	800	0.16
7	Lebertia sp.	-	-	-	CV	50	0.50	NE	0	0.41	-	-	-	CV	150	0.37	NE	0	0.37	-	-	-	CV	150	0.24	NE	50	0.35	-	-	-	-	-	-	CC	700	0.96
11	Asellus hilgendorfi	-	-	-	-	-	-	CV	200	0.21	-	-	-	-	-	-	CV	250	0.21	-	-	-	-	-	-	CV	250	0.21	-	-	-	-	-	-	-	-	-
12	Paratya improvisa	-	-	-	CV	50	0.15	ST	0	0.40	-	-	-	CC	400	0.30	ST	200	0.16	-	-	-	CC	400	0.38	ST	100	0.14	-	-	-	-	-	-	-	-	-
19	Ephemera orientalis	-	-	-	NE	0	0.22	NE	0	0.47	-	-	-	CC	350	0.07	NE	0	0.42	-	-	-	CC	350	0.07	NE	50	0.45	-	-	-	-	-	-	-	-	-
26	Micronecta sp.	-	-	-	PE	150	0.02	CV	250	0.51	-	-	-	PE	400	0.25	CV	250	0.38	-	-	-	PE	400	0.24	CV	250	0.45	-	-	-	-	-	-	CV	500	0.55
40	Ceratopogonidae	-	-	-	CV	50	0.45	CC	400	0.03	PE	300	0.52	PE	400	0.56	CV	200	0.22	PE	300	0.67	PE	400	0.51	CV	250	0.22	-	-	-	-	-	-	CV	500	0.80
45	Cryptochironomus sp.	-	-	-	CV	0	0.37	CV	150	0.38	-	-	-	PE	350	0.84	NE	100	0.62	-	-	-	PE	350	0.84	NE	100	0.62	-	-	-	-	-	-	-	-	-
47	Stictochironomus sp.	-	-	-	ST	100	0.07	CV	200	0.40	-	-	-	CV	250	0.76	CC	100	0.53	-	-	-	CV	250	0.33	CC	100	0.53	-	-	-	-	-	-	-	-	-
49	Dolichopodidae	-	-	-	PE	150	0.31	NE	0	0.25	-	-	-	PE	400	0.38	CV	200	0.23	-	-	-	PE	400	0.19	CV	200	0.30	-	-	-	-	-	-	NE	400	0.92
1	Dugesia japonica	-	-	-	-	-	-	-	-	-	NE	0	0.32	-	-	-	-	-	-	NE	50	0.34	-	-	-	-	-	-	CV	600	0.36	-	-	-	-	-	-
2	Prostoma sp.	-	-	-	NE	0	0.25	CV	100	0.24	CC	0	0.31	PE	400	0.21	ST	300	0.21	CC	400	0.30	PE	400	0.37	CV	250	0.21	CV	600	0.53	-	-	-	CV	500	0.68
4	Limnoperna fortunei	-	-	-	NE	0	0.34	-	-	-	CV	250	0.18	PE	350	-	-	-	-	CV	250	0.14	PE	350	0.43	-	-	-	-	-	-	-	-	-	-	-	-
6	Slavina appendiculata	-	-	-	NE	0	0.51	-	-	-	-	-	-	CC	100	-	-	-	-	-	-	-	CC	350	0.23	-	-	-	-	-	-	-	-	-	-	-	-
10	Hygrobates sp.	-	-	-	CV	50	0.01	CC	0	0.16	CC	300	0.83	CV	250	0.03	CV	250	0.01	CC	300	0.88	CV	250	0.09	CC	300	0.04	-	-	-	-	-	-	-	-	-
14	Baetis taiwanensis	-	-	-	NE	50	0.04	CV	100	0.25	CC	350	0.05	CV	250	0.70	CV	100	0.21	CC	50	0.07	CV	250	0.70	CV	100	0.18	CV	500	0.50	-	-	-	NE	300	0.15
16	Ecdyonurus sp.	-	-	-	CC	0	0.11	CC	0	0.20	CC	0	0.66	PE	200	0.25	CC	0	0.54	CC	400	0.69	PE	400	0.26	CC	50	0.52	PE	800	0.29	-	-	-	PE	700	1.00
20	Potamanthus formosus	-	-	-	NE	50	0.33	ST	300	0.10	-	-	-	NE	50	0.25	ST	300	0.09	-	-	-	NE	50	0.25	ST	300	0.11	-	-	-	-	-	-	-	-	-
23	Caenis sp.	-	-	-	CV	50	0.06	ST	300	0.12	PE	400	0.45	PE	400	0.29	ST	300	0.08	PE	400	0.45	PE	400	0.32	ST	300	0.13	PE	700	0.39	-	-	-	-	-	-
25	Neoperla sp.	-	-	-	CV	50	0.03	CC	200	0.52	CV	150	0.19	ST	200	0.00	CC	200	0.62	CV	150	0.18	CV	200	0.02	CC	200	0.05	CC	400	0.03	-	-	-	-	-	-
31	Hydroptila sp.	-	-	-	CV	50	0.05	CC	300	0.49	PE	400	0.96	PE	400	0.23	CV	200	0.01	PE	400	0.96	PE	400	0.76	CV	250	0.03	CV	600	0.98	-	-	-	ST	300	0.04
33	Mystacides sp.	-	-	-	CV	50	0.14	NE	0	0.59	-	-	-	CC	100	0.18	PE	100	0.23	-	-	-	CC	100	0.06	PE	100	0.23	-	-	-	-	-	-	-	-	-
34	Laccobius sp.	-	-	-	CV	100	0.11	NE	0	0.10	PE	400	0.51	CC	400	0.16	CV	200	0.02	PE	400	0.50	CC	350	0.17	ST	100	0.06	-	-	-	-	-	-	CV	600	0.17
35	Zaitzevia sp.	-	-	-	PE	150	0.06	PE	400	0.53	CC	0	0.08	CV	250	0.12	PE	400	0.21	CC	50	0.05	CV	250	0.13	PE	400	0.23	CV	600	0.47	-	-	-	CV	600	0.37
36	Zaitzeviaria sp.	-	-	-	CV	50	0.00	ST	0	0.32	NE	0	0.18	PE	300	0.70	ST	100	0.25	NE	50	0.18	PE	300	0.69	ST	100	0.22	CC	400	0.11	-	-	-	-	-	-
37	Tipula sp.	-	-	-	ST	0	0.01	CV	150	0.07	PE	400	0.58	CC	0	0.63	PE	400	0.12	PE	400	0.58	CC	50	0.45	PE	400	0.14	CV	600	0.20	-	-	-	CV	800	0.17
38	Antocha sp.	-	-	-	NE	0	0.07	PE	200	1.00	PE	400	0.36	CV	200	0.18	PE	200	0.98	PE	400	0.33	CV	200	0.15	PE	200	0.98	CV	500	0.20	-	-	-	-	-	-
39	Hexatoma sp.	-	-	-	NE	0	0.12	PE	100	0.53	CC	0	0.21	PE	400	0.44	ST	0	0.04	CC	50	0.18	PE	400	0.44	ST	50	0.01	CV	700	0.68	-	-	-	ST	400	0.14
41	Tanypodinae	-	-	-	CC	100	0.01	NE	0	0.12	PE	400	0.46	PE	350	0.20	NE	50	0.03	PE	400	0.47	CV	300	0.21	NE	50	0.03	CV	600	0.44	-	-	-	PE	800	0.05
43	Cricotopus sp.	-	-	-	CC	0	0.10	CV	150	0.11	PE	300	0.20	CV	250	0.31	CV	150	0.32	PE	300	0.20	CV	250	0.31	CV	150	0.29	PE	600	0.13	-	-	-	-	-	-
44	Orthocladius sp.	-	-	-	CC	0	0.08	CC	0	0.11	NE	0	0.18	CV	200	0.04	CC	0	0.08	NE	50	0.14	CV	250	0.14	CC	50	0.07	CC	800	0.27	-	-	-	CC	800	0.58
46	Dicrotendipes sp.	-	-	-	CV	50	0.23	NE	0	0.00	CV	250	0.73	PE	400	0.46	CV	150	0.14	CV	250	0.73	PE	400	0.45	CV	200	0.10	-	-	-	-	-	-	NE	300	0.20
48	Tanytarsus sp.	-	-	-	PE	100	0.06	CC	0	0.15	-	-	-	ST	100	0.28	CV	200	0.07	-	-	-	CV	300	0.26	NE	100	0.06	-	-	-	-	-	-	CV	500	0.06
50	Empididae	-	-	-	PE	100	0.22	CV	100	0.36	NE	0	0.36	CV	250	0.30	NE	100	0.43	CV	100	0.27	CV	200	0.69	CV	150	0.22	-	-	-	-	-	-	-	-	-
5	Nais bretscheri	-	-	-	CV	50	0.35	-	-	-	PE	300	0.92	CC	200	-	-	-	-	PE	300	0.92	CC	200	0.42	-	-	-	-	-	-	-	-	-	-	-	-
24	Sinogomphus flavolimbatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Peak age: habitat age at peak abundance. R: Ccorrelation coefficient between habitat age and species abundance.

Figure 5.4.1 shows habitat age effects on species richness by counting the number of species that belong to each classified type. Figure 5.4.2 shows habitat age effects on species richness classified by counting the number of species that habitat age reached to peak abundance. A set of these figures are prepared based on Table 5.4.1. It is noted that for habitat age at level 5, number of data are limited for analyzing habitat age effects, since there are a few habitats existed from the large flood in 2011 until a period when sampling of macro-invertebrates was conducted in 2012 and 2013.

1) Principal habitats of Rfs

Species whose principal habitats are Rfs showed that most of species have positive exponential (PE) and convex (CV) types at habitat age of since-birth (Figure 5.4.1). At habitat age of level 2, classification of Rfs does not exist at all since Rfs have been receiving disturbances as lotic systems. Habitat ages of level 3 and level 4 showed similar effects on species richness. Most of species have a concave (CC) type as compared with positive exponential (PE) and convex (CV) types, which have high species richness at habitat age of since-birth. At habitat age of level 5, concave (CC), convex (CV), and exponential (PE) types could be found with almost same behaviors.

Rfs in Figure 5.4.2 showed that habitat age reached to peak abundance was found at 700 days at since-birth, 0 or 200 days at level 3 and level 4, 600 to 800 days at level 5. These results indicate that in Rfs there is a certain cycle of the concave (CC) type determined by disturbances of level 3 and level 4, which are considered to be middle floods. Such middle floods tend to occur in around September, reducing species in Rfs. Then in 200 days at level 3 and level 4 (around April in the following year), the second generation can grow up and reach to peak abundance. On one hand, after large floods, 700 days at since-birth are required to reach to peak abundance, indicating that species can be recovered from a disturbance at level 5 over two or three generations.

2) Principal habitats of BWs and SPs

Species whose principal habitats are BWs and SPs showed that a negative exponential (NE) type was found in SPs but not in BWs, and a positive exponential (PE) type was found in BWs but not in SPs (Figure 5.4.1). The reason why a positive exponential (PE) type was well found in BWs could be assumed that species of this type are new generations and require planktons and silt riverbed, explaining that it takes time to form such micro habitats. For example, planktons and fine sediment are deposited over recurrent small floods.

BWs and SPs of principal habitats in Figure 5.4.2 showed that habitat age reached to peak abundance was 400 days at since-birth and 200 days at level 3 and level 4. This cycle is shorter than that of Rfs of principal habitats, which reached to the peak abundance at 600 to 800 days. This indicates that species living in lentic systems (BWs and SPs) are not relatively disturbance-tolerant rather than those living in lotic systems (Rfs).

3) Principal habitats of Rfs, BWs, and SPs

Species whose principal habitats are Rfs, BWs and SPs showed that most of species were convex (CV) types at since birth and level 5. At level 3 and level 4, species have various types such as positive exponential (PE), convex (CV), and concave (CC) types. At level 2, species of negative exponential types were increased as compared with other habitat ages.

Rfs, BWs, and SPs of principal habitats in Figure 5.4.2 showed that habitat age reached to peak abundance differs among different habitat ages, which were 100 to 400 days at since-birth, 0 to 50 days at level 2, 0 to 200 days at level 3 and level 4, and 600 days at level 5. Since these species use various habitats, this behavior seems to make it difficult to show clear characteristics for this analysis.

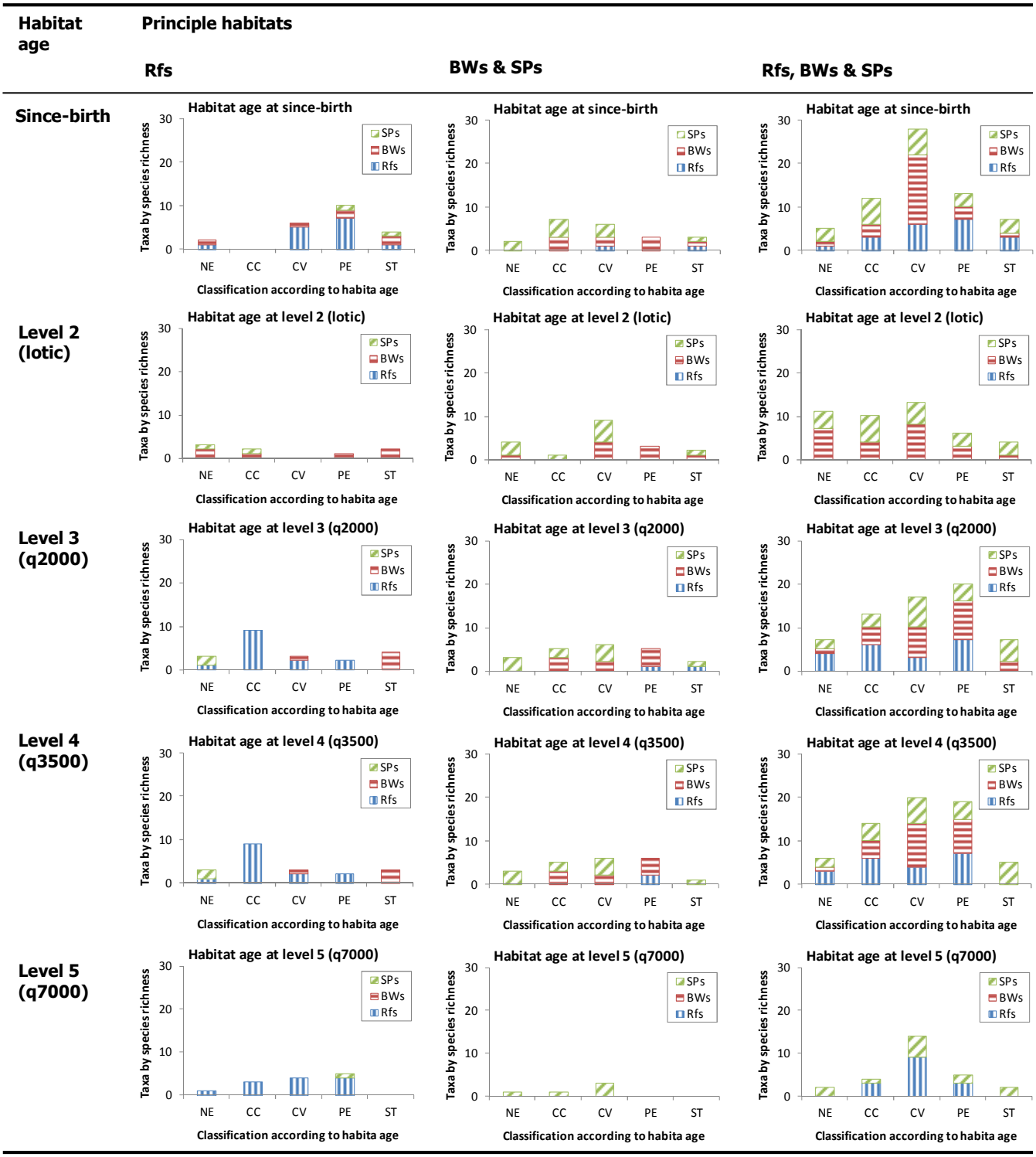


Figure 5.4.1 Habitat age effects on species richness by counting the number of species that belong to each classified type.

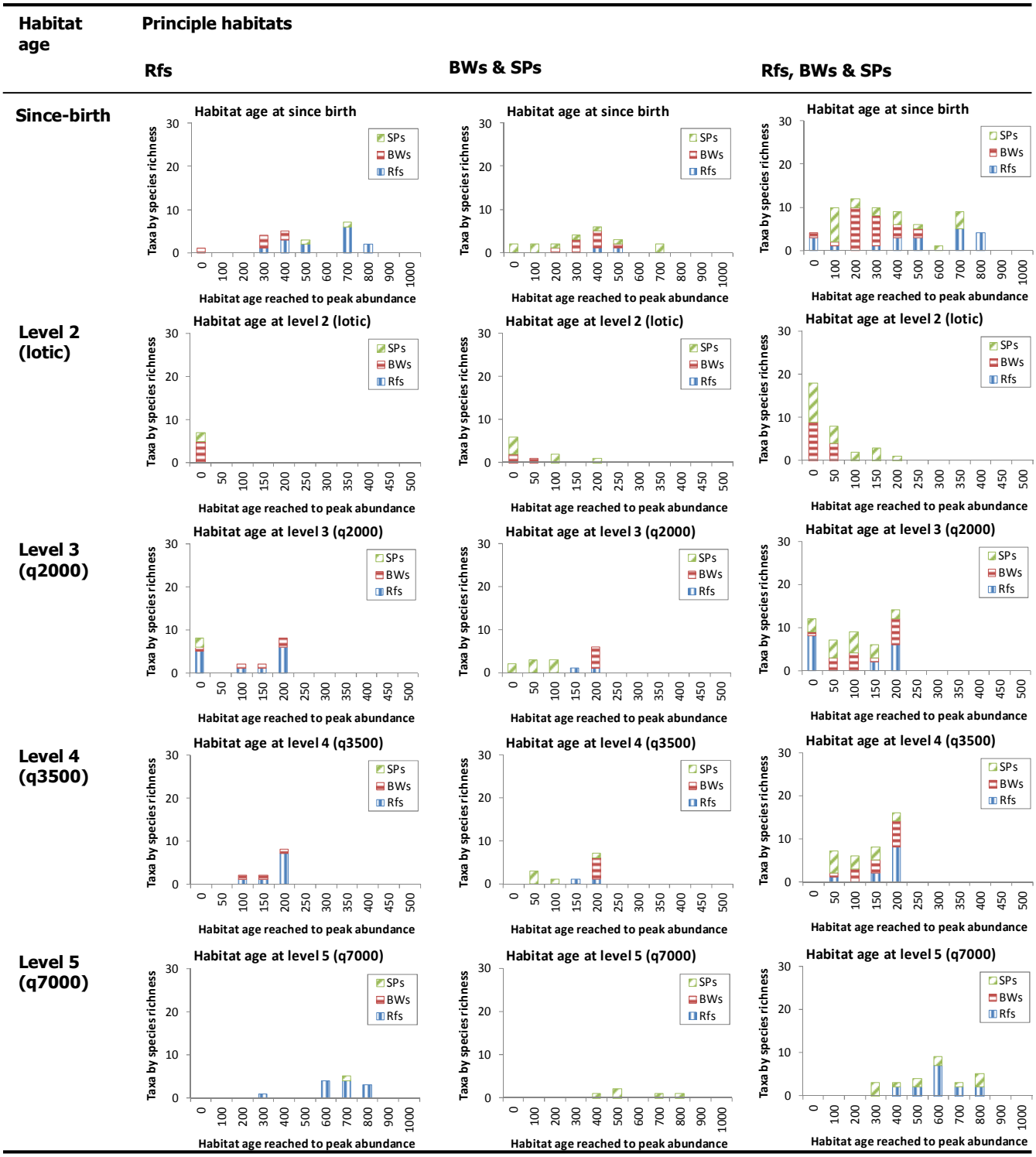


Figure 5.4.2 Habitat age effects on species richness classified by counting the number of species that habitat age reached to peak abundance.

5.4.2 Understanding requirements and roles of various disturbance regimes in sustaining biodiversity

Through the analysis on correspondence between habitat age and species abundance, taxa, and biodiversity, it was revealed that there would be requirements for macro-invertebrates and roles of different disturbances to be played in order to sustain their biodiversity. Table 5.4.3 shows a brief of requirements and roles of various disturbance regimes in sustaining biodiversity.

Table 5.4.3 Requirements and roles of various disturbance regimes in sustaining biodiversity.

Habitat age by disturbance regimes	Riverbed changing patterns just after the disturbances	Biological response according to habitat age
Since-birth	New habitats created as a result of changes. Mostly it occurs by large floods changing channel configuration or middle floods changing the riverbed at a habitat scale.	When habitats have heterogeneous ages, biodiversity is sustained.
Level 2 (lotic system)	BWs and SPs are influenced since lentic systems are changed to lotic systems. Changes at micro habitat scale occur by depositing fine sediment leading to soft riverbed. Rfs are also influenced by eroding the riverbed at a micro habitat scale, leading to hard riverbed.	Biodiversity in BWs and SPs are in some cases influenced by disturbances at level 2. Some of species showed changes like a concave function. Biodiversity in Rfs are not much influenced by the disturbances.
Level 3 (annual flood) and Level 4 (middle flood)	The riverbed changes and some habitats are created and some are eliminated, but others are sustained. Such changes occur at a habitat scale.	Species have various response patterns. Some species eliminated but heterogeneous habitats support sustaining biodiversity. For example, lentic systems of BWs and SPs are used as refugee for species principally living in Rfs.
Level 5 (large flood)	While existing habitats are almost eliminated, new habitats are created as a result of changes in channel configuration.	Species are assumed to respond to as same as habitat age effects at since-birth, since most of habitats are newly distributed as a result of change in channel configuration.

5.4.3 Structure of sustaining biodiversity

Structure of sustaining biodiversity was revealed by tracking shifting habitat history and sampling macro-invertebrates almost every two month. Then question may be raised on which spatial and temporal patterns under flow and sediment regimes caused by disturbances can maximize biodiversity in a reach of the river. Intermediate disturbance hypothesis is one of keys to discussing evaluation of species richness, originally developed for marine intertidal communities (Connel, 1978). This hypothesis explains that disturbance of intermediate intensity and frequency will maximize species richness by reducing density of dominant species and create habitat for more fugitive species in interspecific competition. Townsend and Scarsbrook (1997) tested this hypothesis based on a survey conducted in the Taieri River on the South Islands of New Zealand and obtained results that support the intermediate disturbance hypothesis showing bell-shaped curve and found a positive relationship of species richness with bed disturbance and a refugia. However, the structure of sustaining species richness is considered to be different by several researches. Some of recent hypotheses that have been discussed for decades would be the habitat templet concept, which focuses on the premise that the habitat under spatial and temporal heterogeneity conditions provides the templet on which evolution forges species characteristics (Southwood, 1977 and 1988, Townsend, 1994) and the patch dynamics concept, which explains streams conform reasonably and closely to the patch dynamics explanation of community organization that emphasizes temporal phenomena and focuses on the importance of history and chance (Townsend, 1989). These concepts are different approaches from the context of the intermediate disturbance hypothesis. Ward et al (2002) and Tockner et al (2010) addressed the importance of spatial and temporal heterogeneity and, followed by such a paradigm shift, shifting habitat steady state (Arscott et al. 2002) and habitat age (Tockner et al. 2010) in the Tagliamento River were highlighted. Another study discussed that habitat heterogeneity also plays an important role as a refugia in recovery from disturbances, sustaining biodiversity (Sedell et al, 1990). However, these studies are conceptually well developed, but structure of sustaining biodiversity does not seem to be discussed.

Our study supports numerous efforts made to conceptualize that spatial and temporal heterogeneity maximize biodiversity as previously discussed in Chapter 2 as the habitat diversity hypothesis. Through this study in the Tenryu River, it was revealed that heterogeneous habitats with different habitat ages are of particular importance in sustaining biodiversity under shifting habitat conditions, rather than interspecific competition. The structure of sustaining biodiversity could be analyzed by tracking all the history of shifting habitats and its responses of species to various disturbance regimes. Ecological evaluations should thus integrate structure of sifting habitat history. We also discussed in the previous sections that small, middle and large disturbances play roles respectively to structure species richness, since resilient disturbance regimes for a specific species are not suitable for other species as shown through analyses for 50 selected macro-invertebrates. Even though a review on restoration projects conducted by Palmer et al (2010) showed that most of projects were successful in enhancing physical habitat heterogeneity but only a few studies obtained significant increase in biodiversity, analysis on the structure of sustaining biodiversity addressing spatial and temporal variables will provide useful inputs

for successful restoration. When we plan for ecological restoration, implications to riverbed management could be that targeted species or a group of targeted species need to be specified. If the responses of species in relation to disturbance regimes and habitat age/ longevity (i.e., temporal variables) are understood, flow and sediment regimes and resulting shifting habitat history (i.e., spatial and temporal patterns of habitats) that maximize richness of (a group of) targeted species can be quantitatively evaluated.

For such studies to be successful, study sites should be carefully selected in order to be able to analyze shifting habitat history. The Tenryu River in Japan was an ideal study site to understand shifting habitat history, since various disturbance regimes occur within relatively short periods and resultant riverbed changes and biological responses could be tracked. Figure 5.4.3 shows the coefficient of river regime (a ratio of maximum to minimum discharge) in the world. The coefficient of well-known rivers in Europe and Africa tends to be lower than most of rivers in Japan and U.S.A. The coefficient of the Tenryu River is larger than average, showing that this river is subject to various disturbance regimes.

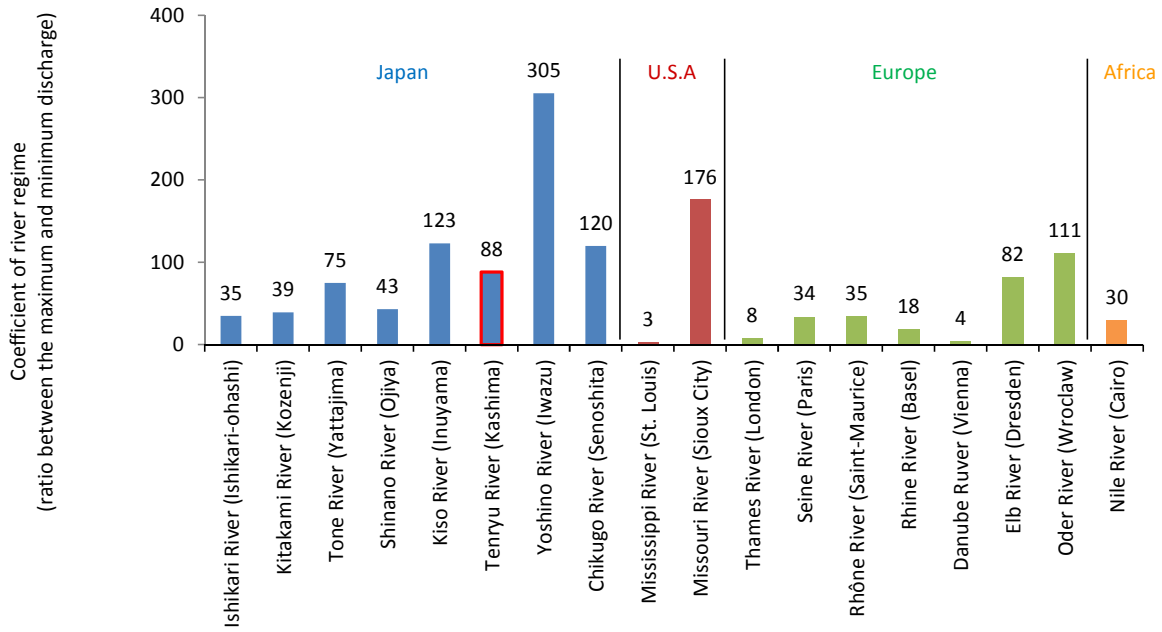


Figure 5.4.3 Coefficient of river regime (maximum discharge/ minimum discharge) in the world. Values of coefficient of river regimes in Japanese rivers were cited by the Ministry of Land, Infrastructure, Transport and Tourism of Japan, based on discharge data between 1993 and 2002. Values on U.S.A, Europe, and Africa were cited by Takahashi (2008). Blanket ( ) in labels of the horizontal axis refer to observation locations.

5.5 Conclusions

We analyzed relations between shifting habitat history and its responses to macro-invertebrates, and showed habitat age effects on biodiversity. We also analyzed how each species contributes to structuring

biodiversity by classifying four types on changing patterns of species abundance. A set of analysis showed the importance of habitats having different ages within a reach in order to sustain biodiversity and how small, middle, and large floods play a role in supporting it. Discussions extended to intermediate disturbance hypothesis, which was explained by inter-species competition. Our results however showed habitat diversity with different ages play a key role and not only middle disturbances but also small and large disturbances also determine responses of species in sustaining biodiversity. This study also showed effectiveness in applying to interval-recording cameras for analyzing habitat age effects on macro-invertebrates under shifting habitat conditions.

5.6 References

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6 Application to riverbed management

6.1 Introduction and objectives

Results obtained through previous chapters showed the importance of addressing spatiotemporal patterns of habitats to explain: (i) how spawning redds for Ayu (*Plecoglossus altivelis altivelis*) is developed by a disturbance by a middle flood and how functions of developed suitable redds are deteriorated, indicating importance of timing of the disturbance; and (ii) how macro-invertebrates sustain biodiversity in a reach under various disturbance regimes and how heterogeneous habitats with different habitat ages are important to sustain biodiversity. Thus, previous chapters identified roles of disturbance regimes including middle and larger floods, which have been treated as targets from flood management perspectives. In order to apply for ecological evaluations to riverbed management at a practical level, there is a need to analyze riverbed changes under sifting habitat history and impacts of riverbed changes on flood management. As discussed in Chapter 2, a review on ecological restorations projects revealed the importance of restoring fluvial systems that are consisted of flow and sediment regimes. As such, ecological evaluations of shifting habitat history should evaluate riverbed changes such as erosion and deposition processes, which are suitable for sustaining targeted species or biodiversity. From flood management perspectives, it is also important that fluvial systems be restored that balance flow and sediment regimes, since extreme processes of longitudinal and lateral degradation or aggradation could be avoided (WMO, 2006). Therefore, objectives of this chapter are to discuss approaches and methodologies on ecological evaluations of shifting habitat history in order to apply to riverbed management at a practical level.

6.2 Methods

6.2.1 A review on current status of riverbed management methodologies

A review was conducted to understand current status of riverbed management methodologies in ecological restorations at various scales from a river basin scale to a reach one. There are, among others, four types of management methodologies. The first type is management at mountainous and sediment yield area, which includes forest management such as forestation and deforestation and management of sediment production area such as construction and removal of check dams. The second type is management of flow and sediment regimes at river-basin and segment scales, which includes reservoir operation for managed flows and sediment bypassing allowing for sediment to be transported from up to downstream. The third type is riverbed management at a reach scale, which includes sediment replenishment and channel modifications such as channel widening and meandering. The forth type is riverbed management at a habitat local scale, which includes direct creation of a specific habitat such as side pools. This chapter discusses riverbed management at a river-basin to reach scale, which can significantly influence fluvial systems under certain flow and sediment regimes. The mountainous and sediment yield area are also important, but are excluded for simplification, since discussions are likely to go far broad to highlight shifting habitat history for riverbed management. The habitat local scale management is also excluded, since it is neither effective nor sustainable as a management methodology

under shifting habitat conditions.

6.2.2 Development of quasi-three-dimensional flow and bed variation model for the analysis

In order to show approaches and methodologies on ecological evaluations, it is important to show case studies that support the discussions to be applied to riverbed management at the practical level. Therefore, a quasi-three-dimensional flow and bed variation model originally developed by Okamura et al (2010) and Okamura and Fukuoka (2012) was used for the analysis and developed for the Tenryu River under conditions depicted in Table 6.2.1. This model was verified by the following three parameters: (i) longitudinal profiles of water stages at the Sept. 2011 peak flood discharge (7520 m3/s at Kashima); (ii) surface water distributions under low flow conditions in 2013 (100 m3/s at Kashima); and (iii) deposition and erosion distributions of the riverbed by a Sept. 2013 flood hydrograph in comparison with orthogonized photo data developed, using the photogrammetric method (Hyodo et al, 2014a, and also see Chapter 3). Geographical features of the quasi-three-dimensional flow and bed variation model are shown in Table 6.2.1. This geographical mesh data was developed by results of a cross section survey conducted in February 2013 by Ministry of Land, Infrastructure, Transport and Tourism, Japan.

Table 6.2.1 Computational conditions of quasi-three-dimensional flow and bed variation model.

Item	Condition
Period	15 to 19 September 2013 (of which peak discharge is 4900 m3/s)
Length	7 km, 13.0 to 20.0 k-points
Initial riverbed data	February 2013 (Cross section surveys conducted)
Geographical mesh data	Longitudinal: 20 m/ mesh Lateral (channel): approximately 15 m /mesh Lateral (left and right high area): approximately 40 m /mesh
Turbulence model	Mixing length model
Sediment	Bed load by Ashida & Michiue equations Suspended load by Kishi & Itakura equations
Initial grains size distribution	survey data in 2007
Upstream boundary	Flows: hourly discharge data more than 500m^3/s Sediment: none
Downstream boundary (i.e., water stage)	Relational expressions between water stage and discharge estimated by quasi 2D non-uniform flow model

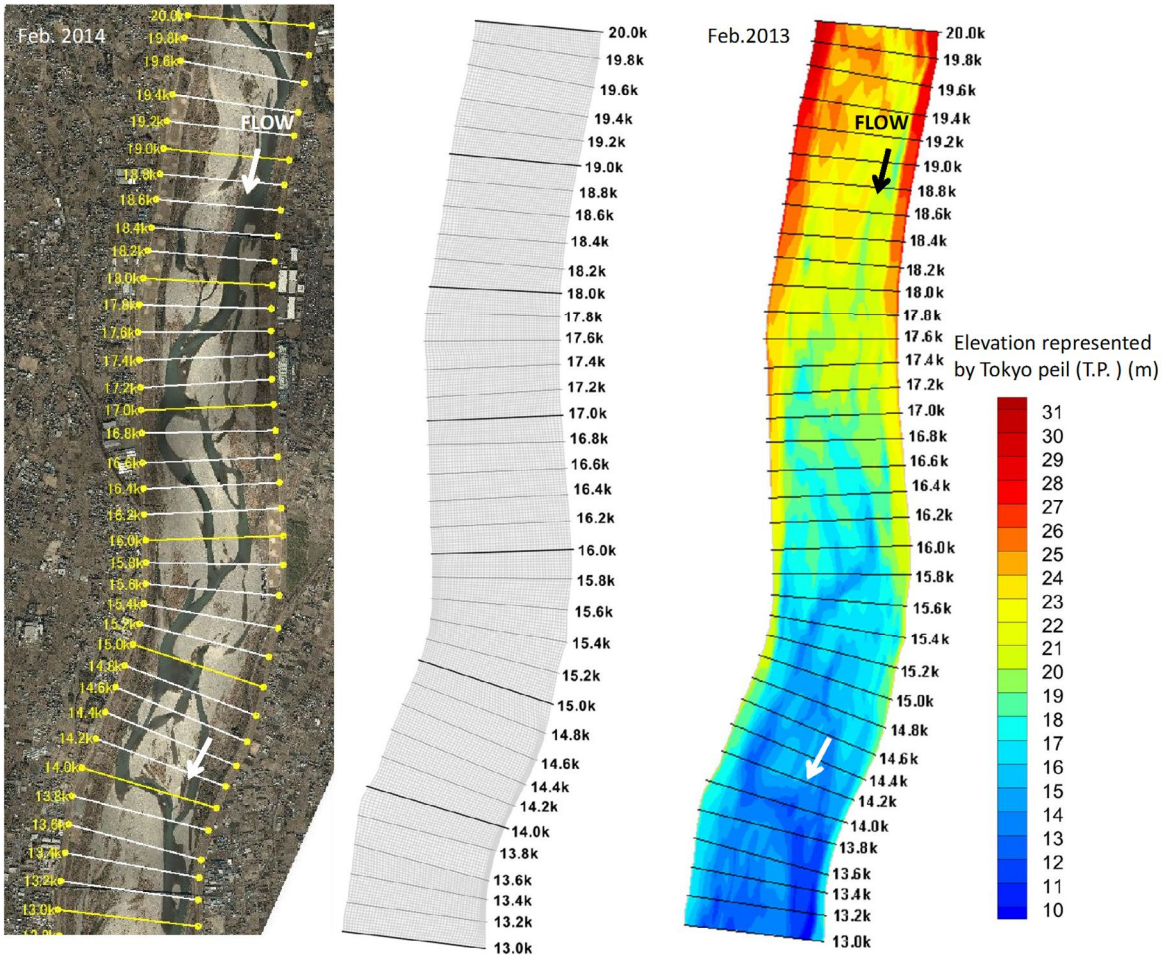


Figure 6.2.1 Geographical features of the quasi-three-dimensional flow and bed variation model. This geographical mesh data was developed by results of a cross section survey conducted in February 2013.

Grain size distributions of survey results from 13 k-point to 19 k-point are shown in Figure 6.2.2. These surveys were conducted by Ministry of Land, Infrastructure, Transport and Tourism, Japan, and they sampled riverbed sediment of surface and ground layers at the middle of a channel and right and left channels adjacent to natural banks. Since the distribution variabilities are not relevant over all the survey results, average grain size distributions of surface and ground layers were used as initial conditions of the riverbed characteristics.

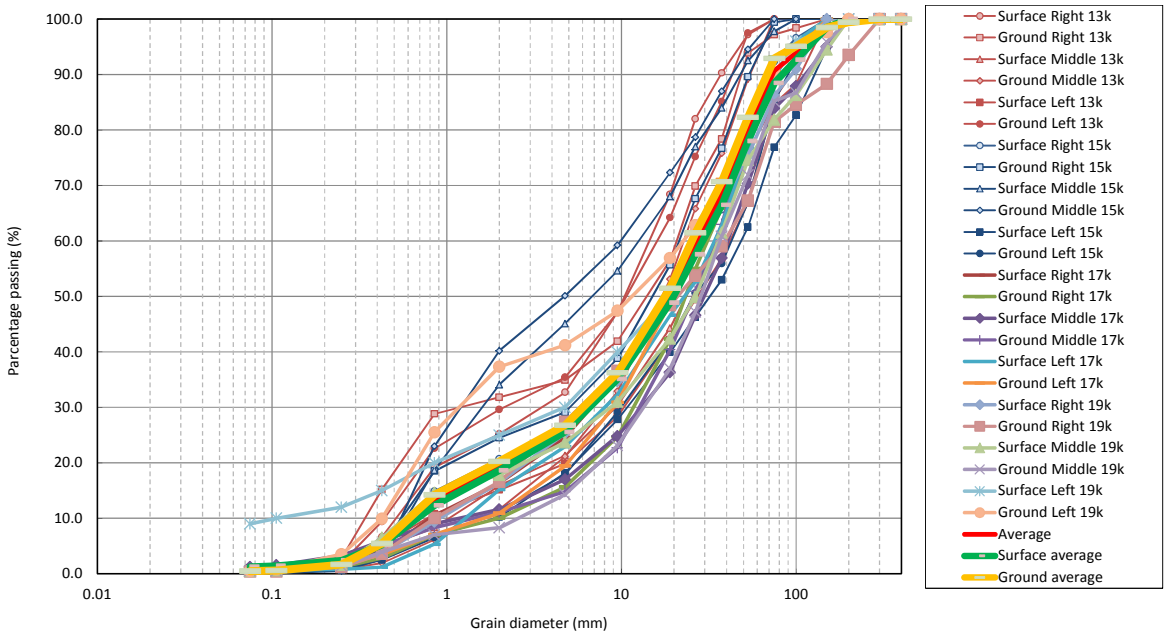


Figure 6.2.2 Grain size distributions used for the model development

Verification results are shown in Figure 6.2.3, Figure 6.2.4, and Figure 6.2.5. (i) Longitudinal profiles of water stages at the Sept. 2011 flood peak (Figure 6.2.3); (ii) surface water distributions under low flow conditions in 2013 (Figure 6.2.4); and (iii) deposition and erosion distributions of the riverbed by a Sept. 2013 flood hydrograph in comparison with orthogonized photo data (Figure 6.2.5) showed good correspondence between observed verification data and simulation results.

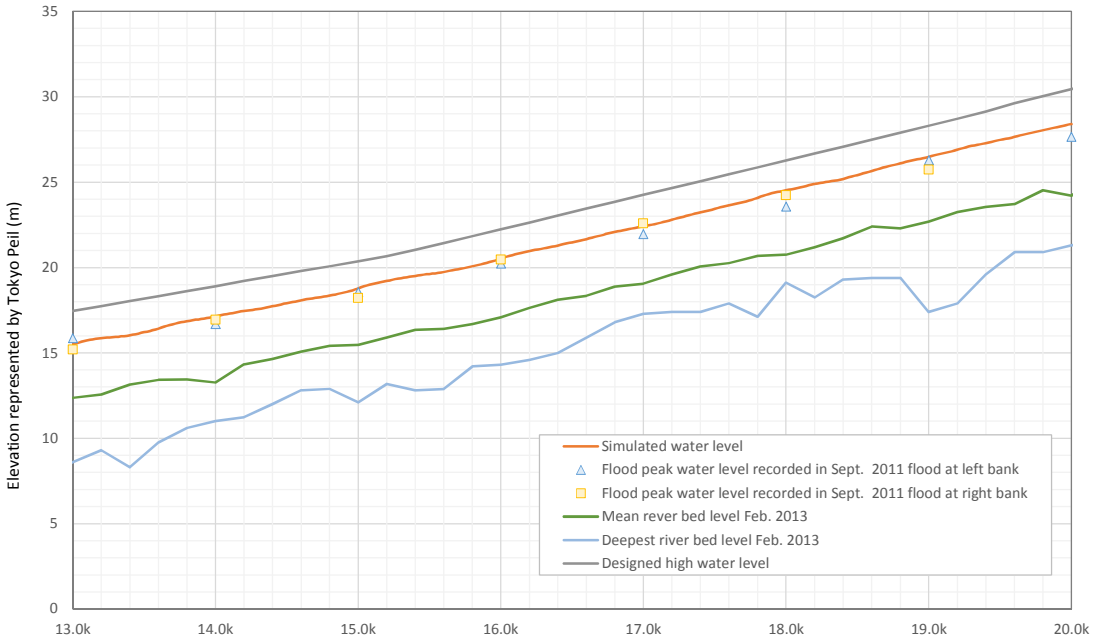


Figure 6.2.3 Verification of the developed model by observed and calculated longitudinal water stages at a Sept. 2011 flood (7520 m3/s)

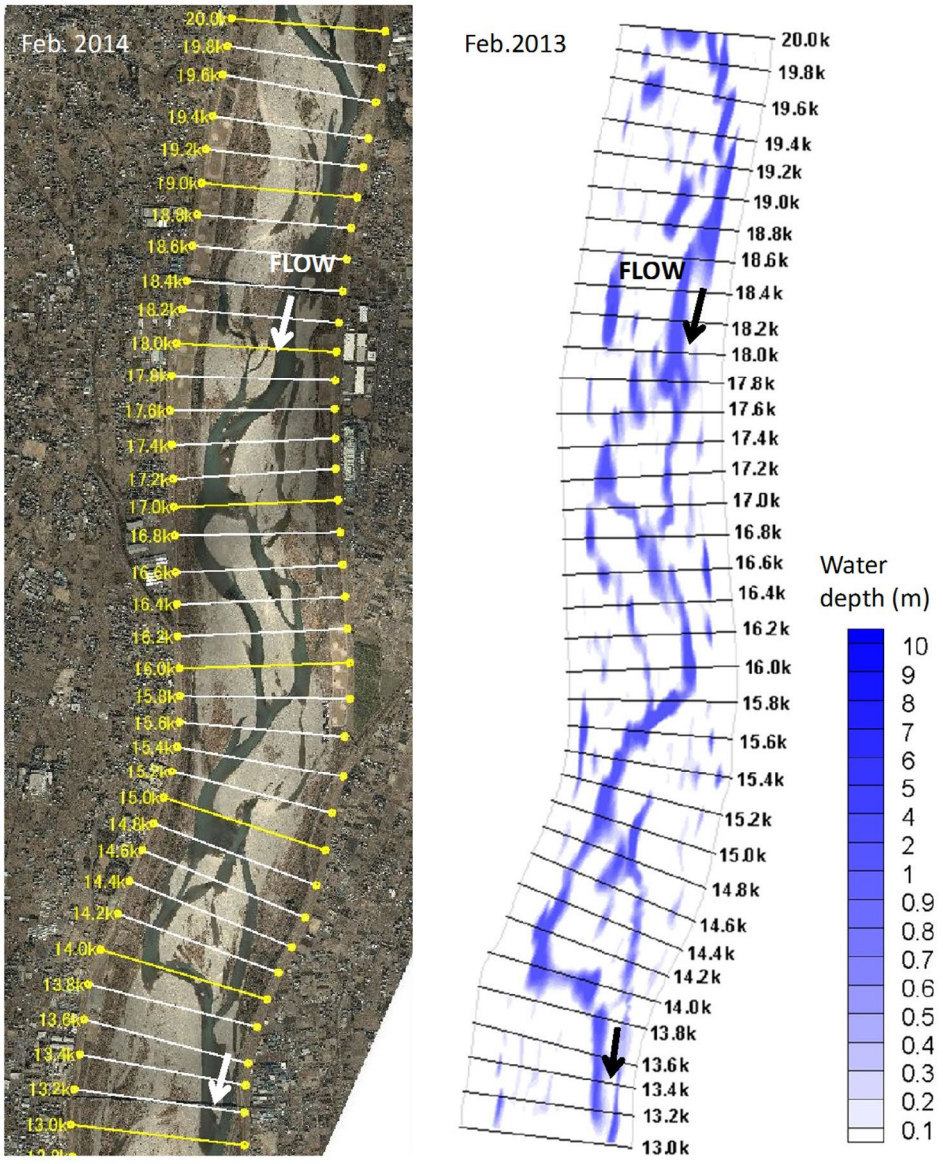


Figure 6.2.4 Verification of the model by water depth distributions at low flow 100m3/s at Kashima

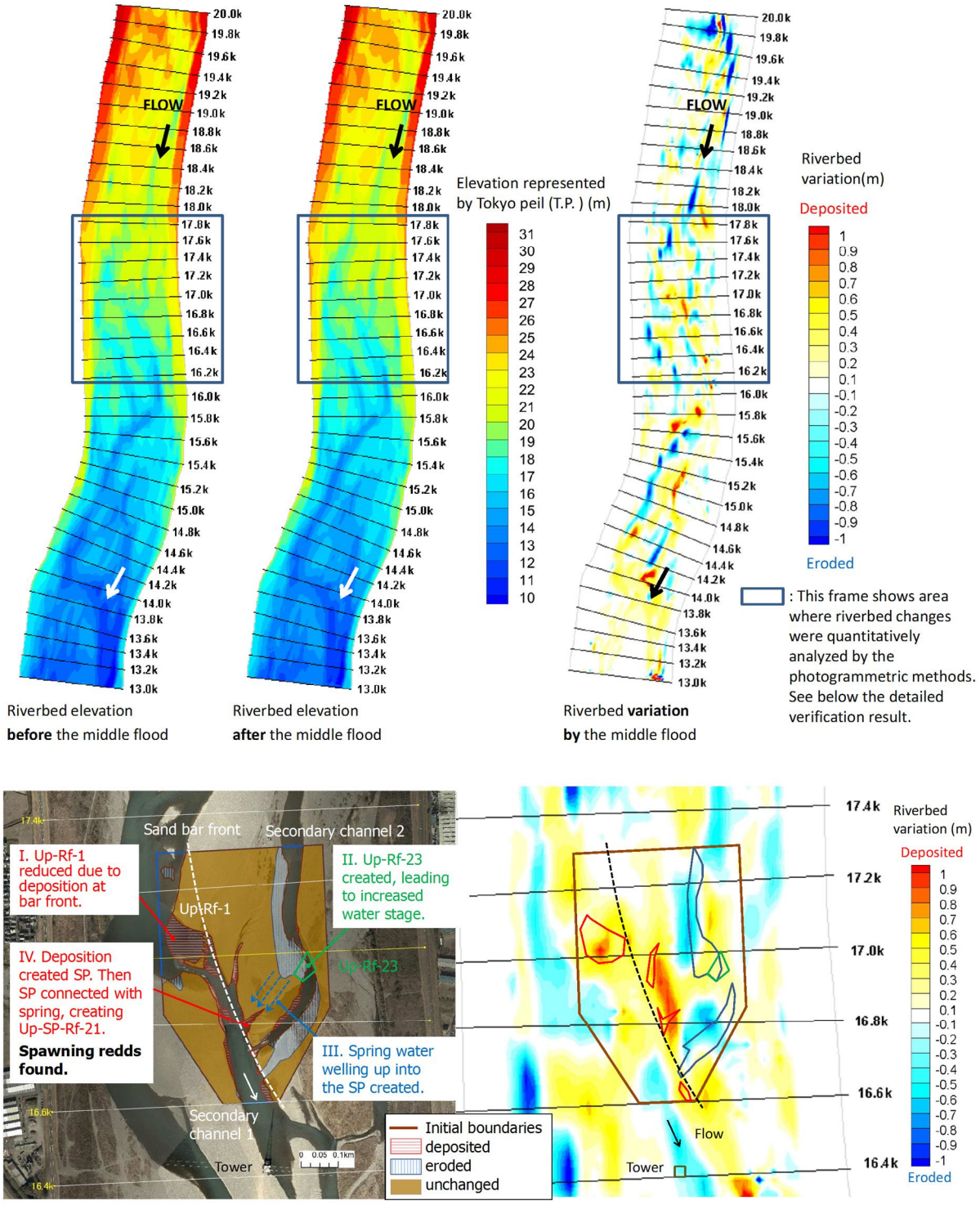


Figure 6.2.5 Verification of the model by surface distributions of deposit and erosion by a middle flood in September 2013.

Figure 6.2.6 shows simulation results of riverbed variations by the middle flood in September 2013 and resultant distributions of the riverbed softness (in November 2013). Habitats of soft riverbed obtained by the middle flood such as U-SP-Rf-21, D-SP-Rf-22, U-SP-1, and U-BW-22 were particularly deposited according to simulation results. On one hand, habitats of hard riverbed such as U-Rf-1, U-Rf-2, U-Rf-21, and U-Rf-22 were not apparently deposited according to simulation results. This result shows good correspondence between simulated results of riverbed variations and survey results of riverbed softness.

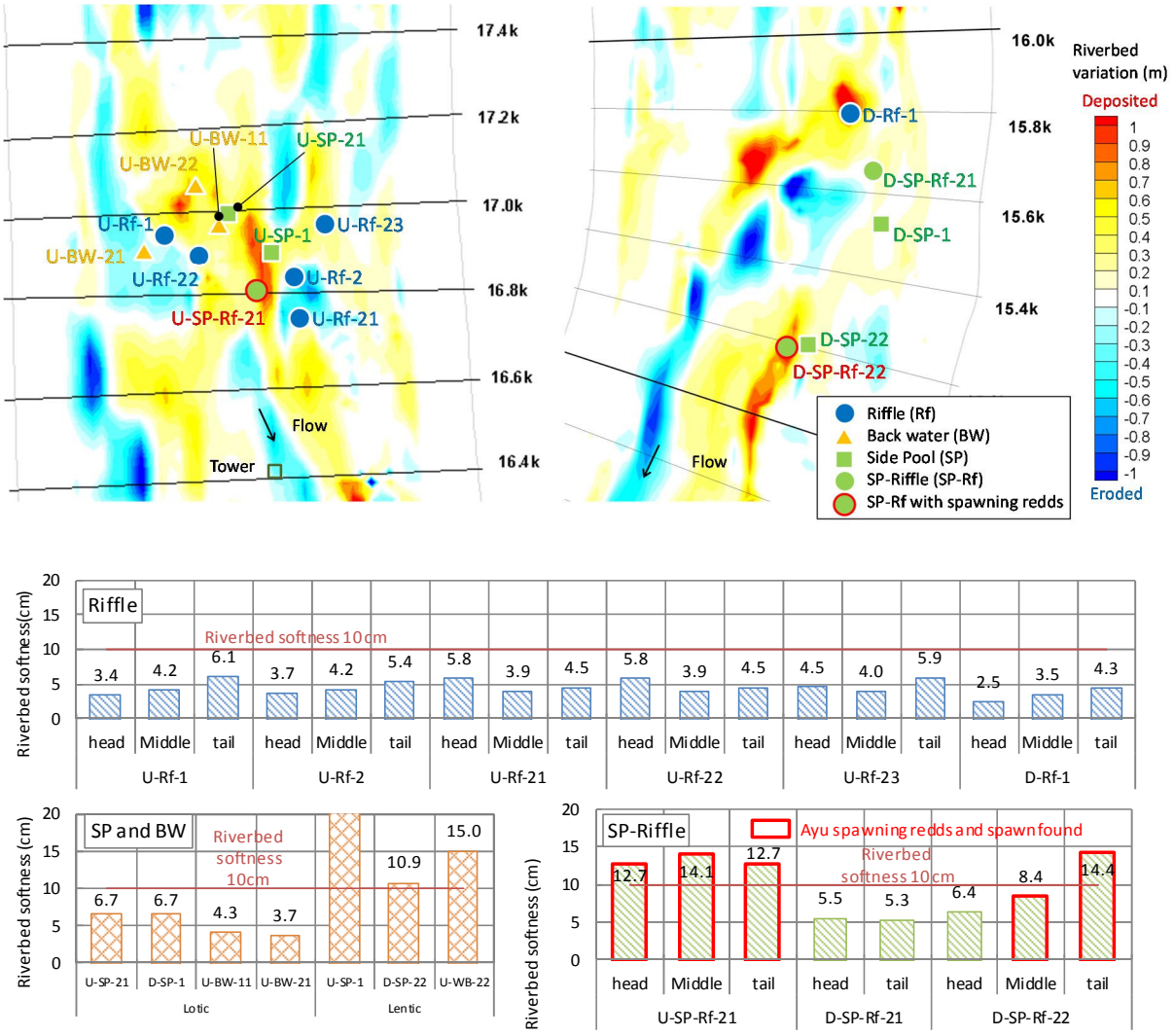


Figure 6.2.6 Comparison between riverbed variations caused by the middle flood in September 2013 and resultant distributions of the riverbed softness (in November 2013). The results of the simulation were extracted from Figure 4.4.6 and riverbed softness were extracted from Figure 4.3.3.

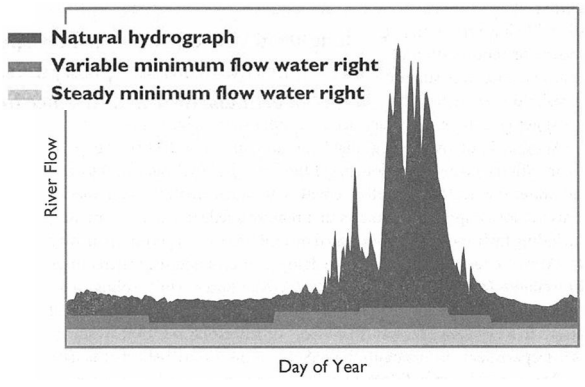
6.3 Results and discussions

6.3.1 Current status of riverbed management methodology

1) River-basin and segment scale options

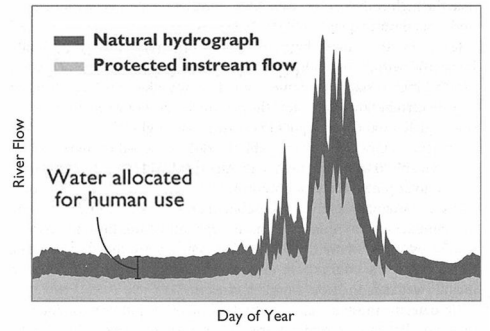
i) Flow regimes (for river-basin and segment scale options)

Reservoir operation for managed flows is considered one of useful methodologies for restoring flow regimes, which have the potential to transport sediment downstream by inducing higher share stress on the riverbed. According to the World Meteorological Organization (2011), an objective of managed flows should be: "To mimic the natural flow conditions, as far as possible, in order to minimize the adverse impacts on the livelihoods of people through ecosystem services". The planning of managed flows leads to reallocation of certain rights for water use by different sectors or the sections of the society. Establishment of such rights is generally a result of negotiations and discussions and may be based on the principles of equity of development. However, only a few cases exist where water was allocated exclusively for meeting the needs of the river environment, even though in several countries by-laws exist that guarantee minimum flows at the outlet of reservoirs to maintain an ecologically "healthy" river. The aim of managed flows is to find a compromise in the water allocation between managed flows and retaining sufficient water within the reservoir to support the economic activities (e.g., flood moderation, water supply, and hydropower) for which the reservoirs were originally built or it is planned to be built for. The hydrographs below show how conventional instream flow water right (an example shown in Figure 6.3.1 can be reallocated based on a managed flow concept, i.e., mimic of natural flow regimes to the extent possible (Figure 6.3.2 and Figure 6.3.3). As mentioned before, it has to be clear that there is no single solution determining such compromised hydrographs. These are to be determined in given conditions of a river basin and based on transparent decision-making processes involving various stakeholders. The Trinity River in U.S.A. determined five water year types of flows addressing a life cycle of salmon, steelhead, and chinook smolts (McBain & Trush, Inc., 2000) as shown in Figure 6.3.4.



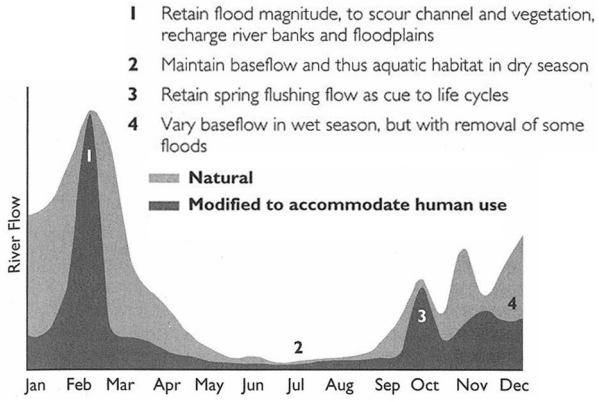
A conventional instream flow right defines a fixed amount of water to be left in a river. Such rights are usually expressed as a single minimum flow level, sometimes varying by month, to be protected. Because the remaining water is available for other uses, this approach provides little protection for the natural flow regime.

Figure 6.3.1 Conventional instream flow water right, U.S.A. (Postel and Richter, 2003, and Silk et al, 2000).



In the upside-down approach for protecting instream flows, the allowable human use is a fixed constant. On any given day, this amount is shaved from natural river flow. By limiting withdrawals to a fixed level, much of the river's flow variability is protected.

Figure 6.3.2 Upside-down instream flow water right, U.S.A. (Postel and Richter, 2003, and Silk et al, 2000).



At a 1993 workshop in South Africa, scientists drew natural hydrographs for selected rivers, containing only half as much water to show how they would accommodate human uses while keeping the river as healthy as possible. Based on commonalities in their recommendations, they summarized some general principles for protecting flows adequate to maintain river health.

Figure 6.3.3 Natural and modified hydrographs, South Africa (Postel and Richter, 2003 and Tharme and Jackie, 1998).

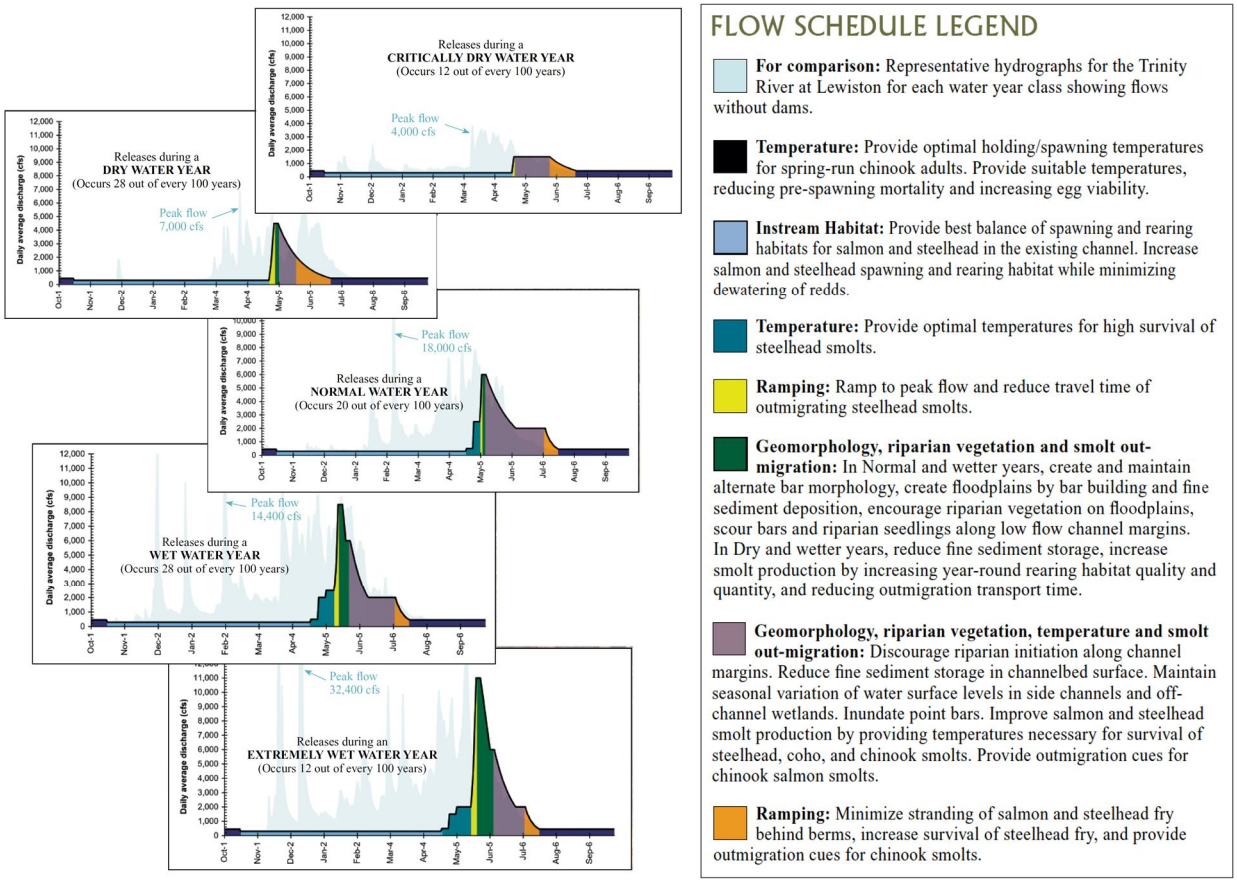


Figure 6.3.4 Flow schedules of five water year types in intra-annual or "within-year" flow variability (McBain & Trush, Inc. 2000). Note: 1 Cubic Foot = 0.0283168466 Cubic Meters.

ii) Sediment regimes (for river-basin and segment scale options)

Methodologies for riverbed management addressing sediment regimes at river-basin and segment scales could be considered two types: one is how to bring back sediment, which satisfies ecological requirements, into the downstream riverbed in the case of lack of sediment; and the other is how to reduce sediment supplied to the downstream riverbed causing intense aggradation in the case of excessive sediment. This section discusses the former condition (i.e., lack of sediment downstream), requiring deposition within channels.

Switzerland and Japan are countries adopting sediment bypass tunnels to transport sediment to downstream reaches of rivers (Vischer et al, 1997, Auel et al, 2010, and Kondolf, 2013) as shown in Table 6.3.1. In Japan, three are in operation and two under construction, and in Switzerland, six are in operation. For example, the Miwa dam in the Mibu River of the Tenryu River-basin was built in 1959 (see Figure 6.3.5). In order to address extensive sediment deposition and expensive dredging measures in the dam reservoir, a sediment bypass tunnel and diversion weir at the upstream end of the reservoir were constructed in 2005 (Sumi et al, 2012).

Table 6.3.1 Characteristics of successful sediment bypass tunnels in Japan and Switzerland. (Kondolf et al, 2014)

Name of Dam	Country	Date Constr	Tunnel Shape	Tunnel Cross Section (BxH) (m)	Tunnel Length (m)	General Slope (%)	Design Q ($m^3 s^{-1}$)	Design Velocity (ms^{-1})	Annual Operation Frequency (days/a)
Nunobiki	JP	1908	Archway	2.9 × 2.9	258	1.3	39	7	—
Asahi	JP	1998	Archway	3.8 × 3.8	2350	2.9	140	12	13
Miwa	JP	2004	Horseshoe	2r = 7.8	4300	1	300	10	2–3
Matsukawa	JP	2015	Archway	5.2 × 5.2	1417	4	200	15	—
Koshibu	JP	2016	Horseshoe	2r = 7.9	3982	2	370	9	—
Egshi	CH	1976	Circular	R = 2.8	360	2.6	74	10	10
Palagnedra	CH	1974	Circular	2r = 6.2	1800	2	110	13	2–5
Pffaffensprung	CH	1922	Horseshoe	A = 21 m^2	280	3	220	14	ca. 200
Rempen	CH	1983	Horseshoe	3.5 × 3.3	450	4	80	12	1–5
Runcahez	CH	1961	Archway	3.8 × 4.5	572	1.4	110	9	4
Solis	CH	2012	Archway	4.4 × 4.68	968	1.8	170	11	1–10

Notes: CH = Switzerland, JP = Japan, Q = discharge.

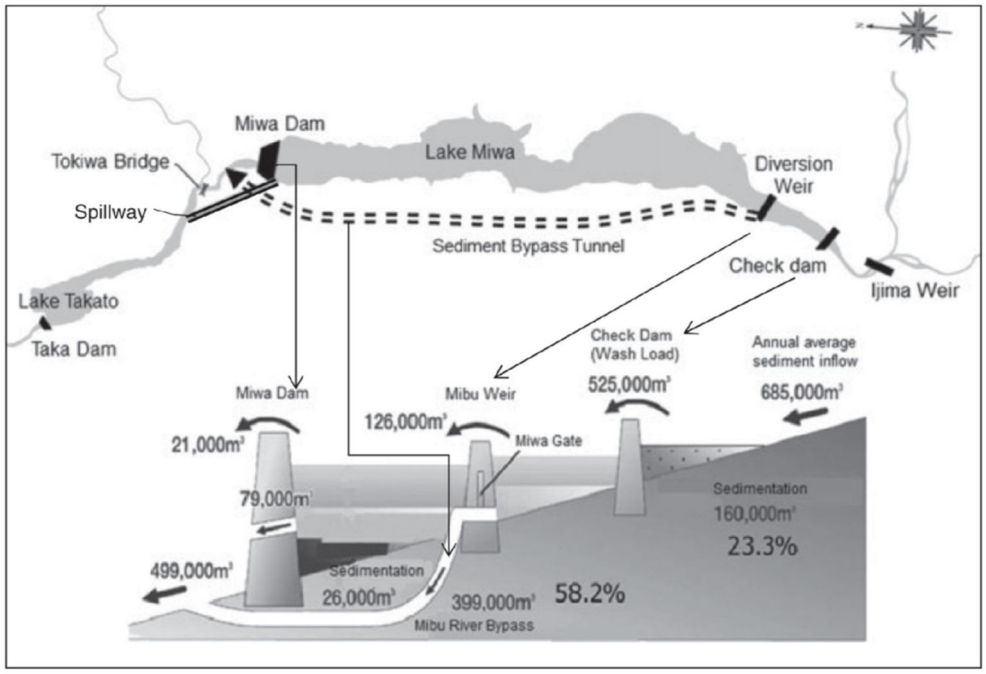
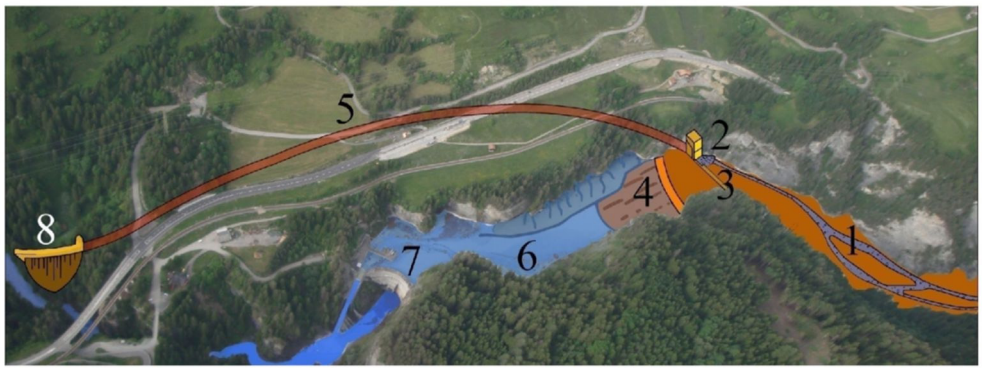


Figure 6.3.5 Sediment bypass system for the Miwa dam, Mibu River, Japan. A check dam traps coarse sediment, and a diversion weir diverts flows with high suspended sediment concentrations into a bypass tunnel. (Kondolf et al, 2014)

A sediment bypass tunnel was constructed in 2012 at the Solis dam in the Albula River in Switzerland (see Figure 6.3.6). Its operation procedure is: (i) drawdown to minimum operating level prior to flood;

(ii) head of reservoir moves downstream; (iii) delta subjected to free-surface flow; (iv) bedload transported over delta to foreset slope (tunnel intake); (v) bedload discharged through bypass tunnel to tailwater enables sediment passability for bed and suspended loads similar to pre-dam conditions (Robert, 2011).



1. Albula river on delta deposits
2. Intake structure
3. Guiding structure
4. Foreset talus
5. Bypass tunnel
6. Reservoir at minimum operation level
7. Dam
8. Outlet structure



A view from the top of the intake structure [2] looking the upstream reservoir



A view from outlet structure [8] to the downstream reach



A view of the outlet structure [8] from the downstream reach

Figure 6.3.6 Sediment bypass system for the Solis dam, Albula River, Switzerland. (Robert, 2011) Bottom photos were taken by the author in August 2014 looking at intake and outlet structures.

2) Reach-scale options

Summary of Chapter 2 is depicted here in this section. All the seven case studies on ecological restoration in U.S.A., Europe, and Japan have been addressing restoration of some parts of spatial habitat structure, depending on their project scale and goals such as: gravel banks (e.g., Drau River, Chikuma River, Thur River, Tama River, and Mana River) and riffles and pools (e.g., Mana River and Trinity River). However, approaches to achieving their goals are different. While some projects addressed only modifying river shapes locally (e.g., Thur River, Drau River, Waar River, and Chikuma River), but the other projects addressed operation of flow or morphological regimes in an integrated manner (e.g., Trinity River, Tama River and Mana River). Only two case studies of the Trinity River and Mana River integrated restoration of both flow and sediment regimes into their restoration projects (see Table 2.2.1). From a perspective of temporal patterns, little case studies addressed temporal change of habitat structure, except for some local deposition and erosion processes. Through the review, we found that flow and

morphological regimes, which can be considered as explanatory variables for spatiotemporal patterns of habitat structure, have been addressed by only a few case studies. In the review however, it should be noted that: case studies are in the ongoing processes of determining desirable spatiotemporal patterns of river corridor habitat and how they are evaluated; and that options for ecological restoration should be adopted based on appropriate combination of flow and morphological regimes (Kantoush et al, 2011 and Sumi and Kantoush, 2012). Importantly, for some case studies, flood management objectives are at center of their restoration projects (e.g., Drau River and Chikuma River) based on a concept that restoring some part of fluvial processes can contribute to, for example, lowering of water stages during flooding, instead of constraining flood water in channelized embankments.

A schematic diagram on options for riverbed management at basin/ segment and reach scales is depicted in Figure 6.3.7. For basin/ segment scale options, flow and sediment discharge into and/ or from reservoirs can be managed, which are likely to influence flow and sediment regimes further downstream such as alluvial river channel, river estuary, and coastal zone depending on characteristics of flows and sediment (volume and particle size) and downstream geomorphology. For reach scale options, flow and sediment discharge around alluvial river channels and the resultant riverbed change can be managed but they may not be influential to the further downstream geomorphology.

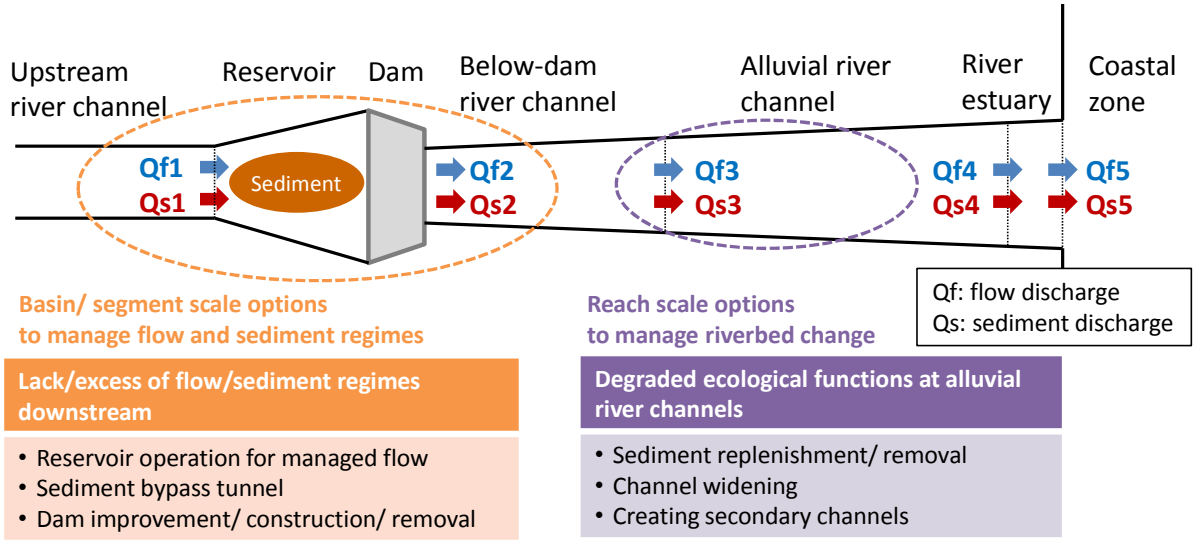


Figure 6.3.7 A schematic diagram on options for riverbed management at basin/ segment and reach scales.

6.3.2 Approaches to and procedures for riverbed management

In this section, the following practical approaches and procedures are discussed, introducing some case studies to support the discussion to be applied at the practical level.

Procedure 1) Understanding historical riverbed change and associated ecological responses

Procedure 2) Setting target vectors (goals)

Procedure 3) Collecting data on shifting habitat history

Procedure 4) Evaluating ecological functions explained by physical parameters

Procedure 5) Identifying potential locations for restoration

Procedure 6) Evaluating various options for decision-making processes

Procedure 7) Establishing schemes to monitor and evaluate selected options

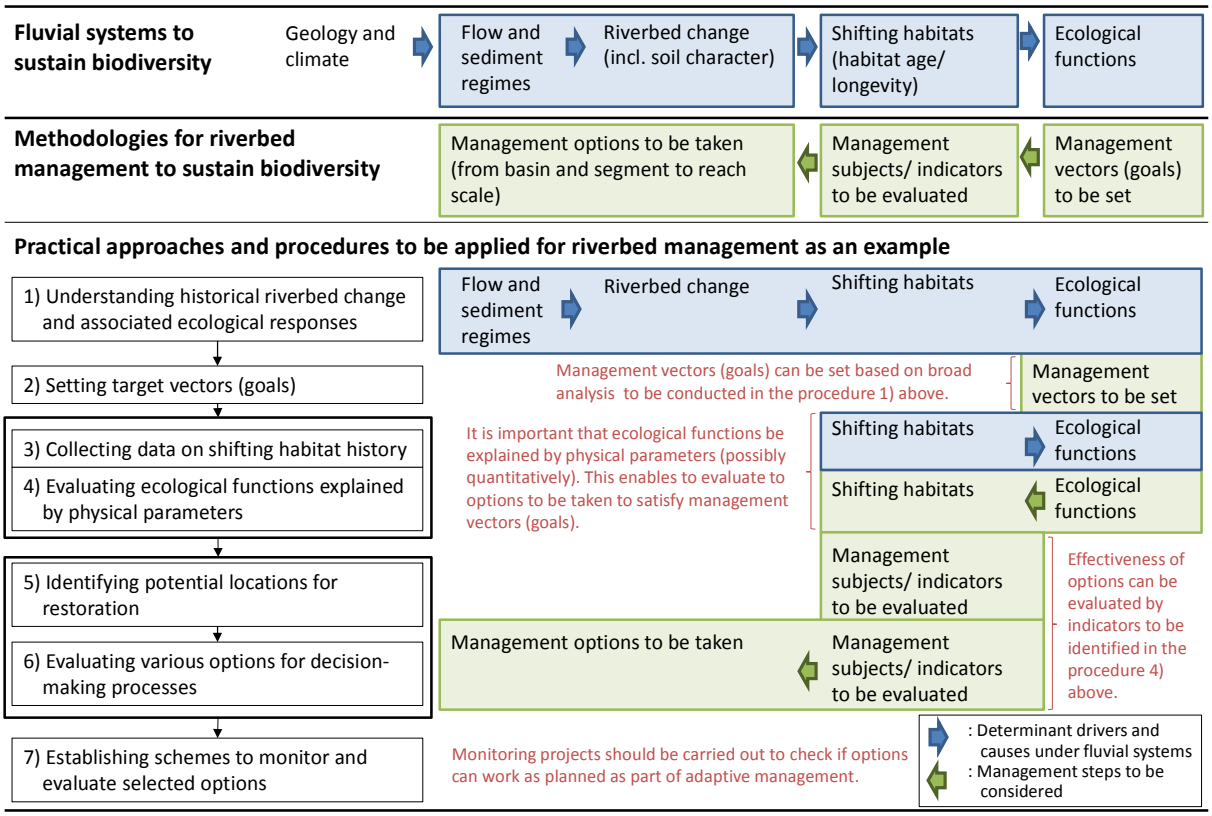


Figure 6.3.8 A schematic diagram on fluvial systems to sustain biodiversity and methodologies for riverbed management.

Figure 6.3.8 shows a schematic diagram on fluvial systems to sustain biodiversity and methodologies for riverbed management. Methodologies for restoring fluvial systems to sustain biodiversity should have reverse steps against determinant drivers and causes of fluvial systems to work. In brief, firstly management vectors (goals) can be set in the procedure 2), based on broad analysis to be conducted in the procedure 1). Secondly, analyses under the procedure 3) and 4) are of particular importance and would be that ecological functions should be explained by physical parameters (possibly quantitatively).

This enables to evaluate options to be taken to satisfy management vectors (goals). Thirdly, in the procedure 5) and 6), effectiveness of options can be evaluated by indicators to be identified in the procedure 4). Finally, monitoring projects should be carried out to check if options can work as planned as part of adaptive management in the procedure 7).

1) Understanding historical riverbed change and associated ecological responses

It is important to collect long term geographical data such as photo data (preferable of aerial photo data) and cross section survey data and hydrological data such as discharge and water level hydrograph, and data on human interventions on fluvial systems to understand how the riverbed and habitats change under disturbance regimes. Ecological data on targeted species or biodiversity should also be collected to analyze responses of species to disturbances. In case of spawning redds for Ayufish (*Plecoglossus altivelis altivelis*), we identified that locations of spawning redds used to be channels and were developed as a result of deposition along a sandbar front under disturbances due to a middle flood in the Tenryu River. Aerial photo data used to analyze this process is depicted in Figure 6.3.9.

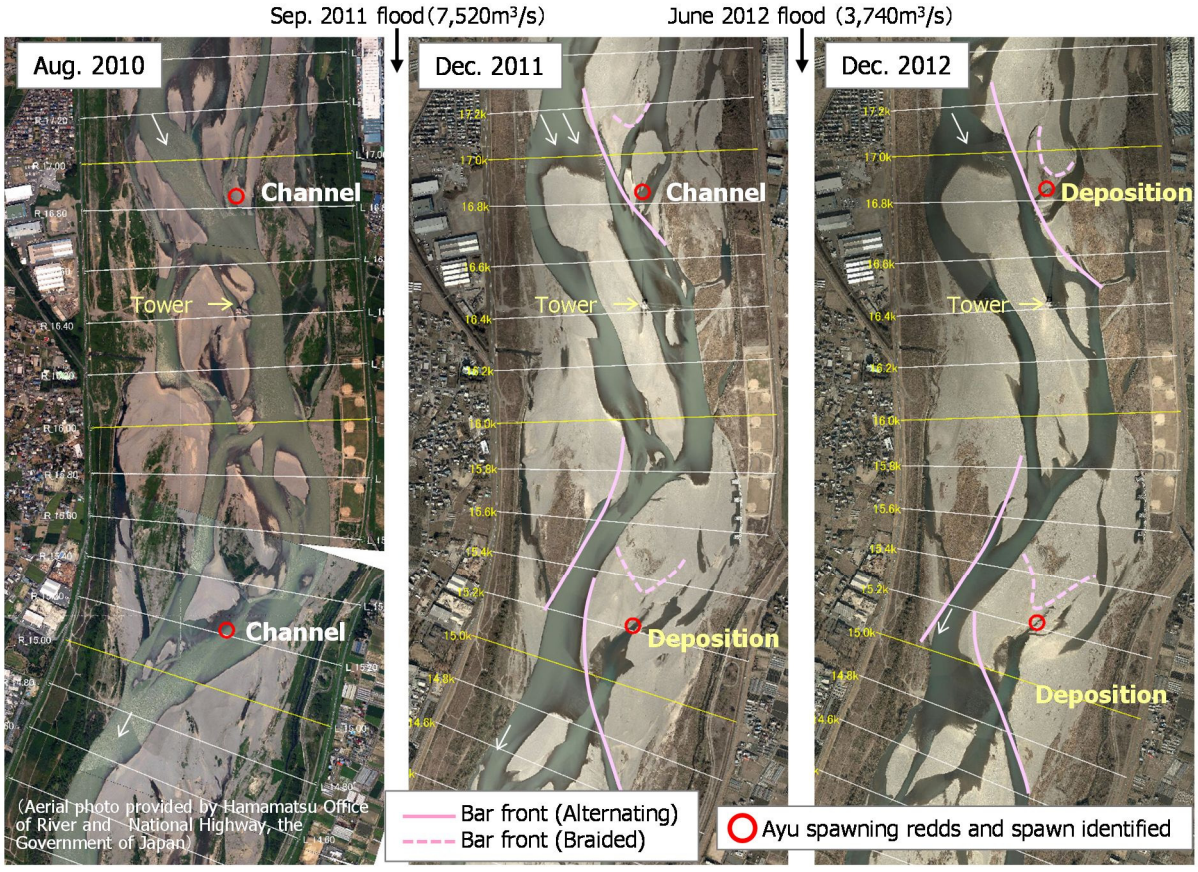


Figure 6.3.9 Riverbed changing patterns at a reach scale by aerial photos from 2010 to 2012 in relation to configuration of sandbar front and spawning redds (Extracted from previous Figure 4.3.7).

2) Setting target vectors (goals)

Based on a result of analysis on pristine conditions of shifting habitat history, target vectors (goals) and its indicators should be set. Vectors can be restoring sediment regimes, for example by increasing or reducing sediment with which grain size distributions, and restoring flow regimes, for example by increasing or decreasing flood peak flows, by increasing or reducing flood frequency, etc. Indicators can be qualitative rather than quantitative since, collected data are not sufficient for the quantitative analysis to be conducted. Quantitative indicators can be determined in the following process of 3).

3) Collecting data on shifting habitat history

In order to analyze recent riverbed changes and shifting habitats and its responses of targeted species or biodiversity, interval-recording cameras are of particular importance. Figure 6.3.10 shows an example of analyzing riverbed changing patterns due to a middle flood, and processes of developing spawning redds for Ayufish, adopting photogrammetric method based on photo data taken by interval-recording cameras. Data on spawning redds could be obtained through field surveys. Through these analyses, riverbed changing data and ecological data could be integrated, thus enabling to determine physical conditions and quantitative indicators required for assessing target vectors or goals.

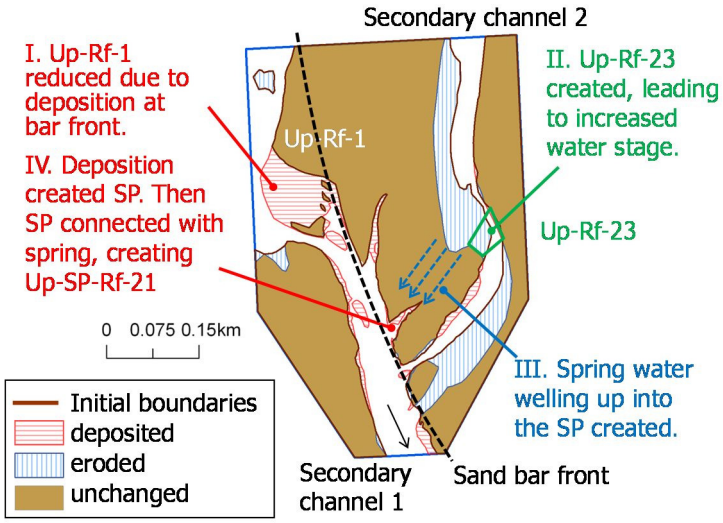


Figure 6.3.10 Riverbed change by erosion and deposition after middle flood in September 2013 with the discharge of 4,900m3/s. The photogrammetric method was used for developing 2 D orthogonal data (Extracted from Figure 4.3.5).

4) Evaluating ecological functions explained by physical parameters

Based on collected data on spatiotemporal changing patterns of habitats and ecology, as already discussed in the previous 3), physical conditions explaining optimum ecological status could be determined for evaluating options for ecological restorations. In case of the spawning redds for Ayufish

in the Tenryu River, physical conditions for the optimum ecological status could be: (i) locations along a sandbar front where sediment deposition could be expected by a milled flood, (ii) high water quality with DO, more than approximately 7.0 mg/l, (iii) spring waters welling up could be expected, (iv) loose riverbed represented by the riverbed softness higher than approximately 10 cm measured by Shino, and (v) riverbed material could be small gravels explained by representative diameters (by 60 %) are smaller than approximately 50cm not including fine sediment, according to the previous study (Hyodo et al, 2014b and also see Chapter 4).

5) Identifying potential locations for restoration

Potential locations for restoration differ according to expected levels of restoration vectors or goals. Therefor it is important to determine which spatial scales should be adopted to identify potential locations and priority setting for restoration. Figure 6.3.11 shows a hierarchical organization of a stream system and its habitat system developed by Frissel et al (1986). Scales of this hierarchal organization require supplementary notes when discussing based on this figure. For example, catchment area of the Tenryu River in Japan is much larger than that of this figure. In comparison, in the Tenryu River, rough estimation of a scale of stream system (i.e., river basin scale) is 10^5 m, segment system is 10^4 m, reach system is 10^3 m, and pool/ riffle system (i.e., habitat scale) is 10^2 m to 10^0 m. But, the scale of micro habitat system is 10^0 m, which is more or less generally same at any stream system. Therefore, it is important that the scale of restoration methodologies be defined at the beginning.

We identified the importance of pool/ riffle systems and microhabitat systems, and showed how these systems change and relate to biological responses under disturbances regimes are discussed in Chapter 3 and Chapter 5. But in order to analyze small scale systems such as 10^1 m to 10^{-1} m order, detailed surveys are required and they are not practical enough to simulate and quantitatively assess them if middle-to-long term goals for restoration should be achieved. Therefore, it is recommended that potential locations for restoration be assessed at least at scales of reach system or desirably larger systems.

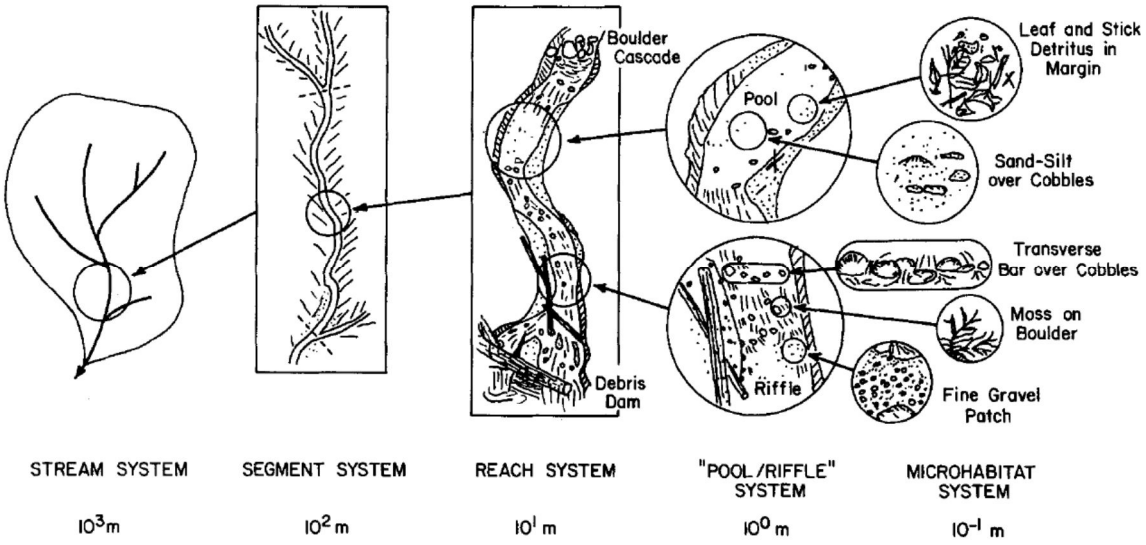
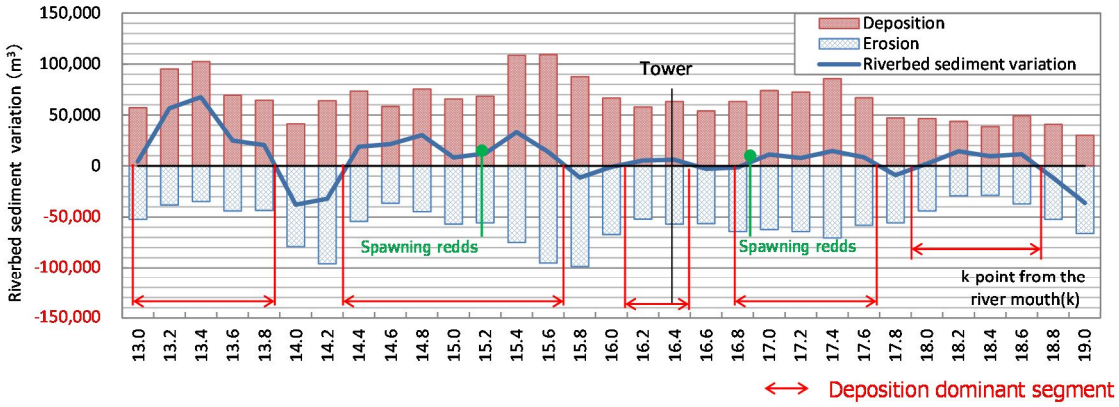
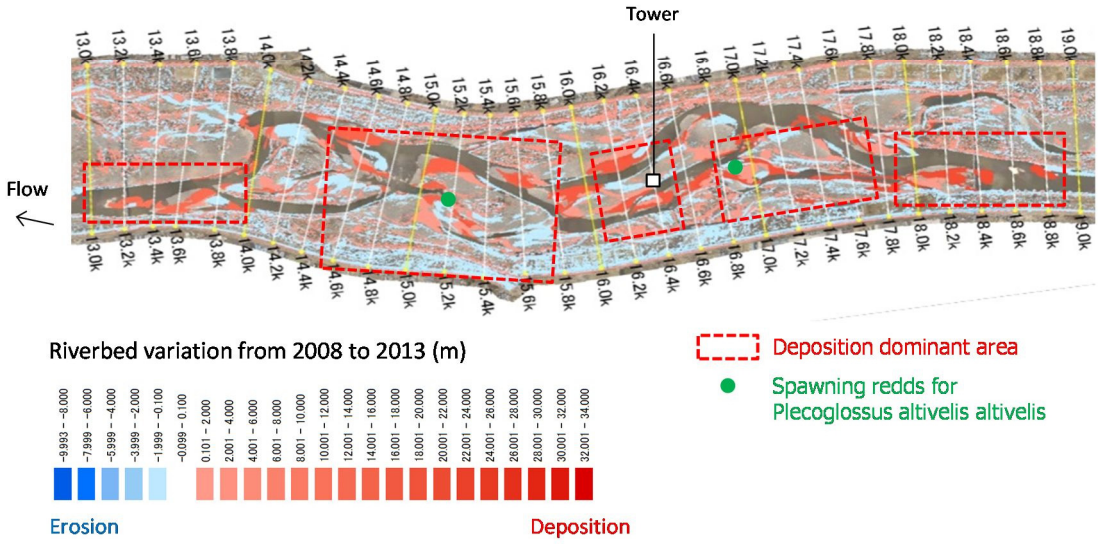


Figure 6.3.11 Hierarchical Organization of a stream system and its habitat subsystems (Frissell et al, 1986).

Figure 6.3.12 shows an example of potential locations for creating spawning redds for Ayu (*Plecoglossus altivelis altivelis*) at a segment scale. Figure 6.3.12 (a) shows longitudinal riverbed sediment variations within channels from 2008 to 2013. Cross section surveys were conducted in 2008 and 2013 with the interval of 200 m each by Ministry of Land, Infrastructure, Transport and Tourism, Japan (MLIT). Cross section profiles were superposed to identify deposition and erosion area (m2) for each cross section. Average area of erosion and deposition between two adjacent profiles (e.g., 16.0 k-point and 16.2 k-point) multiplied by intervals of 200 m result in riverbed sediment variation volumes (m3). Figure 6.3.12 (b) shows riverbed variation distributions (m) from November 2010 to December 2012. Laser profile surveys were conducted by airplane in November 2010 and December 2012 by MLIT. Riverbed variation distribution values are obtained by differences in two survey results in 2010 and 2012. This survey enables to measure accurate coordinate values and its elevation by 5 m grid points, but cannot measure elevation below water (considered zero value). Therefore, when this figure is discussed, it is noted that locations where are initially below-water in 2010 and above-water by deposition in 2012 show higher values than actual ones. According to this result, actually, spawning redds for Ayufish were found in 15.2 k-point and 16.9 k-point and these redds were the location where are estimated to be the potential locations.



(a) Longitudinal riverbed sediment variations within channels from 2008 to 2013 based on cross section surveys.



(b) Riverbed variation distributions from November 2010 to December 2012 based on laser profile surveys

Figure 6.3.12 Potential locations for creating spawning redds for Ayufish at a segment scale.

6) Evaluating various options for decision-making processes

For evaluating various options, it requires quantitative analysis. Since analyzing shifting habitat history requires riverbed changing patterns, simulations based on riverbed variation model are important for ecological evaluations. There are numerous options that can be taken for the restoration. However it is important that these options be selected as a result of analysis on physical conditions that sustain targeted objectives. From a spatial perspective, options could be diverse such as from local, reach, segment, and river basin scales. Therefore, options should be evaluated duly considering period and spatial scales to discuss. Figure 6.3.13 shows an example of options for restoring spawning redds for Ayufish at a reach scale and Figure 6.3.14 shows results of riverbed simulation models for these options. All of options induced deposition downstream of the replenished location, indicating that this option has the potential for creating suitable spawning redds for Ayufish. Particularly, the option (c) sounds effective, since replenished sediment induced deposition on the channel and adjacent sand bars leading to loose gravels and interstitial channels for upwelling water.

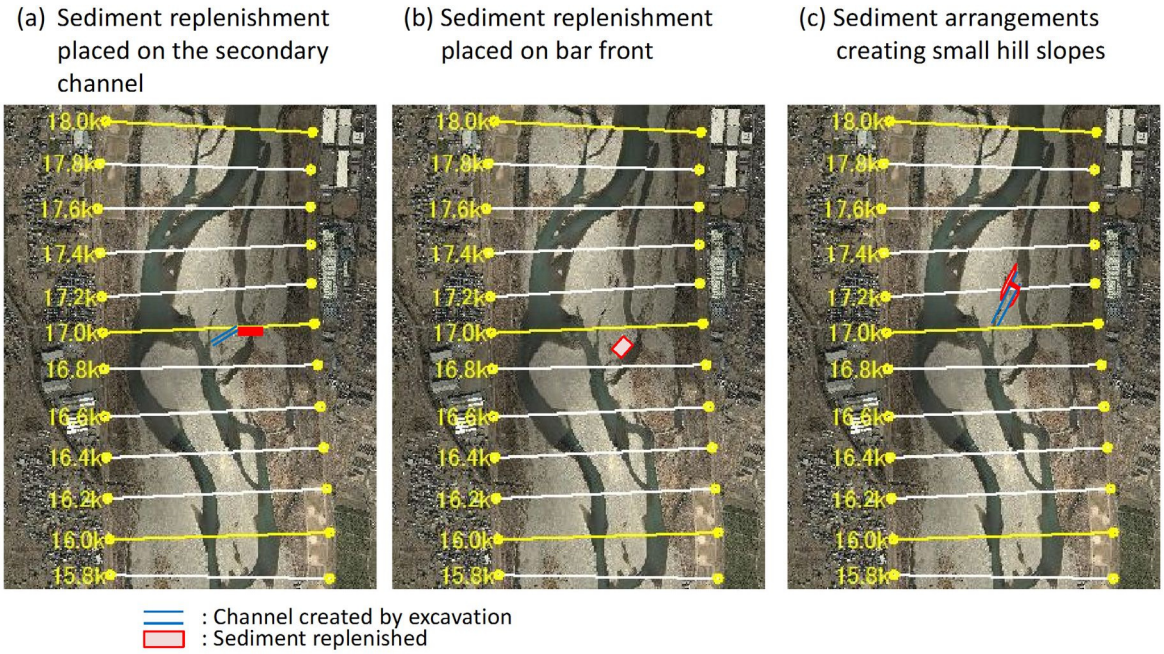


Figure 6.3.13 An example of options for restoring spawning redds for Ayufish at a reach scale.

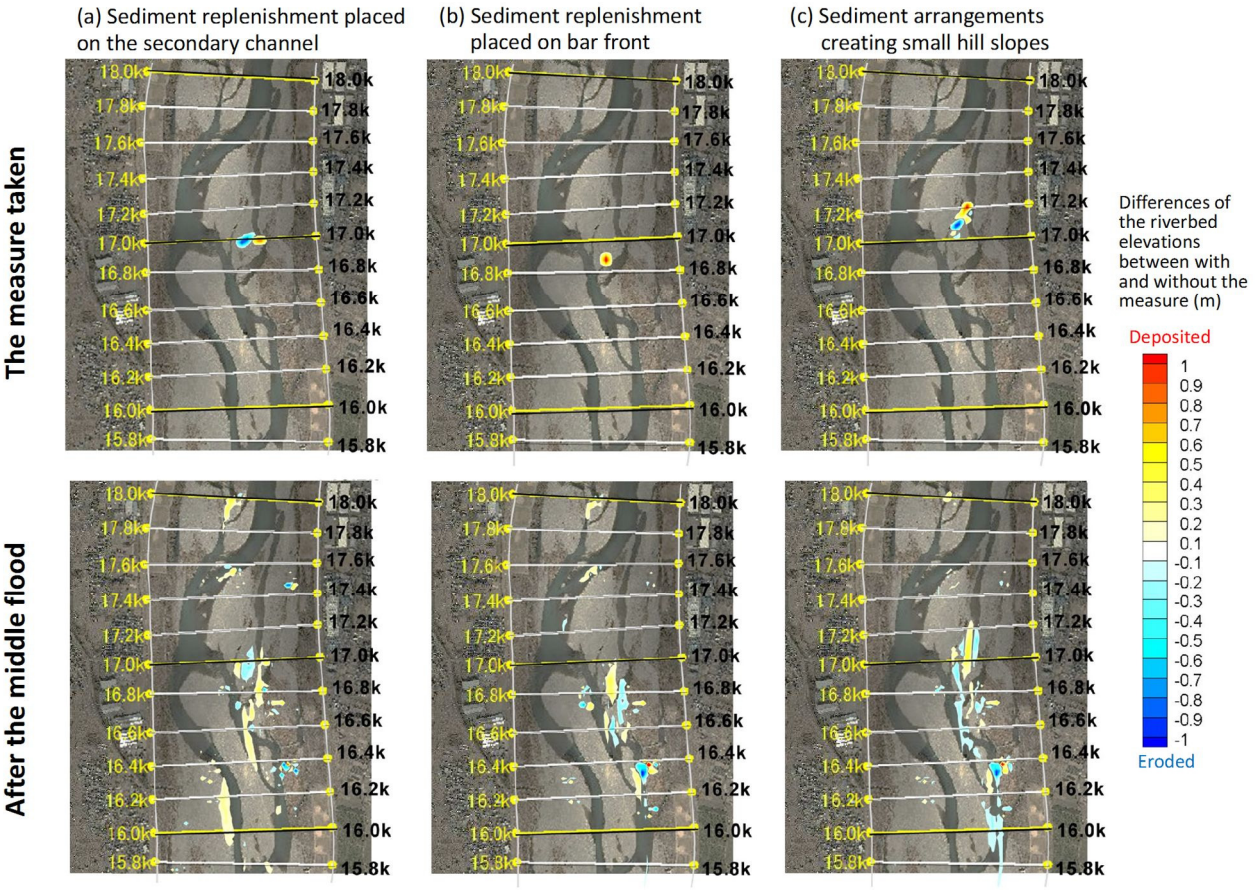


Figure 6.3.14 Result of sediment replenishment for creating a new riffle and spring water at a secondary channel.

7) Establishing schemes to monitor and evaluate selected options

In order to understand whether restoration projects are successful, it is important to establish schemes for monitoring changes after the implementation and based on which monitoring results should be evaluated as part of adaptive management. Monitoring through interval-recording cameras deemed effective in this process supported by field surveys on collecting physical and ecological data. The evaluations are so simple that gaps between actual collected data through monitoring and indicators determined at the planning level can be analyzed. When gaps are not relevant, indicators can be deemed appropriate and lessons can be used for the outreach activities. On the other hand gaps are relevant, it is important to analyze why such gaps are caused, leading to adaptive management for modification of the projects and improving future activities. Figure 6.3.15 shows a conceptual image of ecological hysteresis developed based on Nikanorov, A. et al (2008) and Pingintha, N. et al (2010). Ecological hysteresis depicts a loop of processes of degradation and restoration in relation to time. Even though physical conditions determining suitable habitats for targeted species or biodiversity are identified, restoration may not be successfully achieved if an ecological restoration option is too local to reach to a goal as shown in (a) in Figure 6.3.15. In this case, a larger scale option leading to restoration process (b) is required. In the monitoring process, this gap should be carefully analyzed. The framework for adaptive management was

developed by the WMO (2006) as shown in Figure 6.3.16, which the author fully participated to develop all the contents. But this chapter provides practical inputs supporting such a framework to be effective.

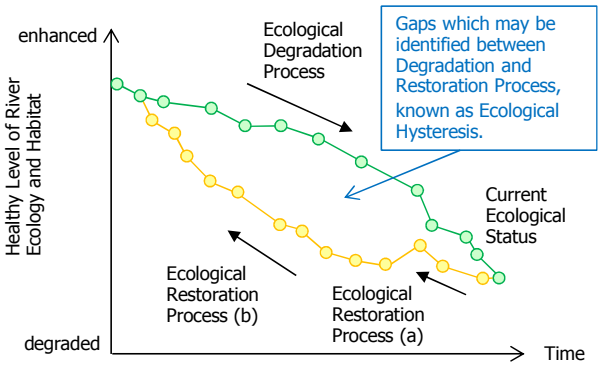


Figure 6.3.15 A conceptual image of ecological hysteresis (developed based on Nikanorov, A. et al (2008) and Pingintha, N. et al (2010).

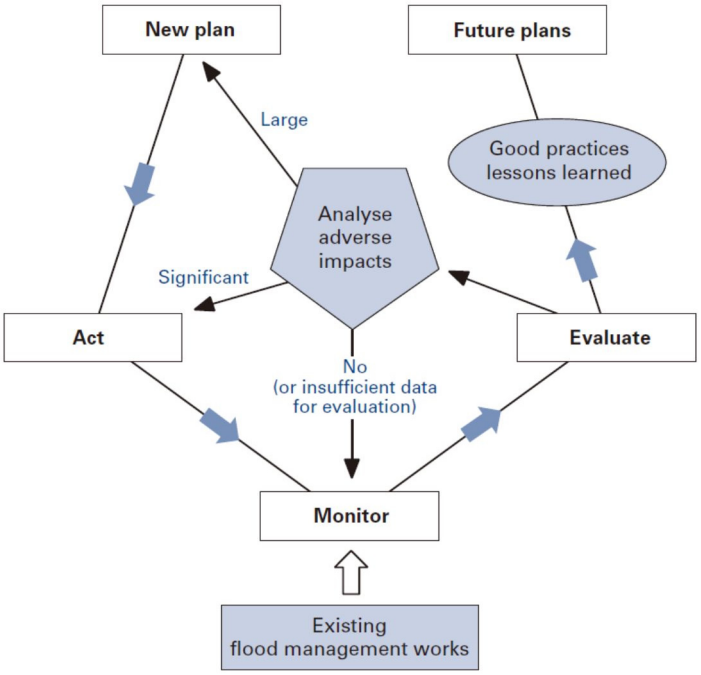


Figure 6.3.16 Adaptive management approach (WMO, 2006).

6.4 Conclusions

This chapter showed approaches and methodologies on ecological evaluations of shifting habitat history in order to apply to riverbed management from various spatial scales at a practical level. Since this study also identified the importance of disturbances due to middle and larger floods, which have been treated as targets from flood management perspectives, this chapter discussed riverbed management that considers sediment and flow regimes

6.5 References

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7 Conclusions

Various habitat evaluation tools have been adopted in decision-making processes in flood and water resources management. However these tools have not addressed spatiotemporal pattern of habitats, even though they change drastically due to natural disturbances. Recent studies on shifting habitat state and habitat age in the Tagliamento River, North Italy, have indicated various habitat types with different habitat age are required for biodiversity conservation. However, they have neither shown temporal variables of habitats nor tracked changing patterns of each habitat with shifting history. In ecological evaluation of the river environment, therefore there is a need to evaluate shifting habitat history. Objectives of this study are i) to analyze relations between habitat suitability to sediment transfer and flood intensity and frequency, ii) to develop a tool for evaluating ecological functions, and iii) to proposes basic approaches for applying this tool to riverbed management at a practical level.

Characteristics of this study can be explained to, among others, three elements. First element was to choose the Tenryu River in Japan, which has various disturbance regimes from small to large floods and various riverbed changes that create, eliminate, and sustain habitats, even though there has been several dams constructed in the main stream of the river basin. Second element was to install several interval-recording cameras on 50 m above the riverbed at electric transmission tower located in the middle of a river corridor to record hourly shifting habitat history. Third element was to conduct sampling of macro-invertebrates and physical conditions of selected habitat units almost every two month. These three elements integrated into analyses of this study enable to understand shifting habitat history quantitatively, including temporal variables and habitat age, and its correspondence to physical conditions of macro and micro habitats and responses of species represented by macro-invertebrates.

Chapter 1 Introduction and overall objectives:
A review on ecological evaluation tools and previous studies was conducted to discuss the importance of addressing shifting habitat history in ecological evaluations for the river environment.

Chapter 2 Habitat diversity hypothesis:
Previous works of ecological restoration of river corridor habitats were reviewed, particularly through channel widening and creating secondary channels. Well-known restoration projects were selected including case studies over the world in U.S.A., Europe, and Japan. Most of them addressed spatial distributions of habitat structure, but not temporal variables reflecting the history of habitat changes in spite of the importance. Therefore, we proposed “habitat diversity hypothesis” as a new approach to ecological evaluation of shifting habitats history. We hypothesized that biodiversity of the stream ecosystem is determined by spatiotemporal patters of habitat structure reflecting intensity and frequency of disturbances and resultant habitat age.

Chapter 3 Spatiotemporal patterns determining riverine habitat heterogeneity:

In this chapter, spatiotemporal patterns of habitats were quantitatively analyzed to describe shifting habitat history in relation to disturbance regimes. Shifting habitat history has been recorded at 16.4 k-point of the Tenryu River in Japan, using interval-recording cameras installed at an electric transmission tower located in the middle of the river channel. Patterns of shifting habitat history were analyzed based on these photo data in relation to deposition and erosion areas under different disturbance regimes, and thereby discussions were made on roles of small, middle, and large flood disturbances in formation and conditioning of stream habitats.

Chapter 4 Development processes of spawning redds for Ayufish (*Plecoglossus altivelis altivelis*) under shifting habitat history:

Formation and conditioning processes of spawning redds for Ayufish (*Plecoglossus altivelis altivelis*) were investigated in relation to shifting habitat history in the Tenryu River, using the interval-recording cameras and field measurements of the riverbed conditions. Suitable spawning redds for Ayufish were found within a photo frame of the interval-recording cameras installed. We analyzed shifting habitat history of these spawning redds in relation to microhabitat environmental conditions such as substrate grain size, riverbed softness and DO concentration of interstitial flows in the riverbed. The results identified that suitable spawning redds would be created by during middle to large flood disturbances and would be degraded during small floods, indicating that suitable spawning redds are ephemeral habitats and therefore depend on timing and intensity of disturbances.

Chapter 5 Habitat age effects on biodiversity of macro-invertebrates:

Habitat age effects on biodiversity macro-invertebrates were analyzed based on the photo data by interval-recording cameras and field survey data. Through this study we found that macro-invertebrates showed species specific changes in spatiotemporal distributions in lotic and lentic habitats during flood disturbances. Relations between the species diversity and habitat ages indicated that the habitat diversity with different age within a reach is important for sustaining biodiversity and how small, middle, and large floods are essential for maintaining mechanisms of the habitat age diversity.

Chapter 6 Application to riverbed management:

Methodologies for ecological evaluations and approaches for application to riverbed management at a practical level were proposed. Perspectives from integration of sediment and flood management into environmental riverbed management were discussed.

Acknowledgements

This study was conducted under direct supervisions by Professor Tetsuya Sumi and Associated Professor Takemon in Disaster Prevention Research Institute (DPRI) in Kyoto University, Japan. It requires comprehensive knowledge on hydraulics, morphology and ecology of rivers, making it difficult to conduct this study. However, at a practical level, there has been a certain gap in integrating different disciplines into riverbed management, even though the importance has been emphasized and highlighted in words for a long time. Narrowing this gap was the incentive to conducting this study. Professor Sumi is an expert in the field of hydraulics and morphology, Associate Professor Takemon is an expert in the field of ecology addressing dynamic habitats, and I am a professional engineer working in the field of river restoration and river and sediment management. In an effort to integrate our expertise into this study, it is clear that it has never been achieved unless supports from my supervisors were to be provided, which are most acknowledged.

Acknowledgements are given to my supervisors and colleagues of DPRI, Kyoto University, among others, Professor Masaharu Fujita for reviewing contents of this study from a perspective of flow and sediment management at a practical level, Dr Sohei Koyabashi for proposing substantial inputs to enhancing the contents particularly on evaluation of macro-invertebrates, Associate Professor Sameh Kantoush for fruitful discussions and providing ideas to enrich this study, and colleagues (students) for supporting to conduct field survey in the Tenryu River, among others Yosuke Awazu and Kosuke Izumi.

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Last but not least, I will take this opportunity to express my sincere thanks to my wife Dr Yuki Hyodo for all the support to me as a family member and international expert. It was certainly my family including my daughter Ms Mizuki Hyodo, who gave me incentives to successfully complete this Ph.D. thesis.

Appendixes

Appendix 1 All species found throughout the survey on macro-invertebrates

Table 1.1 List of all species found throughout the survey on macro-invertebrates.
Table 1.2 All survey data on macro-invertebrates.

Appendix 2 Survey data on selected 50 macro-invertebrates for the analysis

Table 2 Survey data on selected 50 macro-invertebrates for the analysis.

Table 1.1 List of all species found throughout the survey on macro-invertebrates.

No	Class	Order	Family	Species name
1	Hydrozoa	Anthomedusae	Hydridae	Hydridae
2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*
3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.
4	Gastropoda	Discopoda	Hydrobiidae	*Potamopyrgus antipodarum*
5	Gastropoda	Basommatophora	Ancylidae	*Laevapex nipponica*
6	Gastropoda	Basommatophora	Lymnaeidae	*Lymnaea truncatula*
7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*
8	Gastropoda	Basommatophora	Physidae	*Physa acuta*
9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*
10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*
11	Bivalvia	Veneroida	Corbiculidae	*Corbicula* sp.
12	Oligochaeta	Lumbriculida	Lumbriculidae	*Lumbriculus* sp.
13	Oligochaeta	Tubificida	Enchytraeidae	*Marionina* sp.
14	Oligochaeta	Tubificida	Naididae	*Chaetogaster diaphanus*
15	Oligochaeta	Tubificida	Naididae	*Nais barbata*
16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*
17	Oligochaeta	Tubificida	Naididae	*Nais communis*
18	Oligochaeta	Tubificida	Naididae	*Nais pardalis*
19	Oligochaeta	Tubificida	Naididae	*Nais* sp.
20	Oligochaeta	Tubificida	Naididae	*Ophidonais serpentina*
21	Oligochaeta	Tubificida	Naididae	*Piguetiella denticulata*
22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*
23	Oligochaeta	Tubificida	Naididae	*Stylaria fossularis*
24	Oligochaeta	Tubificida	Naididae	*Limnodrilus hoffmeisteri*
25	Oligochaeta	Tubificida	Naididae	Naididae
26	Oligochaeta	Lumbricida	Lumbricidae	Lumbricidae
27	Oligochaeta	Lumbricida	-	LUMBRICIDA
28	Hirudinea	Rhynchobdellida	Glossiphoniidae	*Alboglossiphonia lata*
29	Hirudinea	Rhynchobdellida	Piscicolidae	*Limnotrachelobdella* sp.
30	Hirudinea	Arhynchobdellida	Erpobdellidae	Erpobdellidae
31	Hirudinea	Arhynchobdellida	Salifidae	Salifidae
32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.
33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.
34	Arachnida	Acarina	Spercontidae	*Sperchonopsis* sp.
35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.
36	Arachnida	Acarina	Axonopsidae	*Axonopsis* sp.
37	Arachnida	Acarina	Axonopsidae	*Brachypoda* sp.
38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.
39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.
40	Malacostraca	Amphipoda	Lucioblividae	*Lucioblivio kozaensis*
41	Malacostraca	Amphipoda	Pseudocrangonyctidae	*Pseudocrangonyx* sp.
42	Malacostraca	Amphipoda	Crangonyctidae	*Crangonyx floridanus*
43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*
44	Malacostraca	Isopoda	Asellidae	Asellidae
45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*
46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*
47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*
48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*
49	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium nipponense*
50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*
51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*
52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.
53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*
54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*
55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*
56	Insecta	Ephemeroptera	Baetidae	*Baetis sahoensis*
57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*
58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*
59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J
60	Insecta	Ephemeroptera	Baetidae	*Cloeon* sp.
61	Insecta	Ephemeroptera	Baetidae	*Labiobaetis atrebatinus orientalis*
62	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis chocoratus*
63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D
64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.
65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*
66	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis parvipterus*
67	Insecta	Ephemeroptera	Heptageniidae	*Cinygmula* sp.
68	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus bajkovae*

Table 1.1 List of all species found throughout the survey on macro-invertebrates. (continued)

No	Class	Order	Family	Species name
69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*
70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.
71	Insecta	Ephemeroptera	Heptageniidae	*Epeorus curvatulus*
72	Insecta	Ephemeroptera	Heptageniidae	*Epeorus ikanonis*
73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*
74	Insecta	Ephemeroptera	Heptageniidae	*Epeorus* sp.
75	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena tetrapunctigera*
76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.
77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*
78	Insecta	Ephemeroptera	Siphlonuridae	*Siphlonurus* sp.
79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*
80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.
81	Insecta	Ephemeroptera	Ephemeridae	*Ephemera japonica*
82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*
83	Insecta	Ephemeroptera	Ephemeridae	*Ephemera strigata*
84	Insecta	Ephemeroptera	Ephemeridae	*Ephemera* sp.
85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*
86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*
87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.
88	Insecta	Ephemeroptera	Ephemerellidae	*Drunella ishiyamana*
89	Insecta	Ephemeroptera	Ephemerellidae	*Drunella sachalinensis*
90	Insecta	Ephemeroptera	Ephemerellidae	*Drunella* sp.
91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*
92	Insecta	Ephemeroptera	Ephemerellidae	*Ephemerella cornuta*
93	Insecta	Ephemeroptera	Ephemerellidae	*Ephemerella setigera*
94	Insecta	Ephemeroptera	Ephemerellidae	*Ephemerella* sp.
95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*
96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*
97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.
98	Insecta	Odonata	Agrionidae	*Ischnura* sp.
99	Insecta	Odonata	Calopterygidae	*Calopteryx atrata*
100	Insecta	Odonata	Calopterygidae	*Calopteryx cornelia*
101	Insecta	Odonata	Macromiidae	*Anax parthenope julius*
102	Insecta	Odonata	Macromiidae	*Boyeria maclachlani*
103	Insecta	Odonata	Gomphidae	*Anisogomphus maacki*
104	Insecta	Odonata	Gomphidae	*Davidius nanus*
105	Insecta	Odonata	Gomphidae	*Davidius* sp.
106	Insecta	Odonata	Gomphidae	*Nihonogomphus viridis*
107	Insecta	Odonata	Gomphidae	*Onychogomphus viridicostus*
108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*
109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*
110	Insecta	Odonata	Gomphidae	*Stylogomphus suzukii*
111	Insecta	Odonata	Gomphidae	Gomphidae
112	Insecta	Odonata	Corduliidae	*Macromia amphigena amphigena*
113	Insecta	Odonata	Libellulidae	*Orthetrum albistylum speciosum*
114	Insecta	Odonata	Libellulidae	*Sympetrum* sp.
115	Insecta	Plecoptera	Capniidae	Capniidae
116	Insecta	Plecoptera	Leuctridae	Leuctridae
117	Insecta	Plecoptera	Nemouridae	*Amphinemura* sp.
118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.
119	Insecta	Plecoptera	Taeniopterygidae	*Obipteryx* sp.
120	Insecta	Plecoptera	Taeniopterygidae	*Strophopteryx* sp.
121	Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae
122	Insecta	Plecoptera	Chloroperlidae	*Haploperla japonica*
123	Insecta	Plecoptera	Chloroperlidae	*Suwallia* sp.
124	Insecta	Plecoptera	Chloroperlidae	*Sweltsa* sp.
125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae
126	Insecta	Plecoptera	Perlidae	*Xanthoneuria jouklii*
127	Insecta	Plecoptera	Perlidae	*Gibosia* sp.
128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*
129	Insecta	Plecoptera	Perlidae	*Kamimuria uenoi*
130	Insecta	Plecoptera	Perlidae	*Kamimuria* sp.
131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.
132	Insecta	Plecoptera	Perlidae	*Oyamia lugubris*
133	Insecta	Plecoptera	Perlidae	*Oyamia cryptomeria*
134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.
135	Insecta	Plecoptera	Perlidae	*Paragnetina* sp.
136	Insecta	Plecoptera	Perlidae	Perlidae

Table 1.1 List of all species found throughout the survey on macro-invertebrates. (continued)

No	Class	Order	Family	Species name
137	Insecta	Plecoptera	Perlodidae	*Isoperla nipponica*
138	Insecta	Plecoptera	Perlodidae	*Isoperla* sp.
139	Insecta	Plecoptera	Perlodidae	*Ostrovus* sp.
140	Insecta	Plecoptera	Perlodidae	*Stavsolus japonicus*
141	Insecta	Plecoptera	Perlodidae	*Stavsolus* sp.
142	Insecta	Plecoptera	Perlodidae	*Tadamus* sp.
143	Insecta	Plecoptera	Perlodidae	Perlodidae
144	Insecta	Hemiptera	Gerridae	*Aquarius paludum paludum*
145	Insecta	Hemiptera	Gerridae	*Gerris latiabdominis*
146	Insecta	Hemiptera	Gerridae	*Gerris* sp.
147	Insecta	Hemiptera	Gerridae	Gerrinae
148	Insecta	Hemiptera	Veliidae	*Microvelia* sp.
149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*
150	Insecta	Hemiptera	Corixidae	*Micronecta orientalis*
151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.
152	Insecta	Odonata	Corydalidae	*Parachauliodes continentalis*
153	Insecta	Odonata	Corydalidae	*Protohermes grandis*
154	Insecta	Trichoptera	Ecnomidae	*Ecnomus* sp.
155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*
156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*
157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.
158	Insecta	Trichoptera	Hydropsychidae	*Diplectrona* sp.
159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*
160	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche setensis*
161	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche* sp.
162	Insecta	Trichoptera	Hydropsychidae	*Macrostemum radiatum*
163	Insecta	Trichoptera	Polycentropodidae	*Plectrocnemia* sp.
164	Insecta	Trichoptera	Psychomyiidae	*Psychomyia* sp.
165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*
166	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche sauteri*
167	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche* sp.
168	Insecta	Trichoptera	Glossosomatidae	*Padunia* sp.
169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.
170	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila kawamurae*
171	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila kisoensis*
172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*
173	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila* sp.
174	Insecta	Trichoptera	Apataniidae	*Apatania* sp.
175	Insecta	Trichoptera	Calamoceratidae	*Anisocentropus kawamurai*
176	Insecta	Trichoptera	Goeridae	*Goera japonica*
177	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma satoi*
178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.
179	Insecta	Trichoptera	Leptoceridae	*Ceraclea* sp.
180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.
181	Insecta	Trichoptera	Leptoceridae	*Oecetis* sp.
182	Insecta	Trichoptera	Sericostomatidae	*Gumaga orientalis*
183	Insecta	Diptera	Tipulidae	*Tipula* sp.
184	Insecta	Diptera	Tipulidae	*Antocha* sp.
185	Insecta	Diptera	Tipulidae	*Dicranota* sp.
186	Insecta	Diptera	Tipulidae	*Erioptera* sp.
187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.
188	Insecta	Diptera	Tipulidae	*Limnophila* sp.
189	Insecta	Diptera	Tipulidae	*Ormosia* sp.
190	Insecta	Diptera	Tipulidae	*Rhabdomastix* sp.
191	Insecta	Diptera	Ceratopogonidae	*Atrichopogon* sp.
192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae
193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.
194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.
195	Insecta	Diptera	Chironomidae	*Macropelopia* sp.
196	Insecta	Diptera	Chironomidae	*Nilotanypus dubius*
197	Insecta	Diptera	Chironomidae	*Paramerina* sp.
198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.
199	Insecta	Diptera	Chironomidae	*Trissopelopia* sp.
200	Insecta	Diptera	Chironomidae	Tanypodinae
201	Insecta	Diptera	Chironomidae	*Diamesa* sp.
202	Insecta	Diptera	Chironomidae	*Pagastia* sp.
203	Insecta	Diptera	Chironomidae	*Potthastia longimana*
204	Insecta	Diptera	Chironomidae	*Potthastia montium*

Table 1.1 List of all species found throughout the survey on macro-invertebrates. (continued)

No	Class	Order	Family	Species name
205	Insecta	Diptera	Chironomidae	*Potthastia* sp.
206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.
207	Insecta	Diptera	Chironomidae	Diamesinae
208	Insecta	Diptera	Chironomidae	*Prodiamesa* sp.
209	Insecta	Diptera	Chironomidae	*Brillia* sp.
210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.
211	Insecta	Diptera	Chironomidae	*Corynoneura* sp.
212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.
213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*
214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.
215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.
216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.
217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.
218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.
219	Insecta	Diptera	Chironomidae	*Parachaetocladius* sp.
220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.
221	Insecta	Diptera	Chironomidae	*Parametriocnemus* sp.
222	Insecta	Diptera	Chironomidae	*Paratrichocladius* sp.
223	Insecta	Diptera	Chironomidae	*Pseudorthocladius* sp.
224	Insecta	Diptera	Chironomidae	*Psilometriocnemus* sp.
225	Insecta	Diptera	Chironomidae	*Rheocricotopus* sp.
226	Insecta	Diptera	Chironomidae	*Robackia* sp.
227	Insecta	Diptera	Chironomidae	*Stenochironomus* sp.
228	Insecta	Diptera	Chironomidae	*Synorthocladius* sp.
229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.
230	Insecta	Diptera	Chironomidae	*Tvetenia* sp.
231	Insecta	Diptera	Chironomidae	Orthocladiinae
232	Insecta	Diptera	Chironomidae	*Benthalia* sp.
233	Insecta	Diptera	Chironomidae	*Chironomus* sp.
234	Insecta	Diptera	Chironomidae	*Cladopelma* sp.
235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.
236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.
237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.
238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.
239	Insecta	Diptera	Chironomidae	*Harnischia* sp.
240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.
241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.
242	Insecta	Diptera	Chironomidae	*Paratendipes* sp.
243	Insecta	Diptera	Chironomidae	*Polypedilum kamotertium*
244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.
245	Insecta	Diptera	Chironomidae	*Rheotanytarsus* sp.
246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.
247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.
248	Insecta	Diptera	Chironomidae	Chironominae
249	Insecta	Diptera	Culicidae	*Anopheles* sp.
250	Insecta	Diptera	Culicidae	Culicinae
251	Insecta	Diptera	Simuliidae	*Eusimulium* sp.
252	Insecta	Diptera	Simuliidae	*Simulium* sp.
253	Insecta	Diptera	Sciaridae	Sciaridae
254	Insecta	Diptera	Athericidae	*Asuragina caerulescens*
255	Insecta	Diptera	Athericidae	*Atrichops fontinalis*
256	Insecta	Diptera	Athericidae	*Atrichops morimotoi*
257	Insecta	Diptera	Athericidae	*Suragina satsumana*
258	Insecta	Diptera	Stratiomyidae	*Allognosta* sp.
259	Insecta	Diptera	Stratiomyidae	*Odontomyia* sp.
260	Insecta	Diptera	Dolichopodidae	Dolichopodidae
261	Insecta	Diptera	Empididae	Empididae
262	Insecta	Diptera	Canacidae	Canacidae
263	Insecta	Diptera	Ephydridae	Ephydridae
264	Insecta	Coleoptera	Dytiscidae	*Allopachria flavomaculata*
265	Insecta	Coleoptera	Dytiscidae	*Hydroglyphus japonicus*
266	Insecta	Coleoptera	Dytiscidae	Hydroporinae
267	Insecta	Coleoptera	Dytiscidae	Colymbetinae
268	Insecta	Coleoptera	Dytiscidae	*Eretes griseus*
269	Insecta	Coleoptera	Hydraenidae	*Ochthebius hasegawai*
270	Insecta	Coleoptera	Hydrophilidae	*Agraphydrus narusei*
271	Insecta	Coleoptera	Hydrophilidae	*Enochrus japonicus*
272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*

Table 1.1 List of all species found throughout the survey on macro-invertebrates. (continued)

No	Class	Order	Family	Species name
273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*
274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.
275	Insecta	Coleoptera	Hydrophilidae	*Sternolophus rufipes*
276	Insecta	Coleoptera	Helodidae	*Hydrocyphon* sp.
277	Insecta	Coleoptera	Elmidae	*Grouvellinus* sp.
278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.
279	Insecta	Coleoptera	Elmidae	*Stenelmis* sp.
280	Insecta	Coleoptera	Elmidae	*Zaitzevia awana*
281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*
282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.
283	Insecta	Coleoptera	Elmidae	*Zaitzeviaria gotoi*
284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.
285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*
286	Insecta	Coleoptera	Psephenidae	*Macroeubria lewisi*
287	Insecta	Coleoptera	Psephenidae	*Mataeopsephus japonicus*
288	Insecta	Coleoptera	Ptilodactylidae	*Epilichas* sp.

Table 1.2 All survey data on macro-invertebrates.

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1	1	2012/10/13	D-BW-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	16
2	1	2012/10/13	D-BW-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	6
3	1	2012/10/13	D-BW-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2
4	1	2012/10/13	D-BW-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	3
5	1	2012/10/13	D-BW-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	63
6	1	2012/10/13	D-BW-1	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	5
7	1	2012/10/13	D-BW-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	19
8	1	2012/10/13	D-BW-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	18
9	1	2012/10/13	D-BW-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	2
10	1	2012/10/13	D-BW-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
11	1	2012/10/13	D-BW-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	32
12	1	2012/10/13	D-BW-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	39
13	1	2012/10/13	D-BW-1	200	Insecta	Diptera	Chironomidae	Tanypodinae	2
14	1	2012/10/13	D-BW-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	1
15	1	2012/10/13	D-BW-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	2
16	1	2012/10/13	D-BW-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	19
17	1	2012/10/13	D-BW-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	22
18	1	2012/10/13	D-BW-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	18
19	1	2012/10/13	D-BW-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	2
20	1	2012/10/13	D-BW-2	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1
21	1	2012/10/13	D-BW-2	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	4
22	1	2012/10/13	D-BW-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	7
23	1	2012/10/13	D-BW-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
24	1	2012/10/13	D-BW-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	4
25	1	2012/10/13	D-BW-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2
26	1	2012/10/13	D-BW-2	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
27	1	2012/10/13	D-BW-2	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1
28	1	2012/10/13	D-BW-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
29	1	2012/10/13	D-BW-2	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	1
30	1	2012/10/13	D-BW-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	25
31	1	2012/10/13	D-BW-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2
32	1	2012/10/13	D-BW-2	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	16
33	1	2012/10/13	D-BW-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1
34	1	2012/10/13	D-BW-2	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	1
35	1	2012/10/13	D-BW-2	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	36
36	1	2012/10/13	D-BW-2	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	4
37	1	2012/10/13	D-BW-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	5
38	1	2012/10/13	D-BW-2	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	2
39	1	2012/10/13	D-BW-2	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1
40	1	2012/10/13	D-BW-2	261	Insecta	Diptera	Empididae	Empididae	4
41	1	2012/10/13	D-BW-2	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	6
42	1	2012/10/13	D-BW-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	14
43	1	2012/10/13	D-BW-2	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	4
44	1	2012/10/13	D-BW-2	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
45	1	2012/10/13	D-SP-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1
46	1	2012/10/13	D-SP-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	11
47	1	2012/10/13	D-SP-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	15
48	1	2012/10/13	D-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	26
49	1	2012/10/13	D-SP-1	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	5
50	1	2012/10/13	D-SP-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	2
51	1	2012/10/13	D-SP-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1
52	1	2012/10/13	D-SP-1	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	4
53	1	2012/10/13	D-SP-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	3
54	1	2012/10/13	D-SP-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1
55	1	2012/10/13	D-SP-1	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	5
56	1	2012/10/13	D-SP-1	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	2
57	1	2012/10/13	D-SP-1	283	Insecta	Coleoptera	Elmidae	*Zaitzeviaria gotoi*	1
58	1	2012/10/14	D-Rf-1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	8
59	1	2012/10/14	D-Rf-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	9
60	1	2012/10/14	D-Rf-1	25	Oligochaeta	Tubificida	Naididae	Naididae	9
61	1	2012/10/14	D-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	8
62	1	2012/10/14	D-Rf-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	17
63	1	2012/10/14	D-Rf-1	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	8
64	1	2012/10/14	D-Rf-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	19
65	1	2012/10/14	D-Rf-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	1
66	1	2012/10/14	D-Rf-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	3
67	1	2012/10/14	D-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	428
68	1	2012/10/14	D-Rf-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	52
69	1	2012/10/14	D-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	580
70	1	2012/10/14	D-Rf-1	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	2
71	1	2012/10/14	D-Rf-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	12
72	1	2012/10/14	D-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	22
73	1	2012/10/14	D-Rf-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	4
74	1	2012/10/14	D-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	62
75	1	2012/10/14	D-Rf-1	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	28

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
76	1	2012/10/14	D-Rf-1	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	24
77	1	2012/10/14	D-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1
78	1	2012/10/14	D-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	1
79	1	2012/10/14	D-Rf-1	130	Insecta	Plecoptera	Perlidae	*Kamimuria* sp.	1
80	1	2012/10/14	D-Rf-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	7
81	1	2012/10/14	D-Rf-1	134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.	1
82	1	2012/10/14	D-Rf-1	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	44
83	1	2012/10/14	D-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	141
84	1	2012/10/14	D-Rf-1	157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	33
85	1	2012/10/14	D-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	514
86	1	2012/10/14	D-Rf-1	161	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	49
87	1	2012/10/14	D-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	8
88	1	2012/10/14	D-Rf-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	2
89	1	2012/10/14	D-Rf-1	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1
90	1	2012/10/14	D-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2
91	1	2012/10/14	D-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
92	1	2012/10/14	D-Rf-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	1
93	1	2012/10/14	D-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	89
94	1	2012/10/14	D-Rf-1	196	Insecta	Diptera	Chironomidae	*Nilotanypus dubius*	10
95	1	2012/10/14	D-Rf-1	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	1
96	1	2012/10/14	D-Rf-1	200	Insecta	Diptera	Chironomidae	Tanypodinae	10
97	1	2012/10/14	D-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	11
98	1	2012/10/14	D-Rf-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	13
99	1	2012/10/14	D-Rf-1	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	1
100	1	2012/10/14	D-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	25
101	1	2012/10/14	D-Rf-1	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	1
102	1	2012/10/14	D-Rf-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	1
103	1	2012/10/14	D-Rf-1	240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.	1
104	1	2012/10/14	D-Rf-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	18
105	1	2012/10/14	D-Rf-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	8
106	1	2012/10/14	D-Rf-1	248	Insecta	Diptera	Chironomidae	Chironominae	1
107	1	2012/10/14	D-Rf-1	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	1
108	1	2012/10/14	D-Rf-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2
109	1	2012/10/14	D-Rf-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	9
110	1	2012/10/14	D-Rf-1	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	2
111	1	2012/10/14	D-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3
112	1	2012/10/14	D-Rf-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	19
113	1	2012/10/14	D-Rf-1	287	Insecta	Coleoptera	Psephenidae	*Mataeopsephus japonicus*	1
114	1	2012/10/14	U-BW-1	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	35
115	1	2012/10/14	U-BW-1	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	146
116	1	2012/10/14	U-BW-1	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	152
117	1	2012/10/14	U-BW-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	80
118	1	2012/10/14	U-BW-1	49	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium nipponense*	105
119	1	2012/10/14	U-BW-1	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	3
120	1	2012/10/14	U-BW-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	33
121	1	2012/10/14	U-BW-1	112	Insecta	Odonata	Corduliidae	*Macromia amphigena amphigena*	4
122	1	2012/10/14	U-BW-1	147	Insecta	Hemiptera	Gerridae	Gerrinae	2
123	1	2012/10/14	U-BW-1	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	10
124	1	2012/10/14	U-BW-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	202
125	1	2012/10/14	U-BW-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	10
126	1	2012/10/14	U-BW-1	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	2
127	1	2012/10/14	U-BW-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
128	1	2012/10/14	U-BW-1	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	48
129	1	2012/10/14	U-BW-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	1
130	1	2012/10/14	U-BW-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	2
131	1	2012/10/14	U-BW-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1
132	1	2012/10/14	U-BW-1	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	4
133	1	2012/10/14	U-BW-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	13
134	1	2012/10/14	U-BW-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	6
135	1	2012/10/14	U-BW-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	2
136	1	2012/10/14	U-BW-1	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	1
137	1	2012/10/14	U-BW-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	3
138	1	2012/10/14	U-BW-1	275	Insecta	Coleoptera	Hydrophilidae	*Sternolophus rufipes*	1
139	1	2012/10/14	U-Rf-2	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	2
140	1	2012/10/14	U-Rf-2	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1
141	1	2012/10/14	U-Rf-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
142	1	2012/10/14	U-Rf-2	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	18
143	1	2012/10/14	U-Rf-2	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	1
144	1	2012/10/14	U-Rf-2	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	6
145	1	2012/10/14	U-Rf-2	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	883
146	1	2012/10/14	U-Rf-2	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	1
147	1	2012/10/14	U-Rf-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
148	1	2012/10/14	U-Rf-2	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	2
149	1	2012/10/14	U-Rf-2	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	610
150	1	2012/10/14	U-Rf-2	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
151	1	2012/10/14	U-Rf-2	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	4
152	1	2012/10/14	U-Rf-2	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	18
153	1	2012/10/14	U-Rf-2	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	24
154	1	2012/10/14	U-Rf-2	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	19
155	1	2012/10/14	U-Rf-2	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	32
156	1	2012/10/14	U-Rf-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1
157	1	2012/10/14	U-Rf-2	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	1
158	1	2012/10/14	U-Rf-2	134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.	1
159	1	2012/10/14	U-Rf-2	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1
160	1	2012/10/14	U-Rf-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	8
161	1	2012/10/14	U-Rf-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	975
162	1	2012/10/14	U-Rf-2	161	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	32
163	1	2012/10/14	U-Rf-2	163	Insecta	Trichoptera	Polycentropodidae	*Plectrocnemia* sp.	1
164	1	2012/10/14	U-Rf-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	2
165	1	2012/10/14	U-Rf-2	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	16
166	1	2012/10/14	U-Rf-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2
167	1	2012/10/14	U-Rf-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
168	1	2012/10/14	U-Rf-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	11
169	1	2012/10/14	U-Rf-2	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	3
170	1	2012/10/14	U-Rf-2	200	Insecta	Diptera	Chironomidae	Tanypodinae	1
171	1	2012/10/14	U-Rf-2	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	4
172	1	2012/10/14	U-Rf-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	3
173	1	2012/10/14	U-Rf-2	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	16
174	1	2012/10/14	U-Rf-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	2
175	1	2012/10/14	U-Rf-2	225	Insecta	Diptera	Chironomidae	*Rheocricotopus* sp.	1
176	1	2012/10/14	U-Rf-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	1
177	1	2012/10/14	U-Rf-2	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	1
178	1	2012/10/14	U-Rf-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	52
179	1	2012/10/14	U-Rf-2	248	Insecta	Diptera	Chironomidae	Chironominae	1
180	1	2012/10/14	U-Rf-2	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	3
181	1	2012/10/14	U-Rf-2	270	Insecta	Coleoptera	Hydrophilidae	*Agraphydrus narusei*	1
182	1	2012/10/14	U-Rf-2	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	3
183	1	2012/10/14	U-Rf-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	6
184	1	2012/10/14	U-Rf-2	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	1
185	1	2012/10/14	U-Rf-2	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	16
186	1	2012/10/15	D-BW-21	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1
187	1	2012/10/15	D-BW-21	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	38
188	1	2012/10/15	D-BW-21	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	15
189	1	2012/10/15	D-BW-21	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	1
190	1	2012/10/15	D-BW-21	64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.	1
191	1	2012/10/15	D-BW-21	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2
192	1	2012/10/15	D-BW-21	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	1
193	1	2012/10/15	D-BW-21	83	Insecta	Ephemeroptera	Ephemeridae	*Ephemera strigata*	1
194	1	2012/10/15	D-BW-21	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	32
195	1	2012/10/15	D-BW-21	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	1
196	1	2012/10/15	D-BW-21	111	Insecta	Odonata	Gomphidae	Gomphidae	4
197	1	2012/10/15	D-BW-21	112	Insecta	Odonata	Corduliidae	*Macromia amphigena amphigena*	1
198	1	2012/10/15	D-BW-21	127	Insecta	Plecoptera	Perlidae	*Gibosia* sp.	1
199	1	2012/10/15	D-BW-21	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	3
200	1	2012/10/15	D-BW-21	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	34
201	1	2012/10/15	D-BW-21	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	864
202	1	2012/10/15	D-BW-21	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1
203	1	2012/10/15	D-BW-21	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	2
204	1	2012/10/15	D-BW-21	181	Insecta	Trichoptera	Leptoceridae	*Oecetis* sp.	65
205	1	2012/10/15	D-BW-21	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	3
206	1	2012/10/15	D-BW-21	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	156
207	1	2012/10/15	D-BW-21	200	Insecta	Diptera	Chironomidae	Tanypodinae	36
208	1	2012/10/15	D-BW-21	208	Insecta	Diptera	Chironomidae	*Prodiamesa* sp.	1
209	1	2012/10/15	D-BW-21	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	1
210	1	2012/10/15	D-BW-21	225	Insecta	Diptera	Chironomidae	*Rheocricotopus* sp.	5
211	1	2012/10/15	D-BW-21	233	Insecta	Diptera	Chironomidae	*Chironomus* sp.	37
212	1	2012/10/15	D-BW-21	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	2
213	1	2012/10/15	D-BW-21	239	Insecta	Diptera	Chironomidae	*Harnischia* sp.	1
214	1	2012/10/15	D-BW-21	240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.	2
215	1	2012/10/15	D-BW-21	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	202
216	1	2012/10/15	D-BW-21	245	Insecta	Diptera	Chironomidae	*Rheotanytarsus* sp.	163
217	1	2012/10/15	D-BW-21	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1
218	1	2012/10/15	D-BW-21	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	162
219	1	2012/10/15	D-BW-21	248	Insecta	Diptera	Chironomidae	Chironominae	64
220	1	2012/10/15	D-BW-21	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	4
221	1	2012/10/15	D-BW-21	262	Insecta	Diptera	Canacidae	Canacidae	1
222	1	2012/10/15	D-BW-21	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	45
223	1	2012/10/15	D-BW-21	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	32
224	1	2012/10/15	D-BW-21	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
225	1	2012/10/15	D-BW-3	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	10

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
226	1	2012/10/15	D-BW-3	49	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium nipponense*	10
227	1	2012/10/15	D-BW-3	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	8
228	1	2012/10/15	D-BW-3	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	1
229	1	2012/10/15	D-BW-3	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	8
230	1	2012/10/15	D-BW-3	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1
231	1	2012/10/15	D-BW-3	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1
232	1	2012/10/15	D-BW-3	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	8
233	1	2012/10/15	D-BW-3	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	20
234	1	2012/10/15	D-BW-3	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	42
235	1	2012/10/15	D-BW-3	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	1
236	1	2012/10/15	D-BW-3	233	Insecta	Diptera	Chironomidae	*Chironomus* sp.	1
237	1	2012/10/15	D-BW-3	234	Insecta	Diptera	Chironomidae	*Cladopelma* sp.	1
238	1	2012/10/15	D-BW-3	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	14
239	1	2012/10/15	D-BW-3	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	2
240	1	2012/10/15	D-BW-3	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	1
241	1	2012/10/15	D-BW-3	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1
242	1	2012/10/15	D-BW-3	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	102
243	1	2012/10/15	D-BW-3	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2
244	1	2012/10/15	D-SP-2	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	138
245	1	2012/10/15	D-SP-2	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	137
246	1	2012/10/15	D-SP-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	4
247	1	2012/10/15	D-SP-2	40	Malacostraca	Amphipoda	Lucioblividae	*Lucioblivio kozaensis*	2
248	1	2012/10/15	D-SP-2	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	13
249	1	2012/10/15	D-SP-2	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	6
250	1	2012/10/15	D-SP-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2
251	1	2012/10/15	D-SP-2	64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.	5
252	1	2012/10/15	D-SP-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	20
253	1	2012/10/15	D-SP-2	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	4
254	1	2012/10/15	D-SP-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	8
255	1	2012/10/15	D-SP-2	105	Insecta	Odonata	Gomphidae	*Davidius* sp.	1
256	1	2012/10/15	D-SP-2	107	Insecta	Odonata	Gomphidae	*Onychogomphus viridicostus*	1
257	1	2012/10/15	D-SP-2	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	2
258	1	2012/10/15	D-SP-2	111	Insecta	Odonata	Gomphidae	Gomphidae	1
259	1	2012/10/15	D-SP-2	112	Insecta	Odonata	Corduliidae	*Macromia amphigena amphigena*	1
260	1	2012/10/15	D-SP-2	127	Insecta	Plecoptera	Perlidae	*Gibosia* sp.	1
261	1	2012/10/15	D-SP-2	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
262	1	2012/10/15	D-SP-2	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	1
263	1	2012/10/15	D-SP-2	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	271
264	1	2012/10/15	D-SP-2	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	192
265	1	2012/10/15	D-SP-2	175	Insecta	Trichoptera	Calamoceratidae	*Anisocentropus kawamurai*	1
266	1	2012/10/15	D-SP-2	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	11
267	1	2012/10/15	D-SP-2	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	5
268	1	2012/10/15	D-SP-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
269	1	2012/10/15	D-SP-2	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	7
270	1	2012/10/15	D-SP-2	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	132
271	1	2012/10/15	D-SP-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	728
272	1	2012/10/15	D-SP-2	200	Insecta	Diptera	Chironomidae	Tanypodinae	2
273	1	2012/10/15	D-SP-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	128
274	1	2012/10/15	D-SP-2	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	1
275	1	2012/10/15	D-SP-2	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	67
276	1	2012/10/15	D-SP-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1
277	1	2012/10/15	D-SP-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	2
278	1	2012/10/15	D-SP-2	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	6
279	1	2012/10/15	D-SP-2	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	2
280	1	2012/10/15	D-SP-2	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	413
281	1	2012/10/15	D-SP-2	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	71
282	1	2012/10/15	D-SP-2	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	264
283	1	2012/10/15	D-SP-2	248	Insecta	Diptera	Chironomidae	Chironominae	65
284	1	2012/10/15	D-SP-2	258	Insecta	Diptera	Stratiomyidae	*Allognosta* sp.	1
285	1	2012/10/15	D-SP-2	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	5
286	1	2012/10/15	D-SP-2	263	Insecta	Diptera	Ephydridae	Ephydridae	7
287	1	2012/10/15	D-SP-2	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	5
288	1	2012/10/15	D-SP-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	466
289	1	2012/10/15	D-SP-2	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	1
290	1	2012/10/15	U-BW-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1
291	1	2012/10/15	U-BW-1	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	6
292	1	2012/10/15	U-BW-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	2
293	1	2012/10/15	U-BW-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	10
294	1	2012/10/15	U-BW-1	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	5
295	1	2012/10/15	U-BW-1	64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.	1
296	1	2012/10/15	U-BW-1	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	33
297	1	2012/10/15	U-BW-1	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	1
298	1	2012/10/15	U-BW-1	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	2
299	1	2012/10/15	U-BW-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	33
300	1	2012/10/15	U-BW-1	111	Insecta	Odonata	Gomphidae	Gomphidae	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
301	1	2012/10/15	U-BW-1	116	Insecta	Plecoptera	Leuctridae	Leuctridae	1
302	1	2012/10/15	U-BW-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	4
303	1	2012/10/15	U-BW-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2
304	1	2012/10/15	U-BW-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	100
305	1	2012/10/15	U-BW-1	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	32
306	1	2012/10/15	U-BW-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	208
307	1	2012/10/15	U-BW-1	197	Insecta	Diptera	Chironomidae	*Paramerina* sp.	3
308	1	2012/10/15	U-BW-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	1
309	1	2012/10/15	U-BW-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1
310	1	2012/10/15	U-BW-1	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	66
311	1	2012/10/15	U-BW-1	224	Insecta	Diptera	Chironomidae	*Psilometriocnemus* sp.	1
312	1	2012/10/15	U-BW-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	7
313	1	2012/10/15	U-BW-1	232	Insecta	Diptera	Chironomidae	*Benthalia* sp.	33
314	1	2012/10/15	U-BW-1	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	32
315	1	2012/10/15	U-BW-1	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1
316	1	2012/10/15	U-BW-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	37
317	1	2012/10/15	U-BW-1	253	Insecta	Diptera	Sciaridae	Sciaridae	33
318	1	2012/10/15	U-BW-1	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1
319	1	2012/10/15	U-BW-1	262	Insecta	Diptera	Canacidae	Canacidae	3
320	1	2012/10/15	U-BW-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	395
321	1	2012/10/15	U-BW-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	7
322	1	2012/10/15	U-Rf-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2
323	1	2012/10/15	U-Rf-1	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1
324	1	2012/10/15	U-Rf-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	70
325	1	2012/10/15	U-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	2
326	1	2012/10/15	U-Rf-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	1
327	1	2012/10/15	U-Rf-1	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	20
328	1	2012/10/15	U-Rf-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	2
329	1	2012/10/15	U-Rf-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1
330	1	2012/10/15	U-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	564
331	1	2012/10/15	U-Rf-1	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	1
332	1	2012/10/15	U-Rf-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	13
333	1	2012/10/15	U-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	439
334	1	2012/10/15	U-Rf-1	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	76
335	1	2012/10/15	U-Rf-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	10
336	1	2012/10/15	U-Rf-1	71	Insecta	Ephemeroptera	Heptageniidae	*Epeorus curvatulus*	1
337	1	2012/10/15	U-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	1
338	1	2012/10/15	U-Rf-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	16
339	1	2012/10/15	U-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	9
340	1	2012/10/15	U-Rf-1	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	41
341	1	2012/10/15	U-Rf-1	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	98
342	1	2012/10/15	U-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	2
343	1	2012/10/15	U-Rf-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1
344	1	2012/10/15	U-Rf-1	107	Insecta	Odonata	Gomphidae	*Onychogomphus viridicostus*	1
345	1	2012/10/15	U-Rf-1	126	Insecta	Plecoptera	Perlidae	*Xanthoneuria jouklii*	1
346	1	2012/10/15	U-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	4
347	1	2012/10/15	U-Rf-1	129	Insecta	Plecoptera	Perlidae	*Kamimuria uenoi*	1
348	1	2012/10/15	U-Rf-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	4
349	1	2012/10/15	U-Rf-1	133	Insecta	Plecoptera	Perlidae	*Oyamia cryptomeria*	1
350	1	2012/10/15	U-Rf-1	134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.	1
351	1	2012/10/15	U-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	167
352	1	2012/10/15	U-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	711
353	1	2012/10/15	U-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	8
354	1	2012/10/15	U-Rf-1	168	Insecta	Trichoptera	Glossosomatidae	*Padunia* sp.	17
355	1	2012/10/15	U-Rf-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	66
356	1	2012/10/15	U-Rf-1	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1
357	1	2012/10/15	U-Rf-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
358	1	2012/10/15	U-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	10
359	1	2012/10/15	U-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3
360	1	2012/10/15	U-Rf-1	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	1
361	1	2012/10/15	U-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	25
362	1	2012/10/15	U-Rf-1	196	Insecta	Diptera	Chironomidae	*Nilotanypus dubius*	1
363	1	2012/10/15	U-Rf-1	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	19
364	1	2012/10/15	U-Rf-1	200	Insecta	Diptera	Chironomidae	Tanypodinae	18
365	1	2012/10/15	U-Rf-1	205	Insecta	Diptera	Chironomidae	*Potthastia* sp.	1
366	1	2012/10/15	U-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	23
367	1	2012/10/15	U-Rf-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	12
368	1	2012/10/15	U-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1
369	1	2012/10/15	U-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	6
370	1	2012/10/15	U-Rf-1	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	1
371	1	2012/10/15	U-Rf-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	12
372	1	2012/10/15	U-Rf-1	240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.	1
373	1	2012/10/15	U-Rf-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	100
374	1	2012/10/15	U-Rf-1	248	Insecta	Diptera	Chironomidae	Chironominae	20
375	1	2012/10/15	U-Rf-1	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	4

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
376	1	2012/10/15	U-Rf-1	253	Insecta	Diptera	Sciaridae	Sciaridae	1
377	1	2012/10/15	U-Rf-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	6
378	1	2012/10/15	U-Rf-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	1
379	1	2012/10/15	U-Rf-1	280	Insecta	Coleoptera	Elmidae	*Zaitzevia awana*	1
380	1	2012/10/15	U-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2
381	1	2012/10/15	U-Rf-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
382	1	2012/10/15	U-Rf-1	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
383	1	2012/10/15	U-SP-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	32
384	1	2012/10/15	U-SP-1	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	240
385	1	2012/10/15	U-SP-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	32
386	1	2012/10/15	U-SP-1	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	17
387	1	2012/10/15	U-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	21
388	1	2012/10/15	U-SP-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	34
389	1	2012/10/15	U-SP-1	100	Insecta	Odonata	Calopterygidae	*Calopteryx cornelia*	1
390	1	2012/10/15	U-SP-1	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	1
391	1	2012/10/15	U-SP-1	112	Insecta	Odonata	Corduliidae	*Macromia amphigena amphigena*	2
392	1	2012/10/15	U-SP-1	113	Insecta	Odonata	Libellulidae	*Orthetrum albistylum speciosum*	1
393	1	2012/10/15	U-SP-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2
394	1	2012/10/15	U-SP-1	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	123
395	1	2012/10/15	U-SP-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	454
396	1	2012/10/15	U-SP-1	163	Insecta	Trichoptera	Polycentropodidae	*Plectrocnemia* sp.	1
397	1	2012/10/15	U-SP-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	19
398	1	2012/10/15	U-SP-1	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	2
399	1	2012/10/15	U-SP-1	182	Insecta	Trichoptera	Sericostomatidae	*Gumaga orientalis*	2
400	1	2012/10/15	U-SP-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
401	1	2012/10/15	U-SP-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
402	1	2012/10/15	U-SP-1	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	4
403	1	2012/10/15	U-SP-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	176
404	1	2012/10/15	U-SP-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	4
405	1	2012/10/15	U-SP-1	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	7
406	1	2012/10/15	U-SP-1	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	16
407	1	2012/10/15	U-SP-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	16
408	1	2012/10/15	U-SP-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	16
409	1	2012/10/15	U-SP-1	242	Insecta	Diptera	Chironomidae	*Paratendipes* sp.	1
410	1	2012/10/15	U-SP-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	1
411	1	2012/10/15	U-SP-1	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	35
412	1	2012/10/15	U-SP-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	33
413	1	2012/10/15	U-SP-1	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	3
414	1	2012/10/15	U-SP-1	263	Insecta	Diptera	Ephydridae	Ephydridae	48
415	1	2012/10/15	U-SP-1	264	Insecta	Coleoptera	Dytiscidae	*Allopachria flavomaculata*	1
416	1	2012/10/15	U-SP-1	270	Insecta	Coleoptera	Hydrophilidae	*Agraphydrus narusei*	7
417	1	2012/10/15	U-SP-1	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	40
418	1	2012/10/15	U-SP-1	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	16
419	1	2012/10/15	U-SP-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	61
420	1	2012/10/15	U-SP-1	275	Insecta	Coleoptera	Hydrophilidae	*Sternolophus rufipes*	1
421	1	2012/10/15	U-SP-1	277	Insecta	Coleoptera	Elmidae	*Grouvellinus* sp.	1
422	1	2012/10/15	U-SP-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	16
423	1	2012/10/15	U-SP-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
424	1	2012/10/15	U-SP-2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2
425	1	2012/10/15	U-SP-2	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	68
426	1	2012/10/15	U-SP-2	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1
427	1	2012/10/15	U-SP-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	68
428	1	2012/10/15	U-SP-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	5
429	1	2012/10/15	U-SP-2	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	1
430	1	2012/10/15	U-SP-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	5
431	1	2012/10/15	U-SP-2	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	3
432	1	2012/10/15	U-SP-2	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	5
433	1	2012/10/15	U-SP-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1
434	1	2012/10/15	U-SP-2	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1
435	1	2012/10/15	U-SP-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
436	1	2012/10/15	U-SP-2	188	Insecta	Diptera	Tipulidae	*Limnophila* sp.	1
437	1	2012/10/15	U-SP-2	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	260
438	1	2012/10/15	U-SP-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	79
439	1	2012/10/15	U-SP-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	65
440	1	2012/10/15	U-SP-2	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	194
441	1	2012/10/15	U-SP-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	1
442	1	2012/10/15	U-SP-2	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	40
443	1	2012/10/15	U-SP-2	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	2
444	1	2012/10/15	U-SP-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	231
445	1	2012/10/15	U-SP-2	280	Insecta	Coleoptera	Elmidae	*Zaitzevia awana*	1
446	1	2012/10/15	U-SP-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
447	1	2012/10/15	U-SP-2	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	33
448	1	2012/10/15	U-SP-3	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	65
449	1	2012/10/15	U-SP-3	15	Oligochaeta	Tubificida	Naididae	*Nais barbata*	8
450	1	2012/10/15	U-SP-3	25	Oligochaeta	Tubificida	Naididae	Naididae	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
451	1	2012/10/15	U-SP-3	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	26
452	1	2012/10/15	U-SP-3	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	14
453	1	2012/10/15	U-SP-3	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	29
454	1	2012/10/15	U-SP-3	84	Insecta	Ephemeroptera	Ephemeridae	*Ephemera* sp.	1
455	1	2012/10/15	U-SP-3	94	Insecta	Ephemeroptera	Ephemerellidae	*Ephemerella* sp.	1
456	1	2012/10/15	U-SP-3	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	56
457	1	2012/10/15	U-SP-3	103	Insecta	Odonata	Gomphidae	*Anisogomphus maacki*	2
458	1	2012/10/15	U-SP-3	105	Insecta	Odonata	Gomphidae	*Davidius* sp.	2
459	1	2012/10/15	U-SP-3	111	Insecta	Odonata	Gomphidae	Gomphidae	1
460	1	2012/10/15	U-SP-3	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	93
461	1	2012/10/15	U-SP-3	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	24
462	1	2012/10/15	U-SP-3	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	19
463	1	2012/10/15	U-SP-3	181	Insecta	Trichoptera	Leptoceridae	*Oecetis* sp.	2
464	1	2012/10/15	U-SP-3	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
465	1	2012/10/15	U-SP-3	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	74
466	1	2012/10/15	U-SP-3	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	97
467	1	2012/10/15	U-SP-3	196	Insecta	Diptera	Chironomidae	*Nilotanypus dubius*	3
468	1	2012/10/15	U-SP-3	200	Insecta	Diptera	Chironomidae	Tanypodinae	3
469	1	2012/10/15	U-SP-3	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	3
470	1	2012/10/15	U-SP-3	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	90
471	1	2012/10/15	U-SP-3	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	8
472	1	2012/10/15	U-SP-3	232	Insecta	Diptera	Chironomidae	*Benthalia* sp.	1
473	1	2012/10/15	U-SP-3	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	22
474	1	2012/10/15	U-SP-3	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	8
475	1	2012/10/15	U-SP-3	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	42
476	1	2012/10/15	U-SP-3	239	Insecta	Diptera	Chironomidae	*Harnischia* sp.	10
477	1	2012/10/15	U-SP-3	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	26
478	1	2012/10/15	U-SP-3	245	Insecta	Diptera	Chironomidae	*Rheotanytarsus* sp.	3
479	1	2012/10/15	U-SP-3	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	141
480	1	2012/10/15	U-SP-3	248	Insecta	Diptera	Chironomidae	Chironominae	25
481	1	2012/10/15	U-SP-3	261	Insecta	Diptera	Empididae	Empididae	8
482	1	2012/10/15	U-SP-3	262	Insecta	Diptera	Canacidae	Canacidae	5
483	1	2012/10/15	U-SP-3	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	69
484	1	2012/10/15	U-SP-3	279	Insecta	Coleoptera	Elmidae	*Stenelmis* sp.	1
485	1	2012/10/15	U-SP-3	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4
486	2	2012/11/17	D-BW-1	25	Oligochaeta	Tubificida	Naididae	Naididae	16
487	2	2012/11/17	D-BW-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32
488	2	2012/11/17	D-BW-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	6
489	2	2012/11/17	D-BW-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	106
490	2	2012/11/17	D-BW-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	12
491	2	2012/11/17	D-BW-1	115	Insecta	Plecoptera	Capniidae	Capniidae	18
492	2	2012/11/17	D-BW-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	68
493	2	2012/11/17	D-BW-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
494	2	2012/11/17	D-BW-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	32
495	2	2012/11/17	D-BW-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	3
496	2	2012/11/17	D-BW-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
497	2	2012/11/17	D-BW-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	1
498	2	2012/11/17	D-BW-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	17
499	2	2012/11/17	D-BW-1	200	Insecta	Diptera	Chironomidae	Tanypodinae	1
500	2	2012/11/17	D-BW-1	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	16
501	2	2012/11/17	D-BW-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	170
502	2	2012/11/17	D-BW-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	162
503	2	2012/11/17	D-BW-1	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	648
504	2	2012/11/17	D-BW-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	76
505	2	2012/11/17	D-BW-1	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	48
506	2	2012/11/17	D-BW-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	16
507	2	2012/11/17	D-BW-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	17
508	2	2012/11/17	D-BW-1	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	2
509	2	2012/11/17	D-BW-1	248	Insecta	Diptera	Chironomidae	Chironominae	17
510	2	2012/11/17	D-BW-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2
511	2	2012/11/17	D-BW-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	32
512	2	2012/11/17	D-BW-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	9
513	2	2012/11/17	D-BW-2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2
514	2	2012/11/17	D-BW-2	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	50
515	2	2012/11/17	D-BW-2	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	48
516	2	2012/11/17	D-BW-2	25	Oligochaeta	Tubificida	Naididae	Naididae	33
517	2	2012/11/17	D-BW-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	17
518	2	2012/11/17	D-BW-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2
519	2	2012/11/17	D-BW-2	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	3
520	2	2012/11/17	D-BW-2	64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.	1
521	2	2012/11/17	D-BW-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	5
522	2	2012/11/17	D-BW-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1
523	2	2012/11/17	D-BW-2	115	Insecta	Plecoptera	Capniidae	Capniidae	12
524	2	2012/11/17	D-BW-2	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	50
525	2	2012/11/17	D-BW-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
526	2	2012/11/17	D-BW-2	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1
527	2	2012/11/17	D-BW-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2
528	2	2012/11/17	D-BW-2	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	17
529	2	2012/11/17	D-BW-2	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	21
530	2	2012/11/17	D-BW-2	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	100
531	2	2012/11/17	D-BW-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	325
532	2	2012/11/17	D-BW-2	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	151
533	2	2012/11/17	D-BW-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	238
534	2	2012/11/17	D-BW-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	60
535	2	2012/11/17	D-BW-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	16
536	2	2012/11/17	D-BW-2	248	Insecta	Diptera	Chironomidae	Chironominae	1
537	2	2012/11/17	D-BW-2	261	Insecta	Diptera	Empididae	Empididae	16
538	2	2012/11/17	D-BW-2	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	1
539	2	2012/11/17	D-BW-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	9
540	2	2012/11/17	D-BW-2	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	1
541	2	2012/11/17	D-BW-2	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
542	2	2012/11/17	D-Rf-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1
543	2	2012/11/17	D-Rf-1	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	33
544	2	2012/11/17	D-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	142
545	2	2012/11/17	D-Rf-1	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	64
546	2	2012/11/17	D-Rf-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32
547	2	2012/11/17	D-Rf-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	5
548	2	2012/11/17	D-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	272
549	2	2012/11/17	D-Rf-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	35
550	2	2012/11/17	D-Rf-1	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	1
551	2	2012/11/17	D-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	69
552	2	2012/11/17	D-Rf-1	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	2
553	2	2012/11/17	D-Rf-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2
554	2	2012/11/17	D-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	7
555	2	2012/11/17	D-Rf-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	33
556	2	2012/11/17	D-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	92
557	2	2012/11/17	D-Rf-1	81	Insecta	Ephemeroptera	Ephemeridae	*Ephemera japonica*	1
558	2	2012/11/17	D-Rf-1	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	138
559	2	2012/11/17	D-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	129
560	2	2012/11/17	D-Rf-1	107	Insecta	Odonata	Gomphidae	*Onychogomphus viridicostus*	1
561	2	2012/11/17	D-Rf-1	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1
562	2	2012/11/17	D-Rf-1	115	Insecta	Plecoptera	Capniidae	Capniidae	32
563	2	2012/11/17	D-Rf-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	164
564	2	2012/11/17	D-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	3
565	2	2012/11/17	D-Rf-1	130	Insecta	Plecoptera	Perlidae	*Kamimuria* sp.	1
566	2	2012/11/17	D-Rf-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	8
567	2	2012/11/17	D-Rf-1	134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.	3
568	2	2012/11/17	D-Rf-1	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1
569	2	2012/11/17	D-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	108
570	2	2012/11/17	D-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	807
571	2	2012/11/17	D-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	4
572	2	2012/11/17	D-Rf-1	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	3
573	2	2012/11/17	D-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	71
574	2	2012/11/17	D-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3
575	2	2012/11/17	D-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	1
576	2	2012/11/17	D-Rf-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	364
577	2	2012/11/17	D-Rf-1	207	Insecta	Diptera	Chironomidae	Diamesinae	32
578	2	2012/11/17	D-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	110
579	2	2012/11/17	D-Rf-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	992
580	2	2012/11/17	D-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	496
581	2	2012/11/17	D-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	297
582	2	2012/11/17	D-Rf-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	3
583	2	2012/11/17	D-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	8
584	2	2012/11/17	D-Rf-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	65
585	2	2012/11/17	D-SP-1	25	Oligochaeta	Tubificida	Naididae	Naididae	1
586	2	2012/11/17	D-SP-1	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	32
587	2	2012/11/17	D-SP-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	2
588	2	2012/11/17	D-SP-1	40	Malacostraca	Amphipoda	Lucioblividae	*Lucioblivio kozaensis*	4
589	2	2012/11/17	D-SP-1	41	Malacostraca	Amphipoda	Pseudocrangonyctidae	*Pseudocrangonyx* sp.	3
590	2	2012/11/17	D-SP-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	14
591	2	2012/11/17	D-SP-1	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	1
592	2	2012/11/17	D-SP-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2
593	2	2012/11/17	D-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	38
594	2	2012/11/17	D-SP-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1
595	2	2012/11/17	D-SP-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	3
596	2	2012/11/17	D-SP-1	134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.	1
597	2	2012/11/17	D-SP-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	2
598	2	2012/11/17	D-SP-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1
599	2	2012/11/17	D-SP-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	2
600	2	2012/11/17	D-SP-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
601	2	2012/11/17	D-SP-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2
602	2	2012/11/17	D-SP-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
603	2	2012/11/17	D-SP-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	40
604	2	2012/11/17	D-SP-1	200	Insecta	Diptera	Chironomidae	Tanypodinae	2
605	2	2012/11/17	D-SP-1	208	Insecta	Diptera	Chironomidae	*Prodiamesa* sp.	5
606	2	2012/11/17	D-SP-1	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	100
607	2	2012/11/17	D-SP-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	276
608	2	2012/11/17	D-SP-1	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	33
609	2	2012/11/17	D-SP-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	68
610	2	2012/11/17	D-SP-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	35
611	2	2012/11/17	D-SP-1	239	Insecta	Diptera	Chironomidae	*Harnischia* sp.	2
612	2	2012/11/17	D-SP-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	32
613	2	2012/11/17	D-SP-1	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1
614	2	2012/11/17	D-SP-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1
615	2	2012/11/17	D-SP-1	248	Insecta	Diptera	Chironomidae	Chironominae	1
616	2	2012/11/17	D-SP-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	3
617	2	2012/11/17	D-SP-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2
618	2	2012/11/18	U-BW-1	12	Oligochaeta	Lumbriculida	Lumbriculidae	*Lumbriculus* sp.	1
619	2	2012/11/18	U-BW-1	25	Oligochaeta	Tubificida	Naididae	Naididae	36
620	2	2012/11/18	U-BW-1	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1
621	2	2012/11/18	U-BW-1	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1
622	2	2012/11/18	U-BW-1	64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.	2
623	2	2012/11/18	U-BW-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
624	2	2012/11/18	U-BW-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	591
625	2	2012/11/18	U-BW-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4
626	2	2012/11/18	U-BW-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
627	2	2012/11/18	U-BW-1	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	35
628	2	2012/11/18	U-BW-1	190	Insecta	Diptera	Tipulidae	*Rhabdomastix* sp.	1
629	2	2012/11/18	U-BW-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	2
630	2	2012/11/18	U-BW-1	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	1
631	2	2012/11/18	U-BW-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	79
632	2	2012/11/18	U-BW-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	96
633	2	2012/11/18	U-BW-1	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	4
634	2	2012/11/18	U-BW-1	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	1
635	2	2012/11/18	U-BW-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	121
636	2	2012/11/18	U-BW-1	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	33
637	2	2012/11/18	U-BW-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	8
638	2	2012/11/18	U-BW-1	232	Insecta	Diptera	Chironomidae	*Benthalia* sp.	3
639	2	2012/11/18	U-BW-1	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1
640	2	2012/11/18	U-BW-1	239	Insecta	Diptera	Chironomidae	*Harnischia* sp.	1
641	2	2012/11/18	U-BW-1	240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.	1
642	2	2012/11/18	U-BW-1	245	Insecta	Diptera	Chironomidae	*Rheotanytarsus* sp.	1
643	2	2012/11/18	U-BW-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	32
644	2	2012/11/18	U-BW-1	248	Insecta	Diptera	Chironomidae	Chironominae	32
645	2	2012/11/18	U-BW-1	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1
646	2	2012/11/18	U-BW-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	134
647	2	2012/11/18	U-BW-11	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	33
648	2	2012/11/18	U-BW-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	32
649	2	2012/11/18	U-BW-11	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
650	2	2012/11/18	U-BW-11	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1
651	2	2012/11/18	U-BW-11	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	2
652	2	2012/11/18	U-BW-11	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
653	2	2012/11/18	U-BW-11	105	Insecta	Odonata	Gomphidae	*Davidius* sp.	1
654	2	2012/11/18	U-BW-11	115	Insecta	Plecoptera	Capniidae	Capniidae	32
655	2	2012/11/18	U-BW-11	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	1
656	2	2012/11/18	U-BW-11	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
657	2	2012/11/18	U-BW-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	164
658	2	2012/11/18	U-BW-11	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	2
659	2	2012/11/18	U-BW-11	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	66
660	2	2012/11/18	U-BW-11	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1
661	2	2012/11/18	U-BW-11	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	1
662	2	2012/11/18	U-BW-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	6
663	2	2012/11/18	U-BW-11	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	4
664	2	2012/11/18	U-BW-11	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	33
665	2	2012/11/18	U-BW-11	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	1
666	2	2012/11/18	U-BW-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	4
667	2	2012/11/18	U-BW-11	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	35
668	2	2012/11/18	U-BW-11	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	66
669	2	2012/11/18	U-BW-11	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	68
670	2	2012/11/18	U-BW-11	219	Insecta	Diptera	Chironomidae	*Parachaetocladius* sp.	1
671	2	2012/11/18	U-BW-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	1
672	2	2012/11/18	U-BW-11	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	121
673	2	2012/11/18	U-BW-11	248	Insecta	Diptera	Chironomidae	Chironominae	1
674	2	2012/11/18	U-BW-11	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	3
675	2	2012/11/18	U-BW-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	139

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
676	2	2012/11/18	U-BW-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	101
677	2	2012/11/18	U-BW-11	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	98
678	2	2012/11/18	U-BW-11	288	Insecta	Coleoptera	Ptilodactylidae	*Epilichas* sp.	1
679	2	2012/11/18	U-Rf-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	19
680	2	2012/11/18	U-Rf-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	15
681	2	2012/11/18	U-Rf-1	15	Oligochaeta	Tubificida	Naididae	*Nais barbata*	118
682	2	2012/11/18	U-Rf-1	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	18
683	2	2012/11/18	U-Rf-1	25	Oligochaeta	Tubificida	Naididae	Naididae	3
684	2	2012/11/18	U-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	36
685	2	2012/11/18	U-Rf-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1
686	2	2012/11/18	U-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	57
687	2	2012/11/18	U-Rf-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	7
688	2	2012/11/18	U-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	8
689	2	2012/11/18	U-Rf-1	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	22
690	2	2012/11/18	U-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	2
691	2	2012/11/18	U-Rf-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	13
692	2	2012/11/18	U-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	62
693	2	2012/11/18	U-Rf-1	86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*	32
694	2	2012/11/18	U-Rf-1	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	26
695	2	2012/11/18	U-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	97
696	2	2012/11/18	U-Rf-1	115	Insecta	Plecoptera	Capniidae	Capniidae	37
697	2	2012/11/18	U-Rf-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	13
698	2	2012/11/18	U-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	1
699	2	2012/11/18	U-Rf-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2
700	2	2012/11/18	U-Rf-1	143	Insecta	Plecoptera	Perlodidae	Perlodidae	28
701	2	2012/11/18	U-Rf-1	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1
702	2	2012/11/18	U-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	80
703	2	2012/11/18	U-Rf-1	157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	16
704	2	2012/11/18	U-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	213
705	2	2012/11/18	U-Rf-1	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2
706	2	2012/11/18	U-Rf-1	178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	1
707	2	2012/11/18	U-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	49
708	2	2012/11/18	U-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
709	2	2012/11/18	U-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	1
710	2	2012/11/18	U-Rf-1	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	6
711	2	2012/11/18	U-Rf-1	205	Insecta	Diptera	Chironomidae	*Potthastia* sp.	1
712	2	2012/11/18	U-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	8
713	2	2012/11/18	U-Rf-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	25
714	2	2012/11/18	U-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	439
715	2	2012/11/18	U-Rf-1	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	3
716	2	2012/11/18	U-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	53
717	2	2012/11/18	U-Rf-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	1
718	2	2012/11/18	U-Rf-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2
719	2	2012/11/18	U-Rf-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	1
720	2	2012/11/18	U-Rf-1	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	1
721	2	2012/11/18	U-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3
722	2	2012/11/18	U-Rf-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
723	2	2012/11/18	U-Rf-2	26	Oligochaeta	Lumbricida	Lumbricidae	Lumbricidae	38
724	2	2012/11/18	U-Rf-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	3
725	2	2012/11/18	U-Rf-2	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1
726	2	2012/11/18	U-Rf-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1
727	2	2012/11/18	U-Rf-2	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	41
728	2	2012/11/18	U-Rf-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2
729	2	2012/11/18	U-Rf-2	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	5
730	2	2012/11/18	U-Rf-2	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	2
731	2	2012/11/18	U-Rf-2	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	2
732	2	2012/11/18	U-Rf-2	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	75
733	2	2012/11/18	U-Rf-2	86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*	2
734	2	2012/11/18	U-Rf-2	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	33
735	2	2012/11/18	U-Rf-2	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	460
736	2	2012/11/18	U-Rf-2	115	Insecta	Plecoptera	Capniidae	Capniidae	46
737	2	2012/11/18	U-Rf-2	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	38
738	2	2012/11/18	U-Rf-2	134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.	1
739	2	2012/11/18	U-Rf-2	143	Insecta	Plecoptera	Perlodidae	Perlodidae	8
740	2	2012/11/18	U-Rf-2	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	2
741	2	2012/11/18	U-Rf-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	142
742	2	2012/11/18	U-Rf-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	117
743	2	2012/11/18	U-Rf-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	5
744	2	2012/11/18	U-Rf-2	167	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche* sp.	1
745	2	2012/11/18	U-Rf-2	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2
746	2	2012/11/18	U-Rf-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	4
747	2	2012/11/18	U-Rf-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	4
748	2	2012/11/18	U-Rf-2	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	1
749	2	2012/11/18	U-Rf-2	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	37
750	2	2012/11/18	U-Rf-2	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	2

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
751	2	2012/11/18	U-Rf-2	207	Insecta	Diptera	Chironomidae	Diamesinae	1
752	2	2012/11/18	U-Rf-2	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	8
753	2	2012/11/18	U-Rf-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	322
754	2	2012/11/18	U-Rf-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	43
755	2	2012/11/18	U-Rf-2	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	2
756	2	2012/11/18	U-Rf-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	5
757	2	2012/11/18	U-Rf-2	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	66
758	2	2012/11/18	U-Rf-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	1
759	2	2012/11/18	U-Rf-2	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	1
760	2	2012/11/18	U-Rf-2	261	Insecta	Diptera	Empididae	Empididae	1
761	2	2012/11/18	U-Rf-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	1
762	2	2012/11/18	U-Rf-2	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	1
763	2	2012/11/18	U-Rf-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4
764	2	2012/11/18	U-Rf-2	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	6
765	2	2012/11/18	U-SP-1	25	Oligochaeta	Tubificida	Naididae	Naididae	3
766	2	2012/11/18	U-SP-1	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
767	2	2012/11/18	U-SP-1	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	1
768	2	2012/11/18	U-SP-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1
769	2	2012/11/18	U-SP-1	64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.	1
770	2	2012/11/18	U-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
771	2	2012/11/18	U-SP-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
772	2	2012/11/18	U-SP-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	656
773	2	2012/11/18	U-SP-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1
774	2	2012/11/18	U-SP-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3
775	2	2012/11/18	U-SP-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2
776	2	2012/11/18	U-SP-1	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	6
777	2	2012/11/18	U-SP-1	190	Insecta	Diptera	Tipulidae	*Rhabdomastix* sp.	2
778	2	2012/11/18	U-SP-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	1
779	2	2012/11/18	U-SP-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	5
780	2	2012/11/18	U-SP-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	390
781	2	2012/11/18	U-SP-1	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	3
782	2	2012/11/18	U-SP-1	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	128
783	2	2012/11/18	U-SP-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	72
784	2	2012/11/18	U-SP-1	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	1
785	2	2012/11/18	U-SP-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	3
786	2	2012/11/18	U-SP-1	232	Insecta	Diptera	Chironomidae	*Benthalia* sp.	3
787	2	2012/11/18	U-SP-1	233	Insecta	Diptera	Chironomidae	*Chironomus* sp.	1
788	2	2012/11/18	U-SP-1	253	Insecta	Diptera	Sciaridae	Sciaridae	1
789	2	2012/11/18	U-SP-1	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2
790	2	2012/11/18	U-SP-1	262	Insecta	Diptera	Canacidae	Canacidae	1
791	2	2012/11/18	U-SP-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	5
792	2	2012/11/18	U-SP-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	34
793	2	2012/11/18	U-SP-11	25	Oligochaeta	Tubificida	Naididae	Naididae	1
794	2	2012/11/18	U-SP-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	11
795	2	2012/11/18	U-SP-11	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	8
796	2	2012/11/18	U-SP-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	34
797	2	2012/11/18	U-SP-11	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1
798	2	2012/11/18	U-SP-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	38
799	2	2012/11/18	U-SP-11	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
800	2	2012/11/18	U-SP-11	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	17
801	2	2012/11/18	U-SP-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	9
802	2	2012/11/18	U-SP-11	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	52
803	2	2012/11/18	U-SP-11	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	256
804	2	2012/11/18	U-SP-11	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	19
805	2	2012/11/18	U-SP-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	16
806	2	2012/11/18	U-SP-11	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	8
807	2	2012/11/18	U-SP-11	253	Insecta	Diptera	Sciaridae	Sciaridae	8
808	2	2012/11/18	U-SP-11	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	35
809	2	2012/11/18	U-SP-11	263	Insecta	Diptera	Ephydridae	Ephydridae	9
810	2	2012/11/18	U-SP-11	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	6
811	2	2012/11/18	U-SP-11	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	7
812	2	2012/11/18	U-SP-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	149
813	3	2013/02/12	U-BW-11	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2
814	3	2013/02/12	U-BW-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1
815	3	2013/02/12	U-BW-11	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1
816	3	2013/02/12	U-BW-11	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	1
817	3	2013/02/12	U-BW-11	18	Oligochaeta	Tubificida	Naididae	*Nais pardalis*	66
818	3	2013/02/12	U-BW-11	20	Oligochaeta	Tubificida	Naididae	*Ophidonais serpentina*	1
819	3	2013/02/12	U-BW-11	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	8
820	3	2013/02/12	U-BW-11	23	Oligochaeta	Tubificida	Naididae	*Stylaria fossularis*	1
821	3	2013/02/12	U-BW-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	2
822	3	2013/02/12	U-BW-11	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	64
823	3	2013/02/12	U-BW-11	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	2
824	3	2013/02/12	U-BW-11	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	22
825	3	2013/02/12	U-BW-11	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
826	3	2013/02/12	U-BW-11	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	1384
827	3	2013/02/12	U-BW-11	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	4
828	3	2013/02/12	U-BW-11	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
829	3	2013/02/12	U-BW-11	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1
830	3	2013/02/12	U-BW-11	86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*	2
831	3	2013/02/12	U-BW-11	115	Insecta	Plecoptera	Capniidae	Capniidae	1
832	3	2013/02/12	U-BW-11	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	1
833	3	2013/02/12	U-BW-11	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	1
834	3	2013/02/12	U-BW-11	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
835	3	2013/02/12	U-BW-11	139	Insecta	Plecoptera	Perlodidae	*Ostrovus* sp.	1
836	3	2013/02/12	U-BW-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	3878
837	3	2013/02/12	U-BW-11	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	69
838	3	2013/02/12	U-BW-11	174	Insecta	Trichoptera	Apataniidae	*Apatania* sp.	69
839	3	2013/02/12	U-BW-11	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	2
840	3	2013/02/12	U-BW-11	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2
841	3	2013/02/12	U-BW-11	185	Insecta	Diptera	Tipulidae	*Dicranota* sp.	1
842	3	2013/02/12	U-BW-11	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	66
843	3	2013/02/12	U-BW-11	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	210
844	3	2013/02/12	U-BW-11	207	Insecta	Diptera	Chironomidae	Diamesinae	1
845	3	2013/02/12	U-BW-11	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	66
846	3	2013/02/12	U-BW-11	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	71
847	3	2013/02/12	U-BW-11	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	165
848	3	2013/02/12	U-BW-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	331
849	3	2013/02/12	U-BW-11	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	5
850	3	2013/02/12	U-BW-11	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	65
851	3	2013/02/12	U-BW-11	261	Insecta	Diptera	Empididae	Empididae	71
852	3	2013/02/12	U-BW-11	267	Insecta	Coleoptera	Dytiscidae	Colymbetinae	1
853	3	2013/02/12	U-BW-2	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	73
854	3	2013/02/12	U-BW-2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	74
855	3	2013/02/12	U-BW-2	6	Gastropoda	Basommatophora	Lymnaeidae	*Lymnaea truncatula*	1
856	3	2013/02/12	U-BW-2	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	265
857	3	2013/02/12	U-BW-2	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	1
858	3	2013/02/12	U-BW-2	17	Oligochaeta	Tubificida	Naididae	*Nais communis*	5
859	3	2013/02/12	U-BW-2	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	66
860	3	2013/02/12	U-BW-2	31	Hirudinea	Arhynchobdellida	Salifidae	Salifidae	1
861	3	2013/02/12	U-BW-2	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
862	3	2013/02/12	U-BW-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
863	3	2013/02/12	U-BW-2	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1
864	3	2013/02/12	U-BW-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	131
865	3	2013/02/12	U-BW-2	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	3
866	3	2013/02/12	U-BW-2	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	6
867	3	2013/02/12	U-BW-2	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	593
868	3	2013/02/12	U-BW-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	392
869	3	2013/02/12	U-BW-2	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	31
870	3	2013/02/12	U-BW-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	72
871	3	2013/02/12	U-BW-2	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	2
872	3	2013/02/12	U-BW-2	81	Insecta	Ephemeroptera	Ephemeridae	*Ephemera japonica*	1
873	3	2013/02/12	U-BW-2	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	1
874	3	2013/02/12	U-BW-2	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	3
875	3	2013/02/12	U-BW-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	129
876	3	2013/02/12	U-BW-2	115	Insecta	Plecoptera	Capniidae	Capniidae	1
877	3	2013/02/12	U-BW-2	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	5
878	3	2013/02/12	U-BW-2	124	Insecta	Plecoptera	Chloroperlidae	*Sweltsa* sp.	3
879	3	2013/02/12	U-BW-2	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	458
880	3	2013/02/12	U-BW-2	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	7
881	3	2013/02/12	U-BW-2	139	Insecta	Plecoptera	Perlodidae	*Ostrovus* sp.	6
882	3	2013/02/12	U-BW-2	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	65
883	3	2013/02/12	U-BW-2	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	74
884	3	2013/02/12	U-BW-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	8
885	3	2013/02/12	U-BW-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	2
886	3	2013/02/12	U-BW-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	1
887	3	2013/02/12	U-BW-2	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	143
888	3	2013/02/12	U-BW-2	174	Insecta	Trichoptera	Apataniidae	*Apatania* sp.	72
889	3	2013/02/12	U-BW-2	176	Insecta	Trichoptera	Goeridae	*Goera japonica*	2
890	3	2013/02/12	U-BW-2	178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	8
891	3	2013/02/12	U-BW-2	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1
892	3	2013/02/12	U-BW-2	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
893	3	2013/02/12	U-BW-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	996
894	3	2013/02/12	U-BW-2	185	Insecta	Diptera	Tipulidae	*Dicranota* sp.	2
895	3	2013/02/12	U-BW-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6
896	3	2013/02/12	U-BW-2	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	402
897	3	2013/02/12	U-BW-2	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	64
898	3	2013/02/12	U-BW-2	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	339
899	3	2013/02/12	U-BW-2	207	Insecta	Diptera	Chironomidae	Diamesinae	129
900	3	2013/02/12	U-BW-2	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	64

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
901	3	2013/02/12	U-BW-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2
902	3	2013/02/12	U-BW-2	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	1157
903	3	2013/02/12	U-BW-2	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	449
904	3	2013/02/12	U-BW-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	585
905	3	2013/02/12	U-BW-2	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	514
906	3	2013/02/12	U-BW-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	647
907	3	2013/02/12	U-BW-2	240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.	130
908	3	2013/02/12	U-BW-2	261	Insecta	Diptera	Empididae	Empididae	340
909	3	2013/02/12	U-BW-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	1
910	3	2013/02/12	U-BW-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	201
911	3	2013/02/12	U-Rf-1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	4
912	3	2013/02/12	U-Rf-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	89
913	3	2013/02/12	U-Rf-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	686
914	3	2013/02/12	U-Rf-1	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	66
915	3	2013/02/12	U-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
916	3	2013/02/12	U-Rf-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1
917	3	2013/02/12	U-Rf-1	51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*	1
918	3	2013/02/12	U-Rf-1	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	64
919	3	2013/02/12	U-Rf-1	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	3
920	3	2013/02/12	U-Rf-1	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	64
921	3	2013/02/12	U-Rf-1	72	Insecta	Ephemeroptera	Heptageniidae	*Epeorus ikanonis*	271
922	3	2013/02/12	U-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	136
923	3	2013/02/12	U-Rf-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	9
924	3	2013/02/12	U-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	272
925	3	2013/02/12	U-Rf-1	86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*	14
926	3	2013/02/12	U-Rf-1	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	2
927	3	2013/02/12	U-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1178
928	3	2013/02/12	U-Rf-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	64
929	3	2013/02/12	U-Rf-1	115	Insecta	Plecoptera	Capniidae	Capniidae	2
930	3	2013/02/12	U-Rf-1	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	1
931	3	2013/02/12	U-Rf-1	121	Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	3
932	3	2013/02/12	U-Rf-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	531
933	3	2013/02/12	U-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	13
934	3	2013/02/12	U-Rf-1	129	Insecta	Plecoptera	Perlidae	*Kamimuria uenoi*	1
935	3	2013/02/12	U-Rf-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	5
936	3	2013/02/12	U-Rf-1	134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.	2
937	3	2013/02/12	U-Rf-1	138	Insecta	Plecoptera	Perlodidae	*Isoperla* sp.	138
938	3	2013/02/12	U-Rf-1	139	Insecta	Plecoptera	Perlodidae	*Ostrovus* sp.	4
939	3	2013/02/12	U-Rf-1	140	Insecta	Plecoptera	Perlodidae	*Stavsolus japonicus*	3
940	3	2013/02/12	U-Rf-1	141	Insecta	Plecoptera	Perlodidae	*Stavsolus* sp.	1
941	3	2013/02/12	U-Rf-1	142	Insecta	Plecoptera	Perlodidae	*Tadamus* sp.	3
942	3	2013/02/12	U-Rf-1	143	Insecta	Plecoptera	Perlodidae	Perlodidae	3
943	3	2013/02/12	U-Rf-1	153	Insecta	Odonata	Corydalidae	*Protohermes grandis*	1
944	3	2013/02/12	U-Rf-1	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1
945	3	2013/02/12	U-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	497
946	3	2013/02/12	U-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1133
947	3	2013/02/12	U-Rf-1	160	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche setensis*	1
948	3	2013/02/12	U-Rf-1	164	Insecta	Trichoptera	Psychomyiidae	*Psychomyia* sp.	64
949	3	2013/02/12	U-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	17
950	3	2013/02/12	U-Rf-1	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2
951	3	2013/02/12	U-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	459
952	3	2013/02/12	U-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6
953	3	2013/02/12	U-Rf-1	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1
954	3	2013/02/12	U-Rf-1	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	84
955	3	2013/02/12	U-Rf-1	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	1
956	3	2013/02/12	U-Rf-1	204	Insecta	Diptera	Chironomidae	*Potthastia montium*	12
957	3	2013/02/12	U-Rf-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	2
958	3	2013/02/12	U-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	220
959	3	2013/02/12	U-Rf-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	9
960	3	2013/02/12	U-Rf-1	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	66
961	3	2013/02/12	U-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1244
962	3	2013/02/12	U-Rf-1	225	Insecta	Diptera	Chironomidae	*Rheocricotopus* sp.	1
963	3	2013/02/12	U-Rf-1	228	Insecta	Diptera	Chironomidae	*Synorthocladius* sp.	65
964	3	2013/02/12	U-Rf-1	230	Insecta	Diptera	Chironomidae	*Tvetenia* sp.	2
965	3	2013/02/12	U-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	17
966	3	2013/02/12	U-Rf-1	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	7
967	3	2013/02/12	U-Rf-1	254	Insecta	Diptera	Athericidae	*Asuragina caerulescens*	1
968	3	2013/02/12	U-Rf-1	261	Insecta	Diptera	Empididae	Empididae	6
969	3	2013/02/12	U-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4
970	3	2013/02/12	U-Rf-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
971	3	2013/02/12	U-Rf-2	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	37
972	3	2013/02/12	U-Rf-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	3
973	3	2013/02/12	U-Rf-2	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1
974	3	2013/02/12	U-Rf-2	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	1
975	3	2013/02/12	U-Rf-2	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
976	3	2013/02/12	U-Rf-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	3
977	3	2013/02/12	U-Rf-2	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	38
978	3	2013/02/12	U-Rf-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
979	3	2013/02/12	U-Rf-2	72	Insecta	Ephemeroptera	Heptageniidae	*Epeorus ikanonis*	201
980	3	2013/02/12	U-Rf-2	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	34
981	3	2013/02/12	U-Rf-2	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	36
982	3	2013/02/12	U-Rf-2	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	41
983	3	2013/02/12	U-Rf-2	86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*	13
984	3	2013/02/12	U-Rf-2	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	102
985	3	2013/02/12	U-Rf-2	115	Insecta	Plecoptera	Capniidae	Capniidae	9
986	3	2013/02/12	U-Rf-2	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	1
987	3	2013/02/12	U-Rf-2	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	104
988	3	2013/02/12	U-Rf-2	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	1
989	3	2013/02/12	U-Rf-2	132	Insecta	Plecoptera	Perlidae	*Oyamia lugubris*	1
990	3	2013/02/12	U-Rf-2	138	Insecta	Plecoptera	Perlodidae	*Isoperla* sp.	1
991	3	2013/02/12	U-Rf-2	139	Insecta	Plecoptera	Perlodidae	*Ostrovus* sp.	132
992	3	2013/02/12	U-Rf-2	140	Insecta	Plecoptera	Perlodidae	*Stavsolus japonicus*	2
993	3	2013/02/12	U-Rf-2	141	Insecta	Plecoptera	Perlodidae	*Stavsolus* sp.	2
994	3	2013/02/12	U-Rf-2	143	Insecta	Plecoptera	Perlodidae	Perlodidae	33
995	3	2013/02/12	U-Rf-2	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1
996	3	2013/02/12	U-Rf-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	8
997	3	2013/02/12	U-Rf-2	157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	2
998	3	2013/02/12	U-Rf-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	201
999	3	2013/02/12	U-Rf-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	15
1000	3	2013/02/12	U-Rf-2	167	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche* sp.	3
1001	3	2013/02/12	U-Rf-2	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2
1002	3	2013/02/12	U-Rf-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	85
1003	3	2013/02/12	U-Rf-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
1004	3	2013/02/12	U-Rf-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	4
1005	3	2013/02/12	U-Rf-2	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	5
1006	3	2013/02/12	U-Rf-2	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	1
1007	3	2013/02/12	U-Rf-2	207	Insecta	Diptera	Chironomidae	Diamesinae	1
1008	3	2013/02/12	U-Rf-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	658
1009	3	2013/02/12	U-Rf-2	224	Insecta	Diptera	Chironomidae	*Psilometriocnemus* sp.	3
1010	3	2013/02/12	U-Rf-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	4
1011	3	2013/02/12	U-Rf-2	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	2
1012	3	2013/02/12	U-Rf-2	261	Insecta	Diptera	Empididae	Empididae	4
1013	3	2013/02/12	U-Rf-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
1014	3	2013/02/12	U-SP-1	1	Hydrozoa	Anthomedusae	Hydridae	Hydridae	17
1015	3	2013/02/12	U-SP-1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	6
1016	3	2013/02/12	U-SP-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3
1017	3	2013/02/12	U-SP-1	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	15
1018	3	2013/02/12	U-SP-1	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	1
1019	3	2013/02/12	U-SP-1	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	1
1020	3	2013/02/12	U-SP-1	20	Oligochaeta	Tubificida	Naididae	*Ophidonais serpentina*	1
1021	3	2013/02/12	U-SP-1	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	32
1022	3	2013/02/12	U-SP-1	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	2
1023	3	2013/02/12	U-SP-1	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	8
1024	3	2013/02/12	U-SP-1	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1
1025	3	2013/02/12	U-SP-1	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	32
1026	3	2013/02/12	U-SP-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
1027	3	2013/02/12	U-SP-1	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	31
1028	3	2013/02/12	U-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	21
1029	3	2013/02/12	U-SP-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1
1030	3	2013/02/12	U-SP-1	105	Insecta	Odonata	Gomphidae	*Davidius* sp.	1
1031	3	2013/02/12	U-SP-1	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	1
1032	3	2013/02/12	U-SP-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	1
1033	3	2013/02/12	U-SP-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	13
1034	3	2013/02/12	U-SP-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	874
1035	3	2013/02/12	U-SP-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	62
1036	3	2013/02/12	U-SP-1	174	Insecta	Trichoptera	Apataniidae	*Apatania* sp.	1
1037	3	2013/02/12	U-SP-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4
1038	3	2013/02/12	U-SP-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	17
1039	3	2013/02/12	U-SP-1	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	8
1040	3	2013/02/12	U-SP-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	3
1041	3	2013/02/12	U-SP-1	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	1
1042	3	2013/02/12	U-SP-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2
1043	3	2013/02/12	U-SP-1	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	6
1044	3	2013/02/12	U-SP-1	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	1
1045	3	2013/02/12	U-SP-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	70
1046	3	2013/02/12	U-SP-1	228	Insecta	Diptera	Chironomidae	*Synorthocladius* sp.	1
1047	3	2013/02/12	U-SP-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	21
1048	3	2013/02/12	U-SP-1	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1
1049	3	2013/02/12	U-SP-1	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	18
1050	3	2013/02/12	U-SP-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	23

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1051	3	2013/02/12	U-SP-1	261	Insecta	Diptera	Empididae	Empididae	19
1052	3	2013/02/12	U-SP-11	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	44
1053	3	2013/02/12	U-SP-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	18
1054	3	2013/02/12	U-SP-11	13	Oligochaeta	Tubificida	Enchytraeidae	*Marionina* sp.	1
1055	3	2013/02/12	U-SP-11	17	Oligochaeta	Tubificida	Naididae	*Nais communis*	162
1056	3	2013/02/12	U-SP-11	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	130
1057	3	2013/02/12	U-SP-11	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	6
1058	3	2013/02/12	U-SP-11	141	Insecta	Plecoptera	Perlodidae	*Stavsolus* sp.	1
1059	3	2013/02/12	U-SP-11	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1
1060	3	2013/02/12	U-SP-11	176	Insecta	Trichoptera	Goeridae	*Goera japonica*	2
1061	3	2013/02/12	U-SP-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	10
1062	3	2013/02/12	U-SP-11	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
1063	3	2013/02/12	U-SP-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	55
1064	3	2013/02/12	U-SP-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	1
1065	3	2013/02/12	U-SP-11	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	11
1066	3	2013/02/12	U-SP-11	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	2
1067	3	2013/02/12	U-SP-11	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	153
1068	3	2013/02/12	U-SP-11	222	Insecta	Diptera	Chironomidae	*Paratrichocladius* sp.	3
1069	3	2013/02/12	U-SP-11	223	Insecta	Diptera	Chironomidae	*Pseudorthocladius* sp.	1
1070	3	2013/02/12	U-SP-11	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	5
1071	3	2013/02/12	U-SP-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	20
1072	3	2013/02/12	U-SP-11	239	Insecta	Diptera	Chironomidae	*Harnischia* sp.	2
1073	3	2013/02/12	U-SP-11	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	29
1074	3	2013/02/12	U-SP-11	261	Insecta	Diptera	Empididae	Empididae	52
1075	3	2013/02/12	U-SP-11	262	Insecta	Diptera	Canacidae	Canacidae	11
1076	3	2013/02/12	U-SP-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	5
1077	3	2013/02/12	U-SP-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	9
1078	4	2013/04/23	U-BW-2	13	Oligochaeta	Tubificida	Enchytraeidae	*Marionina* sp.	2
1079	4	2013/04/23	U-BW-2	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	1
1080	4	2013/04/23	U-BW-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
1081	4	2013/04/23	U-BW-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	4
1082	4	2013/04/23	U-BW-2	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	2
1083	4	2013/04/23	U-BW-2	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	2
1084	4	2013/04/23	U-BW-2	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	3
1085	4	2013/04/23	U-BW-2	49	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium nipponense*	1
1086	4	2013/04/23	U-BW-2	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	3
1087	4	2013/04/23	U-BW-2	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	5
1088	4	2013/04/23	U-BW-2	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1
1089	4	2013/04/23	U-BW-2	78	Insecta	Ephemeroptera	Siphlonuridae	*Siphlonurus* sp.	1
1090	4	2013/04/23	U-BW-2	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	2
1091	4	2013/04/23	U-BW-2	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	1
1092	4	2013/04/23	U-BW-2	122	Insecta	Plecoptera	Chloroperlidae	*Haploperla japonica*	11
1093	4	2013/04/23	U-BW-2	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
1094	4	2013/04/23	U-BW-2	138	Insecta	Plecoptera	Perlodidae	*Isoperla* sp.	1
1095	4	2013/04/23	U-BW-2	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	5
1096	4	2013/04/23	U-BW-2	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	261
1097	4	2013/04/23	U-BW-2	178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	1
1098	4	2013/04/23	U-BW-2	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1
1099	4	2013/04/23	U-BW-2	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	138
1100	4	2013/04/23	U-BW-2	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1
1101	4	2013/04/23	U-BW-2	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	3
1102	4	2013/04/23	U-BW-2	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	1
1103	4	2013/04/23	U-BW-2	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	2
1104	4	2013/04/23	U-BW-2	207	Insecta	Diptera	Chironomidae	Diamesinae	1
1105	4	2013/04/23	U-BW-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	263
1106	4	2013/04/23	U-BW-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	583
1107	4	2013/04/23	U-BW-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	132
1108	4	2013/04/23	U-BW-2	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	1
1109	4	2013/04/23	U-BW-2	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	2
1110	4	2013/04/23	U-BW-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	64
1111	4	2013/04/23	U-BW-2	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	64
1112	4	2013/04/23	U-BW-2	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2
1113	4	2013/04/23	U-BW-2	263	Insecta	Diptera	Ephydridae	Ephydridae	64
1114	4	2013/04/23	U-BW-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	1
1115	4	2013/04/23	U-Rf-2	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	133
1116	4	2013/04/23	U-Rf-2	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	1
1117	4	2013/04/23	U-Rf-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
1118	4	2013/04/23	U-Rf-2	67	Insecta	Ephemeroptera	Heptageniidae	*Cinygmula* sp.	1
1119	4	2013/04/23	U-Rf-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	64
1120	4	2013/04/23	U-Rf-2	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	69
1121	4	2013/04/23	U-Rf-2	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	4
1122	4	2013/04/23	U-Rf-2	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	4
1123	4	2013/04/23	U-Rf-2	88	Insecta	Ephemeroptera	Ephemerellidae	*Drunella ishiyamana*	1
1124	4	2013/04/23	U-Rf-2	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	137
1125	4	2013/04/23	U-Rf-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1126	4	2013/04/23	U-Rf-2	122	Insecta	Plecoptera	Chloroperlidae	*Haploperla japonica*	139
1127	4	2013/04/23	U-Rf-2	138	Insecta	Plecoptera	Perlodidae	*Isoperla* sp.	4
1128	4	2013/04/23	U-Rf-2	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	2
1129	4	2013/04/23	U-Rf-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	71
1130	4	2013/04/23	U-Rf-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	71
1131	4	2013/04/23	U-Rf-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	5
1132	4	2013/04/23	U-Rf-2	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	4
1133	4	2013/04/23	U-Rf-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	270
1134	4	2013/04/23	U-Rf-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
1135	4	2013/04/23	U-Rf-2	198	Insecta	Diptera	Chironomidae	*Rheopelopia* sp.	71
1136	4	2013/04/23	U-Rf-2	204	Insecta	Diptera	Chironomidae	*Potthastia montium*	1
1137	4	2013/04/23	U-Rf-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	198
1138	4	2013/04/23	U-Rf-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	463
1139	4	2013/04/23	U-Rf-2	223	Insecta	Diptera	Chironomidae	*Pseudorthocladius* sp.	1
1140	4	2013/04/23	U-Rf-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	130
1141	4	2013/04/23	U-Rf-2	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	2
1142	4	2013/04/23	U-Rf-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	129
1143	4	2013/04/23	U-Rf-2	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	73
1144	4	2013/04/23	U-Rf-2	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	1
1145	4	2013/04/23	U-Rf-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2
1146	5	2013/05/17	U-BW-11	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2
1147	5	2013/05/17	U-BW-11	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	1
1148	5	2013/05/17	U-BW-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	69
1149	5	2013/05/17	U-BW-11	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1
1150	5	2013/05/17	U-BW-11	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	160
1151	5	2013/05/17	U-BW-11	25	Oligochaeta	Tubificida	Naididae	Naididae	2
1152	5	2013/05/17	U-BW-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	32
1153	5	2013/05/17	U-BW-11	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
1154	5	2013/05/17	U-BW-11	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	66
1155	5	2013/05/17	U-BW-11	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	136
1156	5	2013/05/17	U-BW-11	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	3
1157	5	2013/05/17	U-BW-11	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	3
1158	5	2013/05/17	U-BW-11	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	10
1159	5	2013/05/17	U-BW-11	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	33
1160	5	2013/05/17	U-BW-11	64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.	4
1161	5	2013/05/17	U-BW-11	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	137
1162	5	2013/05/17	U-BW-11	78	Insecta	Ephemeroptera	Siphlonuridae	*Siphlonurus* sp.	1
1163	5	2013/05/17	U-BW-11	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	38
1164	5	2013/05/17	U-BW-11	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	7
1165	5	2013/05/17	U-BW-11	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	1
1166	5	2013/05/17	U-BW-11	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1
1167	5	2013/05/17	U-BW-11	88	Insecta	Ephemeroptera	Ephemerellidae	*Drunella ishiyamana*	3
1168	5	2013/05/17	U-BW-11	94	Insecta	Ephemeroptera	Ephemerellidae	*Ephemerella* sp.	5
1169	5	2013/05/17	U-BW-11	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	32
1170	5	2013/05/17	U-BW-11	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1
1171	5	2013/05/17	U-BW-11	116	Insecta	Plecoptera	Leuctridae	Leuctridae	2
1172	5	2013/05/17	U-BW-11	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	65
1173	5	2013/05/17	U-BW-11	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
1174	5	2013/05/17	U-BW-11	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
1175	5	2013/05/17	U-BW-11	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	2
1176	5	2013/05/17	U-BW-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	36
1177	5	2013/05/17	U-BW-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	439
1178	5	2013/05/17	U-BW-11	200	Insecta	Diptera	Chironomidae	Tanypodinae	36
1179	5	2013/05/17	U-BW-11	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	32
1180	5	2013/05/17	U-BW-11	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	1
1181	5	2013/05/17	U-BW-11	211	Insecta	Diptera	Chironomidae	*Corynoneura* sp.	32
1182	5	2013/05/17	U-BW-11	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	35
1183	5	2013/05/17	U-BW-11	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	64
1184	5	2013/05/17	U-BW-11	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	99
1185	5	2013/05/17	U-BW-11	224	Insecta	Diptera	Chironomidae	*Psilometriocnemus* sp.	2
1186	5	2013/05/17	U-BW-11	228	Insecta	Diptera	Chironomidae	*Synorthocladius* sp.	1
1187	5	2013/05/17	U-BW-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	34
1188	5	2013/05/17	U-BW-11	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	3
1189	5	2013/05/17	U-BW-11	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	2
1190	5	2013/05/17	U-BW-11	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	338
1191	5	2013/05/17	U-BW-11	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	67
1192	5	2013/05/17	U-BW-11	248	Insecta	Diptera	Chironomidae	Chironominae	64
1193	5	2013/05/17	U-BW-11	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	34
1194	5	2013/05/17	U-BW-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	37
1195	5	2013/05/17	U-BW-11	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	34
1196	5	2013/05/17	U-BW-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	7
1197	5	2013/05/17	U-BW-12	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	7
1198	5	2013/05/17	U-BW-12	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1
1199	5	2013/05/17	U-BW-12	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1
1200	5	2013/05/17	U-BW-12	19	Oligochaeta	Tubificida	Naididae	*Nais* sp.	2

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1201	5	2013/05/17	U-BW-12	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	66
1202	5	2013/05/17	U-BW-12	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1
1203	5	2013/05/17	U-BW-12	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	9
1204	5	2013/05/17	U-BW-12	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	2
1205	5	2013/05/17	U-BW-12	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1
1206	5	2013/05/17	U-BW-12	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	1
1207	5	2013/05/17	U-BW-12	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	1
1208	5	2013/05/17	U-BW-12	88	Insecta	Ephemeroptera	Ephemerellidae	*Drunella ishiyamana*	66
1209	5	2013/05/17	U-BW-12	90	Insecta	Ephemeroptera	Ephemerellidae	*Drunella* sp.	1
1210	5	2013/05/17	U-BW-12	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2
1211	5	2013/05/17	U-BW-12	116	Insecta	Plecoptera	Leuctridae	Leuctridae	2
1212	5	2013/05/17	U-BW-12	123	Insecta	Plecoptera	Chloroperlidae	*Suwallia* sp.	7
1213	5	2013/05/17	U-BW-12	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2
1214	5	2013/05/17	U-BW-12	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2
1215	5	2013/05/17	U-BW-12	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	781
1216	5	2013/05/17	U-BW-12	196	Insecta	Diptera	Chironomidae	*Nilotanypus dubius*	65
1217	5	2013/05/17	U-BW-12	200	Insecta	Diptera	Chironomidae	Tanypodinae	3
1218	5	2013/05/17	U-BW-12	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	66
1219	5	2013/05/17	U-BW-12	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	194
1220	5	2013/05/17	U-BW-12	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	2
1221	5	2013/05/17	U-BW-12	228	Insecta	Diptera	Chironomidae	*Synorthocladius* sp.	2
1222	5	2013/05/17	U-BW-12	231	Insecta	Diptera	Chironomidae	Orthocladiinae	1
1223	5	2013/05/17	U-BW-12	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	2
1224	5	2013/05/17	U-BW-12	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	3
1225	5	2013/05/17	U-BW-12	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
1226	5	2013/05/17	U-BW-12	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	196
1227	5	2013/05/17	U-BW-2	13	Oligochaeta	Tubificida	Enchytraeidae	*Marionina* sp.	66
1228	5	2013/05/17	U-BW-2	19	Oligochaeta	Tubificida	Naididae	*Nais* sp.	64
1229	5	2013/05/17	U-BW-2	24	Oligochaeta	Tubificida	Naididae	*Limnodrilus hoffmeisteri*	3
1230	5	2013/05/17	U-BW-2	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	2
1231	5	2013/05/17	U-BW-2	51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*	1
1232	5	2013/05/17	U-BW-2	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	773
1233	5	2013/05/17	U-BW-2	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	300
1234	5	2013/05/17	U-BW-2	78	Insecta	Ephemeroptera	Siphlonuridae	*Siphlonurus* sp.	3
1235	5	2013/05/17	U-BW-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2
1236	5	2013/05/17	U-BW-2	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	522
1237	5	2013/05/17	U-BW-2	167	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche* sp.	983
1238	5	2013/05/17	U-BW-2	174	Insecta	Trichoptera	Apataniidae	*Apatania* sp.	1
1239	5	2013/05/17	U-BW-2	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3
1240	5	2013/05/17	U-BW-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
1241	5	2013/05/17	U-BW-2	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	4
1242	5	2013/05/17	U-BW-2	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1
1243	5	2013/05/17	U-BW-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	67
1244	5	2013/05/17	U-BW-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	268
1245	5	2013/05/17	U-BW-2	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	1
1246	5	2013/05/17	U-BW-2	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	1
1247	5	2013/05/17	U-BW-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	329
1248	5	2013/05/17	U-BW-2	224	Insecta	Diptera	Chironomidae	*Psilometriocnemus* sp.	1
1249	5	2013/05/17	U-BW-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	69
1250	5	2013/05/17	U-BW-2	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	131
1251	5	2013/05/17	U-BW-2	240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.	64
1252	5	2013/05/17	U-BW-2	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	199
1253	5	2013/05/17	U-BW-2	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	4
1254	5	2013/05/17	U-BW-2	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	194
1255	5	2013/05/17	U-BW-2	248	Insecta	Diptera	Chironomidae	Chironominae	1
1256	5	2013/05/17	U-BW-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	1
1257	5	2013/05/17	U-BW-2	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
1258	5	2013/05/17	U-Rf-1	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1
1259	5	2013/05/17	U-Rf-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	64
1260	5	2013/05/17	U-Rf-1	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	198
1261	5	2013/05/17	U-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	67
1262	5	2013/05/17	U-Rf-1	34	Arachnida	Acarina	Spercontidae	*Sperchonopsis* sp.	1
1263	5	2013/05/17	U-Rf-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	67
1264	5	2013/05/17	U-Rf-1	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	66
1265	5	2013/05/17	U-Rf-1	51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*	1
1266	5	2013/05/17	U-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	1
1267	5	2013/05/17	U-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	2
1268	5	2013/05/17	U-Rf-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
1269	5	2013/05/17	U-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	7
1270	5	2013/05/17	U-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	5
1271	5	2013/05/17	U-Rf-1	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	328
1272	5	2013/05/17	U-Rf-1	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1
1273	5	2013/05/17	U-Rf-1	88	Insecta	Ephemeroptera	Ephemerellidae	*Drunella ishiyamana*	17
1274	5	2013/05/17	U-Rf-1	89	Insecta	Ephemeroptera	Ephemerellidae	*Drunella sachalinensis*	1
1275	5	2013/05/17	U-Rf-1	90	Insecta	Ephemeroptera	Ephemerellidae	*Drunella* sp.	2

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1276	5	2013/05/17	U-Rf-1	92	Insecta	Ephemeroptera	Ephemerellidae	*Ephemerella cornuta*	1
1277	5	2013/05/17	U-Rf-1	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	1
1278	5	2013/05/17	U-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	132
1279	5	2013/05/17	U-Rf-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2
1280	5	2013/05/17	U-Rf-1	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	2
1281	5	2013/05/17	U-Rf-1	116	Insecta	Plecoptera	Leuctridae	Leuctridae	1
1282	5	2013/05/17	U-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	2
1283	5	2013/05/17	U-Rf-1	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1
1284	5	2013/05/17	U-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	7
1285	5	2013/05/17	U-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	11
1286	5	2013/05/17	U-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	131
1287	5	2013/05/17	U-Rf-1	167	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche* sp.	69
1288	5	2013/05/17	U-Rf-1	178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	1
1289	5	2013/05/17	U-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	23
1290	5	2013/05/17	U-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3
1291	5	2013/05/17	U-Rf-1	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	3
1292	5	2013/05/17	U-Rf-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	64
1293	5	2013/05/17	U-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	360
1294	5	2013/05/17	U-Rf-1	196	Insecta	Diptera	Chironomidae	*Nilotanypus dubius*	65
1295	5	2013/05/17	U-Rf-1	200	Insecta	Diptera	Chironomidae	Tanypodinae	15
1296	5	2013/05/17	U-Rf-1	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	73
1297	5	2013/05/17	U-Rf-1	205	Insecta	Diptera	Chironomidae	*Potthastia* sp.	2
1298	5	2013/05/17	U-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	68
1299	5	2013/05/17	U-Rf-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	581
1300	5	2013/05/17	U-Rf-1	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	128
1301	5	2013/05/17	U-Rf-1	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	1
1302	5	2013/05/17	U-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	193
1303	5	2013/05/17	U-Rf-1	230	Insecta	Diptera	Chironomidae	*Tvetenia* sp.	66
1304	5	2013/05/17	U-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	77
1305	5	2013/05/17	U-Rf-1	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	1
1306	5	2013/05/17	U-Rf-1	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	7
1307	5	2013/05/17	U-Rf-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	262
1308	5	2013/05/17	U-Rf-1	248	Insecta	Diptera	Chironomidae	Chironominae	64
1309	5	2013/05/17	U-Rf-1	253	Insecta	Diptera	Sciaridae	Sciaridae	64
1310	5	2013/05/17	U-Rf-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2
1311	5	2013/05/17	U-Rf-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	4
1312	5	2013/05/17	U-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	70
1313	5	2013/05/17	U-Rf-1	283	Insecta	Coleoptera	Elmidae	*Zaitzeviaria gotoi*	1
1314	5	2013/05/17	U-Rf-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	4
1315	5	2013/05/17	U-Rf-2	14	Oligochaeta	Tubificida	Naididae	*Chaetogaster diaphanus*	128
1316	5	2013/05/17	U-Rf-2	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	256
1317	5	2013/05/17	U-Rf-2	17	Oligochaeta	Tubificida	Naididae	*Nais communis*	128
1318	5	2013/05/17	U-Rf-2	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	128
1319	5	2013/05/17	U-Rf-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	389
1320	5	2013/05/17	U-Rf-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	128
1321	5	2013/05/17	U-Rf-2	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	36
1322	5	2013/05/17	U-Rf-2	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	3
1323	5	2013/05/17	U-Rf-2	56	Insecta	Ephemeroptera	Baetidae	*Baetis sahoensis*	1
1324	5	2013/05/17	U-Rf-2	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	1
1325	5	2013/05/17	U-Rf-2	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	128
1326	5	2013/05/17	U-Rf-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
1327	5	2013/05/17	U-Rf-2	71	Insecta	Ephemeroptera	Heptageniidae	*Epeorus curvatulus*	1
1328	5	2013/05/17	U-Rf-2	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	2
1329	5	2013/05/17	U-Rf-2	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	266
1330	5	2013/05/17	U-Rf-2	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	1
1331	5	2013/05/17	U-Rf-2	88	Insecta	Ephemeroptera	Ephemerellidae	*Drunella ishiyamana*	2
1332	5	2013/05/17	U-Rf-2	90	Insecta	Ephemeroptera	Ephemerellidae	*Drunella* sp.	1
1333	5	2013/05/17	U-Rf-2	93	Insecta	Ephemeroptera	Ephemerellidae	*Ephemerella setigera*	1
1334	5	2013/05/17	U-Rf-2	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	1
1335	5	2013/05/17	U-Rf-2	123	Insecta	Plecoptera	Chloroperlidae	*Suwallia* sp.	2
1336	5	2013/05/17	U-Rf-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1
1337	5	2013/05/17	U-Rf-2	161	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche* sp.	256
1338	5	2013/05/17	U-Rf-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	136
1339	5	2013/05/17	U-Rf-2	167	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche* sp.	3
1340	5	2013/05/17	U-Rf-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	3
1341	5	2013/05/17	U-Rf-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	16
1342	5	2013/05/17	U-Rf-2	196	Insecta	Diptera	Chironomidae	*Nilotanypus dubius*	392
1343	5	2013/05/17	U-Rf-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	772
1344	5	2013/05/17	U-Rf-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	388
1345	5	2013/05/17	U-Rf-2	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	128
1346	5	2013/05/17	U-Rf-2	221	Insecta	Diptera	Chironomidae	*Parametriocnemus* sp.	1
1347	5	2013/05/17	U-Rf-2	230	Insecta	Diptera	Chironomidae	*Tvetenia* sp.	4
1348	5	2013/05/17	U-Rf-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	129
1349	5	2013/05/17	U-Rf-2	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	520
1350	5	2013/05/17	U-Rf-2	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	259

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1351	5	2013/05/17	U-Rf-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	8
1352	5	2013/05/17	U-Rf-2	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	3
1353	5	2013/05/17	U-Rf-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4
1354	5	2013/05/17	U-SP-1	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	232
1355	5	2013/05/17	U-SP-1	18	Oligochaeta	Tubificida	Naididae	*Nais pardalis*	32
1356	5	2013/05/17	U-SP-1	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	32
1357	5	2013/05/17	U-SP-1	25	Oligochaeta	Tubificida	Naididae	Naididae	64
1358	5	2013/05/17	U-SP-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	96
1359	5	2013/05/17	U-SP-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32
1360	5	2013/05/17	U-SP-1	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	39
1361	5	2013/05/17	U-SP-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	1
1362	5	2013/05/17	U-SP-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	129
1363	5	2013/05/17	U-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	39
1364	5	2013/05/17	U-SP-1	78	Insecta	Ephemeroptera	Siphlonuridae	*Siphlonurus* sp.	10
1365	5	2013/05/17	U-SP-1	81	Insecta	Ephemeroptera	Ephemeridae	*Ephemera japonica*	4
1366	5	2013/05/17	U-SP-1	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	1
1367	5	2013/05/17	U-SP-1	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	33
1368	5	2013/05/17	U-SP-1	94	Insecta	Ephemeroptera	Ephemerellidae	*Ephemerella* sp.	2
1369	5	2013/05/17	U-SP-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	132
1370	5	2013/05/17	U-SP-1	110	Insecta	Odonata	Gomphidae	*Stylogomphus suzukii*	1
1371	5	2013/05/17	U-SP-1	112	Insecta	Odonata	Corduliidae	*Macromia amphigena amphigena*	1
1372	5	2013/05/17	U-SP-1	116	Insecta	Plecoptera	Leuctridae	Leuctridae	32
1373	5	2013/05/17	U-SP-1	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	861
1374	5	2013/05/17	U-SP-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	448
1375	5	2013/05/17	U-SP-1	167	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche* sp.	2
1376	5	2013/05/17	U-SP-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	250
1377	5	2013/05/17	U-SP-1	178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	1
1378	5	2013/05/17	U-SP-1	182	Insecta	Trichoptera	Sericostomatidae	*Gumaga orientalis*	1
1379	5	2013/05/17	U-SP-1	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	36
1380	5	2013/05/17	U-SP-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	74
1381	5	2013/05/17	U-SP-1	200	Insecta	Diptera	Chironomidae	Tanypodinae	7
1382	5	2013/05/17	U-SP-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	34
1383	5	2013/05/17	U-SP-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	135
1384	5	2013/05/17	U-SP-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	32
1385	5	2013/05/17	U-SP-1	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1
1386	5	2013/05/17	U-SP-1	240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.	32
1387	5	2013/05/17	U-SP-1	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	3
1388	5	2013/05/17	U-SP-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	3
1389	5	2013/05/17	U-SP-1	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	4
1390	5	2013/05/17	U-SP-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1
1391	5	2013/05/17	U-SP-1	248	Insecta	Diptera	Chironomidae	Chironominae	2
1392	5	2013/05/17	U-SP-1	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	2
1393	5	2013/05/17	U-SP-1	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	36
1394	5	2013/05/17	U-SP-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	1
1395	5	2013/05/17	U-SP-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	34
1396	5	2013/05/17	U-SP-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	2
1397	5	2013/05/17	U-SP-11	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	57
1398	5	2013/05/17	U-SP-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	4
1399	5	2013/05/17	U-SP-11	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	16
1400	5	2013/05/17	U-SP-11	17	Oligochaeta	Tubificida	Naididae	*Nais communis*	259
1401	5	2013/05/17	U-SP-11	18	Oligochaeta	Tubificida	Naididae	*Nais pardalis*	440
1402	5	2013/05/17	U-SP-11	25	Oligochaeta	Tubificida	Naididae	Naididae	84
1403	5	2013/05/17	U-SP-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	2
1404	5	2013/05/17	U-SP-11	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	19
1405	5	2013/05/17	U-SP-11	78	Insecta	Ephemeroptera	Siphlonuridae	*Siphlonurus* sp.	11
1406	5	2013/05/17	U-SP-11	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	166
1407	5	2013/05/17	U-SP-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	96
1408	5	2013/05/17	U-SP-11	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	3
1409	5	2013/05/17	U-SP-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	18
1410	5	2013/05/17	U-SP-11	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
1411	5	2013/05/17	U-SP-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	42
1412	5	2013/05/17	U-SP-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	44
1413	5	2013/05/17	U-SP-11	200	Insecta	Diptera	Chironomidae	Tanypodinae	5
1414	5	2013/05/17	U-SP-11	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	14
1415	5	2013/05/17	U-SP-11	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	103
1416	5	2013/05/17	U-SP-11	217	Insecta	Diptera	Chironomidae	*Krenosmittia* sp.	48
1417	5	2013/05/17	U-SP-11	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	72
1418	5	2013/05/17	U-SP-11	224	Insecta	Diptera	Chironomidae	*Psilometriocnemus* sp.	1
1419	5	2013/05/17	U-SP-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	41
1420	5	2013/05/17	U-SP-11	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1
1421	5	2013/05/17	U-SP-11	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	34
1422	5	2013/05/17	U-SP-11	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	53
1423	5	2013/05/17	U-SP-11	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1
1424	5	2013/05/17	U-SP-11	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	99
1425	5	2013/05/17	U-SP-11	248	Insecta	Diptera	Chironomidae	Chironominae	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1426	5	2013/05/17	U-SP-11	253	Insecta	Diptera	Sciaridae	Sciaridae	1
1427	5	2013/05/17	U-SP-11	261	Insecta	Diptera	Empididae	Empididae	1
1428	5	2013/05/17	U-SP-11	263	Insecta	Diptera	Ephydridae	Ephydridae	32
1429	5	2013/05/17	U-SP-11	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	7
1430	5	2013/05/17	U-SP-11	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	7
1431	5	2013/05/17	U-SP-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	143
1432	5	2013/05/17	U-SP-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	24
1433	5	2013/05/17	U-SP-11	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
1434	6	2013/07/17	U-BW-11	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	65
1435	6	2013/07/17	U-BW-11	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	70
1436	6	2013/07/17	U-BW-11	5	Gastropoda	Basommatophora	Ancylidae	*Laevapex nipponica*	1
1437	6	2013/07/17	U-BW-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	141
1438	6	2013/07/17	U-BW-11	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	1
1439	6	2013/07/17	U-BW-11	11	Bivalvia	Veneroida	Corbiculidae	*Corbicula* sp.	1
1440	6	2013/07/17	U-BW-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
1441	6	2013/07/17	U-BW-11	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	3
1442	6	2013/07/17	U-BW-11	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	9
1443	6	2013/07/17	U-BW-11	60	Insecta	Ephemeroptera	Baetidae	*Cloeon* sp.	1
1444	6	2013/07/17	U-BW-11	61	Insecta	Ephemeroptera	Baetidae	*Labiobaetis atrebatinus orientalis*	64
1445	6	2013/07/17	U-BW-11	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
1446	6	2013/07/17	U-BW-11	80	Insecta	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia* sp.	16
1447	6	2013/07/17	U-BW-11	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	2
1448	6	2013/07/17	U-BW-11	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	209
1449	6	2013/07/17	U-BW-11	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	1
1450	6	2013/07/17	U-BW-11	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	211
1451	6	2013/07/17	U-BW-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	64
1452	6	2013/07/17	U-BW-11	176	Insecta	Trichoptera	Goeridae	*Goera japonica*	2
1453	6	2013/07/17	U-BW-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	7
1454	6	2013/07/17	U-BW-11	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	134
1455	6	2013/07/17	U-BW-11	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
1456	6	2013/07/17	U-BW-11	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	195
1457	6	2013/07/17	U-BW-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	790
1458	6	2013/07/17	U-BW-11	200	Insecta	Diptera	Chironomidae	Tanypodinae	3
1459	6	2013/07/17	U-BW-11	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	133
1460	6	2013/07/17	U-BW-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	1
1461	6	2013/07/17	U-BW-11	233	Insecta	Diptera	Chironomidae	*Chironomus* sp.	989
1462	6	2013/07/17	U-BW-11	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	64
1463	6	2013/07/17	U-BW-11	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	4
1464	6	2013/07/17	U-BW-11	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	386
1465	6	2013/07/17	U-BW-11	248	Insecta	Diptera	Chironomidae	Chironominae	5
1466	6	2013/07/17	U-BW-11	256	Insecta	Diptera	Athericidae	*Atrichops morimotoi*	1
1467	6	2013/07/17	U-BW-11	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	65
1468	6	2013/07/17	U-BW-11	270	Insecta	Coleoptera	Hydrophilidae	*Agraphydrus narusei*	1
1469	6	2013/07/17	U-BW-11	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	3
1470	6	2013/07/17	U-BW-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	985
1471	6	2013/07/17	U-BW-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	142
1472	6	2013/07/17	U-BW-11	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	195
1473	6	2013/07/17	U-BW-12	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	128
1474	6	2013/07/17	U-BW-12	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	256
1475	6	2013/07/17	U-BW-12	4	Gastropoda	Discopoda	Hydrobiidae	*Potamopyrgus antipodarum*	24
1476	6	2013/07/17	U-BW-12	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	8
1477	6	2013/07/17	U-BW-12	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	132
1478	6	2013/07/17	U-BW-12	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	131
1479	6	2013/07/17	U-BW-12	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
1480	6	2013/07/17	U-BW-12	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	5
1481	6	2013/07/17	U-BW-12	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	522
1482	6	2013/07/17	U-BW-12	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	3
1483	6	2013/07/17	U-BW-12	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	128
1484	6	2013/07/17	U-BW-12	41	Malacostraca	Amphipoda	Pseudocrangonyctidae	*Pseudocrangonyx* sp.	129
1485	6	2013/07/17	U-BW-12	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	396
1486	6	2013/07/17	U-BW-12	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	3082
1487	6	2013/07/17	U-BW-12	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	3
1488	6	2013/07/17	U-BW-12	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1560
1489	6	2013/07/17	U-BW-12	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	1
1490	6	2013/07/17	U-BW-12	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	789
1491	6	2013/07/17	U-BW-12	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	129
1492	6	2013/07/17	U-BW-12	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1
1493	6	2013/07/17	U-BW-12	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	3
1494	6	2013/07/17	U-BW-12	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	8
1495	6	2013/07/17	U-BW-12	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	135
1496	6	2013/07/17	U-BW-12	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	5
1497	6	2013/07/17	U-BW-12	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	128
1498	6	2013/07/17	U-BW-12	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	1
1499	6	2013/07/17	U-BW-12	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	1
1500	6	2013/07/17	U-BW-12	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1501	6	2013/07/17	U-BW-12	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	133
1502	6	2013/07/17	U-BW-12	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	7
1503	6	2013/07/17	U-BW-12	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	1167
1504	6	2013/07/17	U-BW-12	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	131
1505	6	2013/07/17	U-BW-12	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	3
1506	6	2013/07/17	U-BW-12	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	128
1507	6	2013/07/17	U-BW-12	253	Insecta	Diptera	Sciaridae	Sciaridae	1
1508	6	2013/07/17	U-BW-12	254	Insecta	Diptera	Athericidae	*Asuragina caerulescens*	1
1509	6	2013/07/17	U-BW-12	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	128
1510	6	2013/07/17	U-BW-12	270	Insecta	Coleoptera	Hydrophilidae	*Agraphydrus narusei*	2
1511	6	2013/07/17	U-BW-12	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	1
1512	6	2013/07/17	U-BW-12	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	524
1513	6	2013/07/17	U-BW-12	279	Insecta	Coleoptera	Elmidae	*Stenelmis* sp.	7
1514	6	2013/07/17	U-BW-12	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3
1515	6	2013/07/17	U-BW-12	283	Insecta	Coleoptera	Elmidae	*Zaitzeviaria gotoi*	1
1516	6	2013/07/17	U-BW-12	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	386
1517	6	2013/07/17	U-BW-12	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
1518	6	2013/07/17	U-BW-2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3
1519	6	2013/07/17	U-BW-2	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	3
1520	6	2013/07/17	U-BW-2	12	Oligochaeta	Lumbriculida	Lumbriculidae	*Lumbriculus* sp.	67
1521	6	2013/07/17	U-BW-2	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	128
1522	6	2013/07/17	U-BW-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
1523	6	2013/07/17	U-BW-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	132
1524	6	2013/07/17	U-BW-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
1525	6	2013/07/17	U-BW-2	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	76
1526	6	2013/07/17	U-BW-2	83	Insecta	Ephemeroptera	Ephemeridae	*Ephemera strigata*	1
1527	6	2013/07/17	U-BW-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	588
1528	6	2013/07/17	U-BW-2	147	Insecta	Hemiptera	Gerridae	Gerrinae	2
1529	6	2013/07/17	U-BW-2	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	2030
1530	6	2013/07/17	U-BW-2	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	3136
1531	6	2013/07/17	U-BW-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1
1532	6	2013/07/17	U-BW-2	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	196
1533	6	2013/07/17	U-BW-2	189	Insecta	Diptera	Tipulidae	*Ormosia* sp.	5
1534	6	2013/07/17	U-BW-2	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	3
1535	6	2013/07/17	U-BW-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	148
1536	6	2013/07/17	U-BW-2	200	Insecta	Diptera	Chironomidae	Tanypodinae	2
1537	6	2013/07/17	U-BW-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	70
1538	6	2013/07/17	U-BW-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	2
1539	6	2013/07/17	U-BW-2	235	Insecta	Diptera	Chironomidae	*Cladotanytarsus* sp.	128
1540	6	2013/07/17	U-BW-2	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	66
1541	6	2013/07/17	U-BW-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	67
1542	6	2013/07/17	U-BW-2	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1
1543	6	2013/07/17	U-BW-2	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	405
1544	6	2013/07/17	U-BW-2	248	Insecta	Diptera	Chironomidae	Chironominae	137
1545	6	2013/07/17	U-BW-2	253	Insecta	Diptera	Sciaridae	Sciaridae	1
1546	6	2013/07/17	U-BW-2	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	3
1547	6	2013/07/17	U-BW-2	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	11
1548	6	2013/07/17	U-BW-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	338
1549	6	2013/07/17	U-BW-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
1550	6	2013/07/17	U-Rf-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	8
1551	6	2013/07/17	U-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	69
1552	6	2013/07/17	U-Rf-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	65
1553	6	2013/07/17	U-Rf-1	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	2
1554	6	2013/07/17	U-Rf-1	40	Malacostraca	Amphipoda	Lucioblividae	*Lucioblivio kozaensis*	1
1555	6	2013/07/17	U-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	367
1556	6	2013/07/17	U-Rf-1	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	4
1557	6	2013/07/17	U-Rf-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	67
1558	6	2013/07/17	U-Rf-1	59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J	3
1559	6	2013/07/17	U-Rf-1	62	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis chocoratus*	1
1560	6	2013/07/17	U-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	465
1561	6	2013/07/17	U-Rf-1	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	68
1562	6	2013/07/17	U-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	134
1563	6	2013/07/17	U-Rf-1	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	232
1564	6	2013/07/17	U-Rf-1	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1
1565	6	2013/07/17	U-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	353
1566	6	2013/07/17	U-Rf-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	5
1567	6	2013/07/17	U-Rf-1	107	Insecta	Odonata	Gomphidae	*Onychogomphus viridicostus*	1
1568	6	2013/07/17	U-Rf-1	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1
1569	6	2013/07/17	U-Rf-1	136	Insecta	Plecoptera	Perlidae	Perlidae	1
1570	6	2013/07/17	U-Rf-1	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	3
1571	6	2013/07/17	U-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	154
1572	6	2013/07/17	U-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	240
1573	6	2013/07/17	U-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	148
1574	6	2013/07/17	U-Rf-1	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2
1575	6	2013/07/17	U-Rf-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	2

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1576	6	2013/07/17	U-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	16
1577	6	2013/07/17	U-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	8
1578	6	2013/07/17	U-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	284
1579	6	2013/07/17	U-Rf-1	200	Insecta	Diptera	Chironomidae	Tanypodinae	3
1580	6	2013/07/17	U-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	2
1581	6	2013/07/17	U-Rf-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	74
1582	6	2013/07/17	U-Rf-1	230	Insecta	Diptera	Chironomidae	*Tvetenia* sp.	1
1583	6	2013/07/17	U-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	66
1584	6	2013/07/17	U-Rf-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	1
1585	6	2013/07/17	U-Rf-1	243	Insecta	Diptera	Chironomidae	*Polypedilum kamotertium*	1
1586	6	2013/07/17	U-Rf-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	71
1587	6	2013/07/17	U-Rf-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	66
1588	6	2013/07/17	U-Rf-1	248	Insecta	Diptera	Chironomidae	Chironominae	1
1589	6	2013/07/17	U-Rf-1	256	Insecta	Diptera	Athericidae	*Atrichops morimotoi*	1
1590	6	2013/07/17	U-Rf-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	7
1591	6	2013/07/17	U-Rf-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	2
1592	6	2013/07/17	U-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	78
1593	6	2013/07/17	U-Rf-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
1594	6	2013/07/17	U-Rf-2	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	38
1595	6	2013/07/17	U-Rf-2	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	1065
1596	6	2013/07/17	U-Rf-2	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	97
1597	6	2013/07/17	U-Rf-2	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	33
1598	6	2013/07/17	U-Rf-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
1599	6	2013/07/17	U-Rf-2	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	160
1600	6	2013/07/17	U-Rf-2	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	33
1601	6	2013/07/17	U-Rf-2	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	3
1602	6	2013/07/17	U-Rf-2	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	2
1603	6	2013/07/17	U-Rf-2	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	136
1604	6	2013/07/17	U-Rf-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	32
1605	6	2013/07/17	U-Rf-2	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	65
1606	6	2013/07/17	U-Rf-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	487
1607	6	2013/07/17	U-Rf-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	362
1608	6	2013/07/17	U-Rf-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	342
1609	6	2013/07/17	U-Rf-2	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	35
1610	6	2013/07/17	U-Rf-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	39
1611	6	2013/07/17	U-Rf-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6
1612	6	2013/07/17	U-Rf-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	233
1613	6	2013/07/17	U-Rf-2	200	Insecta	Diptera	Chironomidae	Tanypodinae	32
1614	6	2013/07/17	U-Rf-2	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	48
1615	6	2013/07/17	U-Rf-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	96
1616	6	2013/07/17	U-Rf-2	225	Insecta	Diptera	Chironomidae	*Rheocricotopus* sp.	32
1617	6	2013/07/17	U-Rf-2	230	Insecta	Diptera	Chironomidae	*Tvetenia* sp.	129
1618	6	2013/07/17	U-Rf-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	96
1619	6	2013/07/17	U-Rf-2	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	33
1620	6	2013/07/17	U-Rf-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	448
1621	6	2013/07/17	U-Rf-2	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	32
1622	6	2013/07/17	U-Rf-2	248	Insecta	Diptera	Chironomidae	Chironominae	64
1623	6	2013/07/17	U-Rf-2	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2
1624	6	2013/07/17	U-Rf-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	6
1625	6	2013/07/17	U-Rf-2	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	35
1626	6	2013/07/17	U-Rf-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4
1627	6	2013/07/17	U-Rf-2	283	Insecta	Coleoptera	Elmidae	*Zaitzeviaria gotoi*	1
1628	6	2013/07/17	U-Rf-2	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
1629	6	2013/07/17	U-Rf-2	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
1630	6	2013/07/17	U-SP-1	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	45
1631	6	2013/07/17	U-SP-1	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	2
1632	6	2013/07/17	U-SP-1	28	Hirudinea	Rhynchobdellida	Glossiphoniidae	*Alboglossiphonia lata*	1
1633	6	2013/07/17	U-SP-1	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1
1634	6	2013/07/17	U-SP-1	98	Insecta	Odonata	Agrionidae	*Ischnura* sp.	1
1635	6	2013/07/17	U-SP-1	114	Insecta	Odonata	Libellulidae	*Sympetrum* sp.	2
1636	6	2013/07/17	U-SP-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	651
1637	6	2013/07/17	U-SP-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
1638	6	2013/07/17	U-SP-1	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2
1639	6	2013/07/17	U-SP-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	2
1640	6	2013/07/17	U-SP-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	65
1641	6	2013/07/17	U-SP-1	233	Insecta	Diptera	Chironomidae	*Chironomus* sp.	419
1642	6	2013/07/17	U-SP-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	195
1643	6	2013/07/17	U-SP-1	265	Insecta	Coleoptera	Dytiscidae	*Hydroglyphus japonicus*	1
1644	6	2013/07/17	U-SP-1	269	Insecta	Coleoptera	Hydraenidae	*Ochthebius hasegawai*	1
1645	6	2013/07/17	U-SP-1	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	2
1646	6	2013/07/17	U-SP-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	73
1647	6	2013/07/17	U-SP-1	279	Insecta	Coleoptera	Elmidae	*Stenelmis* sp.	1
1648	6	2013/07/17	U-SP-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	6
1649	6	2013/07/17	U-SP-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
1650	6	2013/07/17	U-SP-11	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1651	6	2013/07/17	U-SP-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1948
1652	6	2013/07/17	U-SP-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
1653	6	2013/07/17	U-SP-11	60	Insecta	Ephemeroptera	Baetidae	*Cloeon* sp.	1
1654	6	2013/07/17	U-SP-11	98	Insecta	Odonata	Agrionidae	*Ischnura* sp.	7
1655	6	2013/07/17	U-SP-11	145	Insecta	Hemiptera	Gerridae	*Gerris latiabdominis*	2
1656	6	2013/07/17	U-SP-11	146	Insecta	Hemiptera	Gerridae	*Gerris* sp.	5
1657	6	2013/07/17	U-SP-11	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	2860
1658	6	2013/07/17	U-SP-11	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	15
1659	6	2013/07/17	U-SP-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	150
1660	6	2013/07/17	U-SP-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2
1661	6	2013/07/17	U-SP-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	278
1662	6	2013/07/17	U-SP-11	200	Insecta	Diptera	Chironomidae	Tanypodinae	4
1663	6	2013/07/17	U-SP-11	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	4
1664	6	2013/07/17	U-SP-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	1
1665	6	2013/07/17	U-SP-11	233	Insecta	Diptera	Chironomidae	*Chironomus* sp.	285
1666	6	2013/07/17	U-SP-11	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1
1667	6	2013/07/17	U-SP-11	248	Insecta	Diptera	Chironomidae	Chironominae	1
1668	6	2013/07/17	U-SP-11	253	Insecta	Diptera	Sciaridae	Sciaridae	1
1669	6	2013/07/17	U-SP-11	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1
1670	6	2013/07/17	U-SP-11	262	Insecta	Diptera	Canacidae	Canacidae	135
1671	6	2013/07/17	U-SP-11	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	8
1672	6	2013/07/17	U-SP-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	284
1673	6	2013/07/17	U-SP-11	279	Insecta	Coleoptera	Elmidae	*Stenelmis* sp.	1
1674	6	2013/07/17	U-SP-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
1675	6	2013/07/17	U-SP-11	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	4
1676	7	2013/08/30	U-BW-11	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	8
1677	7	2013/08/30	U-BW-11	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	692
1678	7	2013/08/30	U-BW-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	342
1679	7	2013/08/30	U-BW-11	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	2
1680	7	2013/08/30	U-BW-11	19	Oligochaeta	Tubificida	Naididae	*Nais* sp.	96
1681	7	2013/08/30	U-BW-11	25	Oligochaeta	Tubificida	Naididae	Naididae	1
1682	7	2013/08/30	U-BW-11	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	64
1683	7	2013/08/30	U-BW-11	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32
1684	7	2013/08/30	U-BW-11	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	2
1685	7	2013/08/30	U-BW-11	60	Insecta	Ephemeroptera	Baetidae	*Cloeon* sp.	1
1686	7	2013/08/30	U-BW-11	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1
1687	7	2013/08/30	U-BW-11	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	142
1688	7	2013/08/30	U-BW-11	98	Insecta	Odonata	Agrionidae	*Ischnura* sp.	4
1689	7	2013/08/30	U-BW-11	113	Insecta	Odonata	Libellulidae	*Orthetrum albistylum speciosum*	1
1690	7	2013/08/30	U-BW-11	147	Insecta	Hemiptera	Gerridae	Gerrinae	1
1691	7	2013/08/30	U-BW-11	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	70
1692	7	2013/08/30	U-BW-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	759
1693	7	2013/08/30	U-BW-11	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	143
1694	7	2013/08/30	U-BW-11	157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	36
1695	7	2013/08/30	U-BW-11	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	2
1696	7	2013/08/30	U-BW-11	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	5
1697	7	2013/08/30	U-BW-11	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1
1698	7	2013/08/30	U-BW-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	2
1699	7	2013/08/30	U-BW-11	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	6
1700	7	2013/08/30	U-BW-11	186	Insecta	Diptera	Tipulidae	*Erioptera* sp.	1
1701	7	2013/08/30	U-BW-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1
1702	7	2013/08/30	U-BW-11	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	34
1703	7	2013/08/30	U-BW-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	4
1704	7	2013/08/30	U-BW-11	222	Insecta	Diptera	Chironomidae	*Paratrichocladius* sp.	1
1705	7	2013/08/30	U-BW-11	233	Insecta	Diptera	Chironomidae	*Chironomus* sp.	134
1706	7	2013/08/30	U-BW-11	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	162
1707	7	2013/08/30	U-BW-11	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	119
1708	7	2013/08/30	U-BW-11	248	Insecta	Diptera	Chironomidae	Chironominae	7
1709	7	2013/08/30	U-BW-11	254	Insecta	Diptera	Athericidae	*Asuragina caerulescens*	1
1710	7	2013/08/30	U-BW-11	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	34
1711	7	2013/08/30	U-BW-11	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	2
1712	7	2013/08/30	U-BW-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	87
1713	7	2013/08/30	U-BW-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	14
1714	7	2013/08/30	U-BW-11	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
1715	7	2013/08/30	U-BW-12	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	169
1716	7	2013/08/30	U-BW-12	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	33
1717	7	2013/08/30	U-BW-12	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	891
1718	7	2013/08/30	U-BW-12	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	1
1719	7	2013/08/30	U-BW-12	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	64
1720	7	2013/08/30	U-BW-12	17	Oligochaeta	Tubificida	Naididae	*Nais communis*	2
1721	7	2013/08/30	U-BW-12	30	Hirudinea	Arhynchobdellida	Erpobdellidae	Erpobdellidae	3
1722	7	2013/08/30	U-BW-12	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	32
1723	7	2013/08/30	U-BW-12	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	6
1724	7	2013/08/30	U-BW-12	44	Malacostraca	Isopoda	Asellidae	Asellidae	2
1725	7	2013/08/30	U-BW-12	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1726	7	2013/08/30	U-BW-12	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1
1727	7	2013/08/30	U-BW-12	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	3
1728	7	2013/08/30	U-BW-12	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	3
1729	7	2013/08/30	U-BW-12	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	16
1730	7	2013/08/30	U-BW-12	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	4
1731	7	2013/08/30	U-BW-12	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	146
1732	7	2013/08/30	U-BW-12	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	399
1733	7	2013/08/30	U-BW-12	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	109
1734	7	2013/08/30	U-BW-12	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1
1735	7	2013/08/30	U-BW-12	157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	1
1736	7	2013/08/30	U-BW-12	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1
1737	7	2013/08/30	U-BW-12	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	8
1738	7	2013/08/30	U-BW-12	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	36
1739	7	2013/08/30	U-BW-12	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	3
1740	7	2013/08/30	U-BW-12	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4
1741	7	2013/08/30	U-BW-12	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	18
1742	7	2013/08/30	U-BW-12	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	5
1743	7	2013/08/30	U-BW-12	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	2
1744	7	2013/08/30	U-BW-12	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	113
1745	7	2013/08/30	U-BW-12	200	Insecta	Diptera	Chironomidae	Tanypodinae	1
1746	7	2013/08/30	U-BW-12	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	1
1747	7	2013/08/30	U-BW-12	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	432
1748	7	2013/08/30	U-BW-12	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	33
1749	7	2013/08/30	U-BW-12	248	Insecta	Diptera	Chironomidae	Chironominae	5
1750	7	2013/08/30	U-BW-12	249	Insecta	Diptera	Culicidae	*Anopheles* sp.	1
1751	7	2013/08/30	U-BW-12	256	Insecta	Diptera	Athericidae	*Atrichops morimotoi*	1
1752	7	2013/08/30	U-BW-12	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2
1753	7	2013/08/30	U-BW-12	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	3
1754	7	2013/08/30	U-BW-12	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	176
1755	7	2013/08/30	U-BW-12	279	Insecta	Coleoptera	Elmidae	*Stenelmis* sp.	6
1756	7	2013/08/30	U-BW-12	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	111
1757	7	2013/08/30	U-BW-12	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	36
1758	7	2013/08/30	U-BW-2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	134
1759	7	2013/08/30	U-BW-2	5	Gastropoda	Basommatophora	Ancylidae	*Laevapex nipponica*	33
1760	7	2013/08/30	U-BW-2	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	330
1761	7	2013/08/30	U-BW-2	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	509
1762	7	2013/08/30	U-BW-2	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	2
1763	7	2013/08/30	U-BW-2	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	32
1764	7	2013/08/30	U-BW-2	23	Oligochaeta	Tubificida	Naididae	*Stylaria fossularis*	64
1765	7	2013/08/30	U-BW-2	25	Oligochaeta	Tubificida	Naididae	Naididae	2
1766	7	2013/08/30	U-BW-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1
1767	7	2013/08/30	U-BW-2	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	148
1768	7	2013/08/30	U-BW-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	6
1769	7	2013/08/30	U-BW-2	60	Insecta	Ephemeroptera	Baetidae	*Cloeon* sp.	5
1770	7	2013/08/30	U-BW-2	61	Insecta	Ephemeroptera	Baetidae	*Labiobaetis atrebatinus orientalis*	4
1771	7	2013/08/30	U-BW-2	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	3
1772	7	2013/08/30	U-BW-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	240
1773	7	2013/08/30	U-BW-2	98	Insecta	Odonata	Agrionidae	*Ischnura* sp.	11
1774	7	2013/08/30	U-BW-2	101	Insecta	Odonata	Macromiidae	*Anax parthenope julius*	1
1775	7	2013/08/30	U-BW-2	113	Insecta	Odonata	Libellulidae	*Orthetrum albistylum speciosum*	50
1776	7	2013/08/30	U-BW-2	144	Insecta	Hemiptera	Gerridae	*Aquarius paludum paludum*	2
1777	7	2013/08/30	U-BW-2	147	Insecta	Hemiptera	Gerridae	Gerrinae	38
1778	7	2013/08/30	U-BW-2	148	Insecta	Hemiptera	Veliidae	*Microvelia* sp.	33
1779	7	2013/08/30	U-BW-2	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	211
1780	7	2013/08/30	U-BW-2	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1005
1781	7	2013/08/30	U-BW-2	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	8
1782	7	2013/08/30	U-BW-2	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	5
1783	7	2013/08/30	U-BW-2	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4
1784	7	2013/08/30	U-BW-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
1785	7	2013/08/30	U-BW-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3
1786	7	2013/08/30	U-BW-2	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	32
1787	7	2013/08/30	U-BW-2	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	7
1788	7	2013/08/30	U-BW-2	200	Insecta	Diptera	Chironomidae	Tanypodinae	6
1789	7	2013/08/30	U-BW-2	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	32
1790	7	2013/08/30	U-BW-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	2
1791	7	2013/08/30	U-BW-2	222	Insecta	Diptera	Chironomidae	*Paratrichocladius* sp.	36
1792	7	2013/08/30	U-BW-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	54
1793	7	2013/08/30	U-BW-2	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	96
1794	7	2013/08/30	U-BW-2	249	Insecta	Diptera	Culicidae	*Anopheles* sp.	16
1795	7	2013/08/30	U-BW-2	250	Insecta	Diptera	Culicidae	Culicinae	35
1796	7	2013/08/30	U-BW-2	259	Insecta	Diptera	Stratiomyidae	*Odontomyia* sp.	1
1797	7	2013/08/30	U-BW-2	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	32
1798	7	2013/08/30	U-BW-2	261	Insecta	Diptera	Empididae	Empididae	32
1799	7	2013/08/30	U-BW-2	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	1
1800	7	2013/08/30	U-BW-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	45

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1801	7	2013/08/30	U-BW-2	275	Insecta	Coleoptera	Hydrophilidae	*Sternolophus rufipes*	4
1802	7	2013/08/30	U-BW-2	279	Insecta	Coleoptera	Elmidae	*Stenelmis* sp.	1
1803	7	2013/08/30	U-BW-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4
1804	7	2013/08/30	U-Rf-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	128
1805	7	2013/08/30	U-Rf-1	5	Gastropoda	Basommatophora	Ancylidae	*Laevapex nipponica*	1
1806	7	2013/08/30	U-Rf-1	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	1055
1807	7	2013/08/30	U-Rf-1	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	5
1808	7	2013/08/30	U-Rf-1	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	4
1809	7	2013/08/30	U-Rf-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	134
1810	7	2013/08/30	U-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	256
1811	7	2013/08/30	U-Rf-1	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	128
1812	7	2013/08/30	U-Rf-1	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	7
1813	7	2013/08/30	U-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	656
1814	7	2013/08/30	U-Rf-1	62	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis chocoratus*	128
1815	7	2013/08/30	U-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	2
1816	7	2013/08/30	U-Rf-1	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1931
1817	7	2013/08/30	U-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	3
1818	7	2013/08/30	U-Rf-1	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	261
1819	7	2013/08/30	U-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1931
1820	7	2013/08/30	U-Rf-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	391
1821	7	2013/08/30	U-Rf-1	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	1
1822	7	2013/08/30	U-Rf-1	130	Insecta	Plecoptera	Perlidae	*Kamimuria* sp.	2
1823	7	2013/08/30	U-Rf-1	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	130
1824	7	2013/08/30	U-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1411
1825	7	2013/08/30	U-Rf-1	157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	1
1826	7	2013/08/30	U-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1
1827	7	2013/08/30	U-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	270
1828	7	2013/08/30	U-Rf-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	392
1829	7	2013/08/30	U-Rf-1	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	1
1830	7	2013/08/30	U-Rf-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	131
1831	7	2013/08/30	U-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	389
1832	7	2013/08/30	U-Rf-1	191	Insecta	Diptera	Ceratopogonidae	*Atrichopogon* sp.	1
1833	7	2013/08/30	U-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	3
1834	7	2013/08/30	U-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	2
1835	7	2013/08/30	U-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	4
1836	7	2013/08/30	U-Rf-1	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	1
1837	7	2013/08/30	U-Rf-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	398
1838	7	2013/08/30	U-Rf-1	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1
1839	7	2013/08/30	U-Rf-1	248	Insecta	Diptera	Chironomidae	Chironominae	128
1840	7	2013/08/30	U-Rf-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	651
1841	7	2013/08/30	U-Rf-1	279	Insecta	Coleoptera	Elmidae	*Stenelmis* sp.	3
1842	7	2013/08/30	U-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	12
1843	7	2013/08/30	U-Rf-1	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
1844	7	2013/08/30	U-Rf-2	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	1
1845	7	2013/08/30	U-Rf-2	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	18
1846	7	2013/08/30	U-Rf-2	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	8
1847	7	2013/08/30	U-Rf-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	388
1848	7	2013/08/30	U-Rf-2	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	1
1849	7	2013/08/30	U-Rf-2	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	4
1850	7	2013/08/30	U-Rf-2	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1038
1851	7	2013/08/30	U-Rf-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	385
1852	7	2013/08/30	U-Rf-2	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	129
1853	7	2013/08/30	U-Rf-2	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	4
1854	7	2013/08/30	U-Rf-2	83	Insecta	Ephemeroptera	Ephemeridae	*Ephemera strigata*	1
1855	7	2013/08/30	U-Rf-2	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	133
1856	7	2013/08/30	U-Rf-2	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	8330
1857	7	2013/08/30	U-Rf-2	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2324
1858	7	2013/08/30	U-Rf-2	134	Insecta	Plecoptera	Perlidae	*Oyamia* sp.	1
1859	7	2013/08/30	U-Rf-2	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	1
1860	7	2013/08/30	U-Rf-2	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	389
1861	7	2013/08/30	U-Rf-2	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	387
1862	7	2013/08/30	U-Rf-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	385
1863	7	2013/08/30	U-Rf-2	157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	1024
1864	7	2013/08/30	U-Rf-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	269
1865	7	2013/08/30	U-Rf-2	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	524
1866	7	2013/08/30	U-Rf-2	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	4
1867	7	2013/08/30	U-Rf-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	5
1868	7	2013/08/30	U-Rf-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	393
1869	7	2013/08/30	U-Rf-2	200	Insecta	Diptera	Chironomidae	Tanypodinae	129
1870	7	2013/08/30	U-Rf-2	237	Insecta	Diptera	Chironomidae	*Demicryptochironomus* sp.	1
1871	7	2013/08/30	U-Rf-2	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	4
1872	7	2013/08/30	U-Rf-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	14
1873	7	2013/08/30	U-Rf-2	248	Insecta	Diptera	Chironomidae	Chironominae	129
1874	7	2013/08/30	U-Rf-2	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1
1875	7	2013/08/30	U-Rf-2	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1876	7	2013/08/30	U-Rf-2	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	779
1877	7	2013/08/30	U-Rf-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3
1878	7	2013/08/30	U-Rf-2	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	2
1879	7	2013/08/30	U-SP-1	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	33
1880	7	2013/08/30	U-SP-1	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	64
1881	7	2013/08/30	U-SP-1	19	Oligochaeta	Tubificida	Naididae	*Nais* sp.	1872
1882	7	2013/08/30	U-SP-1	30	Hirudinea	Arhynchobdellida	Erpobdellidae	Erpobdellidae	6
1883	7	2013/08/30	U-SP-1	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	2
1884	7	2013/08/30	U-SP-1	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1
1885	7	2013/08/30	U-SP-1	60	Insecta	Ephemeroptera	Baetidae	*Cloeon* sp.	42
1886	7	2013/08/30	U-SP-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2
1887	7	2013/08/30	U-SP-1	98	Insecta	Odonata	Agrionidae	*Ischnura* sp.	273
1888	7	2013/08/30	U-SP-1	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	1
1889	7	2013/08/30	U-SP-1	113	Insecta	Odonata	Libellulidae	*Orthetrum albistylum speciosum*	38
1890	7	2013/08/30	U-SP-1	144	Insecta	Hemiptera	Gerridae	*Aquarius paludum paludum*	2
1891	7	2013/08/30	U-SP-1	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	1
1892	7	2013/08/30	U-SP-1	157	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	1
1893	7	2013/08/30	U-SP-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3
1894	7	2013/08/30	U-SP-1	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	34
1895	7	2013/08/30	U-SP-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	3
1896	7	2013/08/30	U-SP-1	195	Insecta	Diptera	Chironomidae	*Macropelopia* sp.	4
1897	7	2013/08/30	U-SP-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	16
1898	7	2013/08/30	U-SP-1	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1
1899	7	2013/08/30	U-SP-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	34
1900	7	2013/08/30	U-SP-1	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1
1901	7	2013/08/30	U-SP-1	262	Insecta	Diptera	Canacidae	Canacidae	1
1902	7	2013/08/30	U-SP-1	266	Insecta	Coleoptera	Dytiscidae	Hydroporinae	1
1903	7	2013/08/30	U-SP-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	3
1904	7	2013/08/30	U-SP-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	68
1905	7	2013/08/30	U-SP-1	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
1906	7	2013/08/30	U-SP-11	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	7
1907	7	2013/08/30	U-SP-11	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	41
1908	7	2013/08/30	U-SP-11	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	34
1909	7	2013/08/30	U-SP-11	19	Oligochaeta	Tubificida	Naididae	*Nais* sp.	5
1910	7	2013/08/30	U-SP-11	60	Insecta	Ephemeroptera	Baetidae	*Cloeon* sp.	1
1911	7	2013/08/30	U-SP-11	98	Insecta	Odonata	Agrionidae	*Ischnura* sp.	12
1912	7	2013/08/30	U-SP-11	113	Insecta	Odonata	Libellulidae	*Orthetrum albistylum speciosum*	11
1913	7	2013/08/30	U-SP-11	144	Insecta	Hemiptera	Gerridae	*Aquarius paludum paludum*	1
1914	7	2013/08/30	U-SP-11	145	Insecta	Hemiptera	Gerridae	*Gerris latiabdominis*	1
1915	7	2013/08/30	U-SP-11	147	Insecta	Hemiptera	Gerridae	Gerrinae	1
1916	7	2013/08/30	U-SP-11	149	Insecta	Hemiptera	Corixidae	*Micronecta guttata*	3
1917	7	2013/08/30	U-SP-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	4
1918	7	2013/08/30	U-SP-11	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	2
1919	7	2013/08/30	U-SP-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	8
1920	7	2013/08/30	U-SP-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1
1921	7	2013/08/30	U-SP-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	9
1922	7	2013/08/30	U-SP-11	200	Insecta	Diptera	Chironomidae	Tanypodinae	1
1923	7	2013/08/30	U-SP-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	1
1924	7	2013/08/30	U-SP-11	248	Insecta	Diptera	Chironomidae	Chironominae	1
1925	7	2013/08/30	U-SP-11	271	Insecta	Coleoptera	Hydrophilidae	*Enochrus japonicus*	1
1926	7	2013/08/30	U-SP-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2
1927	7	2013/08/30	U-SP-11	275	Insecta	Coleoptera	Hydrophilidae	*Sternolophus rufipes*	3
1928	7	2013/08/30	U-SP-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	5
1929	8	2013/11/22	U-Rf-2	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	73
1930	8	2013/11/22	U-Rf-2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	96
1931	8	2013/11/22	U-Rf-2	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1
1932	8	2013/11/22	U-Rf-2	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	11
1933	8	2013/11/22	U-Rf-2	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	5
1934	8	2013/11/22	U-Rf-2	11	Bivalvia	Veneroida	Corbiculidae	*Corbicula* sp.	2
1935	8	2013/11/22	U-Rf-2	29	Hirudinea	Rhynchobdellida	Piscicolidae	*Limnotrachelobdella* sp.	2
1936	8	2013/11/22	U-Rf-2	31	Hirudinea	Arhynchobdellida	Salifidae	Salifidae	1
1937	8	2013/11/22	U-Rf-2	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	232
1938	8	2013/11/22	U-Rf-2	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32
1939	8	2013/11/22	U-Rf-2	44	Malacostraca	Isopoda	Asellidae	Asellidae	2
1940	8	2013/11/22	U-Rf-2	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	1
1941	8	2013/11/22	U-Rf-2	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	15
1942	8	2013/11/22	U-Rf-2	51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*	4
1943	8	2013/11/22	U-Rf-2	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	388
1944	8	2013/11/22	U-Rf-2	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	1
1945	8	2013/11/22	U-Rf-2	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	73
1946	8	2013/11/22	U-Rf-2	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
1947	8	2013/11/22	U-Rf-2	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	33
1948	8	2013/11/22	U-Rf-2	59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J	161
1949	8	2013/11/22	U-Rf-2	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	193
1950	8	2013/11/22	U-Rf-2	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
1951	8	2013/11/22	U-Rf-2	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	33
1952	8	2013/11/22	U-Rf-2	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	210
1953	8	2013/11/22	U-Rf-2	74	Insecta	Ephemeroptera	Heptageniidae	*Epeorus* sp.	128
1954	8	2013/11/22	U-Rf-2	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	3
1955	8	2013/11/22	U-Rf-2	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1
1956	8	2013/11/22	U-Rf-2	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	64
1957	8	2013/11/22	U-Rf-2	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	1132
1958	8	2013/11/22	U-Rf-2	90	Insecta	Ephemeroptera	Ephemerellidae	*Drunella* sp.	32
1959	8	2013/11/22	U-Rf-2	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	193
1960	8	2013/11/22	U-Rf-2	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1994
1961	8	2013/11/22	U-Rf-2	107	Insecta	Odonata	Gomphidae	*Onychogomphus viridicostus*	2
1962	8	2013/11/22	U-Rf-2	115	Insecta	Plecoptera	Capniidae	Capniidae	292
1963	8	2013/11/22	U-Rf-2	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	7
1964	8	2013/11/22	U-Rf-2	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2
1965	8	2013/11/22	U-Rf-2	132	Insecta	Plecoptera	Perlidae	*Oyamia lugubris*	1
1966	8	2013/11/22	U-Rf-2	135	Insecta	Plecoptera	Perlidae	*Paragnetina* sp.	1
1967	8	2013/11/22	U-Rf-2	143	Insecta	Plecoptera	Perlodidae	Perlodidae	133
1968	8	2013/11/22	U-Rf-2	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	64
1969	8	2013/11/22	U-Rf-2	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1748
1970	8	2013/11/22	U-Rf-2	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	326
1971	8	2013/11/22	U-Rf-2	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	57
1972	8	2013/11/22	U-Rf-2	166	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche sauteri*	1
1973	8	2013/11/22	U-Rf-2	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
1974	8	2013/11/22	U-Rf-2	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
1975	8	2013/11/22	U-Rf-2	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	1
1976	8	2013/11/22	U-Rf-2	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	130
1977	8	2013/11/22	U-Rf-2	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	216
1978	8	2013/11/22	U-Rf-2	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	128
1979	8	2013/11/22	U-Rf-2	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1107
1980	8	2013/11/22	U-Rf-2	231	Insecta	Diptera	Chironomidae	Orthocladiinae	129
1981	8	2013/11/22	U-Rf-2	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	32
1982	8	2013/11/22	U-Rf-2	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	103
1983	8	2013/11/22	U-Rf-2	270	Insecta	Coleoptera	Hydrophilidae	*Agraphydrus narusei*	34
1984	8	2013/11/22	U-Rf-2	277	Insecta	Coleoptera	Elmidae	*Grouvellinus* sp.	1
1985	8	2013/11/22	U-Rf-2	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	196
1986	8	2013/11/22	U-Rf-2	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	32
1987	8	2013/11/22	U-Rf-2	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	130
1988	8	2013/11/22	U-Rf-2	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	32
1989	8	2013/11/22	U-Rf-2	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	4
1990	8	2013/11/22	U-Rf-21	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	1
1991	8	2013/11/22	U-Rf-21	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3
1992	8	2013/11/22	U-Rf-21	4	Gastropoda	Discopoda	Hydrobiidae	*Potamopyrgus antipodarum*	1
1993	8	2013/11/22	U-Rf-21	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	2
1994	8	2013/11/22	U-Rf-21	11	Bivalvia	Veneroida	Corbiculidae	*Corbicula* sp.	1
1995	8	2013/11/22	U-Rf-21	27	Oligochaeta	Lumbricida	-	LUMBRICIDA	1
1996	8	2013/11/22	U-Rf-21	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
1997	8	2013/11/22	U-Rf-21	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	103
1998	8	2013/11/22	U-Rf-21	44	Malacostraca	Isopoda	Asellidae	Asellidae	1
1999	8	2013/11/22	U-Rf-21	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1
2000	8	2013/11/22	U-Rf-21	51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*	1
2001	8	2013/11/22	U-Rf-21	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	259
2002	8	2013/11/22	U-Rf-21	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	1
2003	8	2013/11/22	U-Rf-21	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	6
2004	8	2013/11/22	U-Rf-21	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	72
2005	8	2013/11/22	U-Rf-21	59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J	335
2006	8	2013/11/22	U-Rf-21	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	167
2007	8	2013/11/22	U-Rf-21	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1
2008	8	2013/11/22	U-Rf-21	66	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis parvipterus*	32
2009	8	2013/11/22	U-Rf-21	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	98
2010	8	2013/11/22	U-Rf-21	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	110
2011	8	2013/11/22	U-Rf-21	74	Insecta	Ephemeroptera	Heptageniidae	*Epeorus* sp.	65
2012	8	2013/11/22	U-Rf-21	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	7
2013	8	2013/11/22	U-Rf-21	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	589
2014	8	2013/11/22	U-Rf-21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	33
2015	8	2013/11/22	U-Rf-21	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	648
2016	8	2013/11/22	U-Rf-21	107	Insecta	Odonata	Gomphidae	*Onychogomphus viridicostus*	1
2017	8	2013/11/22	U-Rf-21	115	Insecta	Plecoptera	Capniidae	Capniidae	175
2018	8	2013/11/22	U-Rf-21	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	1
2019	8	2013/11/22	U-Rf-21	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	2
2020	8	2013/11/22	U-Rf-21	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
2021	8	2013/11/22	U-Rf-21	133	Insecta	Plecoptera	Perlidae	*Oyamia cryptomeria*	1
2022	8	2013/11/22	U-Rf-21	143	Insecta	Plecoptera	Perlodidae	Perlodidae	2
2023	8	2013/11/22	U-Rf-21	153	Insecta	Odonata	Corydalidae	*Protohermes grandis*	1
2024	8	2013/11/22	U-Rf-21	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	812
2025	8	2013/11/22	U-Rf-21	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	138

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2026	8	2013/11/22	U-Rf-21	162	Insecta	Trichoptera	Hydropsychidae	*Macrostemum radiatum*	1
2027	8	2013/11/22	U-Rf-21	163	Insecta	Trichoptera	Polycentropodidae	*Plectrocnemia* sp.	1
2028	8	2013/11/22	U-Rf-21	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	15
2029	8	2013/11/22	U-Rf-21	166	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche sauteri*	7
2030	8	2013/11/22	U-Rf-21	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
2031	8	2013/11/22	U-Rf-21	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
2032	8	2013/11/22	U-Rf-21	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
2033	8	2013/11/22	U-Rf-21	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	1
2034	8	2013/11/22	U-Rf-21	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	75
2035	8	2013/11/22	U-Rf-21	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	102
2036	8	2013/11/22	U-Rf-21	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	1
2037	8	2013/11/22	U-Rf-21	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	70
2038	8	2013/11/22	U-Rf-21	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1056
2039	8	2013/11/22	U-Rf-21	231	Insecta	Diptera	Chironomidae	Orthocladiinae	46
2040	8	2013/11/22	U-Rf-21	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	2
2041	8	2013/11/22	U-Rf-21	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	45
2042	8	2013/11/22	U-Rf-21	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	33
2043	8	2013/11/22	U-Rf-21	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2
2044	8	2013/11/22	U-Rf-23	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	265
2045	8	2013/11/22	U-Rf-23	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3
2046	8	2013/11/22	U-Rf-23	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	8
2047	8	2013/11/22	U-Rf-23	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	2
2048	8	2013/11/22	U-Rf-23	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	38
2049	8	2013/11/22	U-Rf-23	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	34
2050	8	2013/11/22	U-Rf-23	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	71
2051	8	2013/11/22	U-Rf-23	56	Insecta	Ephemeroptera	Baetidae	*Baetis sahoensis*	67
2052	8	2013/11/22	U-Rf-23	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	1
2053	8	2013/11/22	U-Rf-23	59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J	167
2054	8	2013/11/22	U-Rf-23	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	197
2055	8	2013/11/22	U-Rf-23	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2
2056	8	2013/11/22	U-Rf-23	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	5
2057	8	2013/11/22	U-Rf-23	74	Insecta	Ephemeroptera	Heptageniidae	*Epeorus* sp.	32
2058	8	2013/11/22	U-Rf-23	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	7
2059	8	2013/11/22	U-Rf-23	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	205
2060	8	2013/11/22	U-Rf-23	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	129
2061	8	2013/11/22	U-Rf-23	115	Insecta	Plecoptera	Capniidae	Capniidae	392
2062	8	2013/11/22	U-Rf-23	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	2
2063	8	2013/11/22	U-Rf-23	143	Insecta	Plecoptera	Perlodidae	Perlodidae	4
2064	8	2013/11/22	U-Rf-23	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	78
2065	8	2013/11/22	U-Rf-23	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	44
2066	8	2013/11/22	U-Rf-23	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	4
2067	8	2013/11/22	U-Rf-23	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3
2068	8	2013/11/22	U-Rf-23	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
2069	8	2013/11/22	U-Rf-23	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	4
2070	8	2013/11/22	U-Rf-23	200	Insecta	Diptera	Chironomidae	Tanypodinae	1
2071	8	2013/11/22	U-Rf-23	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	67
2072	8	2013/11/22	U-Rf-23	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	44
2073	8	2013/11/22	U-Rf-23	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	1
2074	8	2013/11/22	U-Rf-23	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	411
2075	8	2013/11/22	U-Rf-23	231	Insecta	Diptera	Chironomidae	Orthocladiinae	105
2076	8	2013/11/22	U-Rf-23	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	44
2077	8	2013/11/22	U-Rf-23	261	Insecta	Diptera	Empididae	Empididae	32
2078	8	2013/11/22	U-Rf-23	270	Insecta	Coleoptera	Hydrophilidae	*Agraphydrus narusei*	3
2079	8	2013/11/22	U-Rf-23	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	71
2080	8	2013/11/22	U-Rf-23	276	Insecta	Coleoptera	Helodidae	*Hydrocyphon* sp.	1
2081	8	2013/11/22	U-Rf-23	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
2082	8	2013/11/22	U-Rf-23	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
2083	8	2013/11/23	D-Rf-1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	105
2084	8	2013/11/23	D-Rf-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3
2085	8	2013/11/23	D-Rf-1	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	3
2086	8	2013/11/23	D-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	56
2087	8	2013/11/23	D-Rf-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	3
2088	8	2013/11/23	D-Rf-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	11
2089	8	2013/11/23	D-Rf-1	51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*	4
2090	8	2013/11/23	D-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	232
2091	8	2013/11/23	D-Rf-1	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	1
2092	8	2013/11/23	D-Rf-1	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	69
2093	8	2013/11/23	D-Rf-1	56	Insecta	Ephemeroptera	Baetidae	*Baetis sahoensis*	2
2094	8	2013/11/23	D-Rf-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1
2095	8	2013/11/23	D-Rf-1	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	2
2096	8	2013/11/23	D-Rf-1	59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J	140
2097	8	2013/11/23	D-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	131
2098	8	2013/11/23	D-Rf-1	66	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis parvipterus*	1
2099	8	2013/11/23	D-Rf-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
2100	8	2013/11/23	D-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	27

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2101	8	2013/11/23	D-Rf-1	74	Insecta	Ephemeroptera	Heptageniidae	*Epeorus* sp.	34
2102	8	2013/11/23	D-Rf-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	69
2103	8	2013/11/23	D-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	3
2104	8	2013/11/23	D-Rf-1	79	Insecta	Ephemeroptera	Leptophlebiidae	*Choroterpes altioculus*	1
2105	8	2013/11/23	D-Rf-1	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	489
2106	8	2013/11/23	D-Rf-1	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	65
2107	8	2013/11/23	D-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	616
2108	8	2013/11/23	D-Rf-1	115	Insecta	Plecoptera	Capniidae	Capniidae	471
2109	8	2013/11/23	D-Rf-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	9
2110	8	2013/11/23	D-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	7
2111	8	2013/11/23	D-Rf-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	6
2112	8	2013/11/23	D-Rf-1	135	Insecta	Plecoptera	Perlidae	*Paragnetina* sp.	1
2113	8	2013/11/23	D-Rf-1	136	Insecta	Plecoptera	Perlidae	Perlidae	1
2114	8	2013/11/23	D-Rf-1	143	Insecta	Plecoptera	Perlodidae	Perlodidae	40
2115	8	2013/11/23	D-Rf-1	153	Insecta	Odonata	Corydalidae	*Protohermes grandis*	2
2116	8	2013/11/23	D-Rf-1	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	64
2117	8	2013/11/23	D-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	465
2118	8	2013/11/23	D-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	39
2119	8	2013/11/23	D-Rf-1	164	Insecta	Trichoptera	Psychomyiidae	*Psychomyia* sp.	2
2120	8	2013/11/23	D-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	18
2121	8	2013/11/23	D-Rf-1	166	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche sauteri*	6
2122	8	2013/11/23	D-Rf-1	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	36
2123	8	2013/11/23	D-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
2124	8	2013/11/23	D-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6
2125	8	2013/11/23	D-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	2
2126	8	2013/11/23	D-Rf-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	1
2127	8	2013/11/23	D-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	55
2128	8	2013/11/23	D-Rf-1	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	67
2129	8	2013/11/23	D-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	476
2130	8	2013/11/23	D-Rf-1	226	Insecta	Diptera	Chironomidae	*Robackia* sp.	1
2131	8	2013/11/23	D-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	39
2132	8	2013/11/23	D-Rf-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	32
2133	8	2013/11/23	D-Rf-1	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	16
2134	8	2013/11/23	D-Rf-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	4
2135	8	2013/11/23	D-Rf-1	280	Insecta	Coleoptera	Elmidae	*Zaitzevia awana*	3
2136	8	2013/11/23	D-Rf-1	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	4
2137	8	2013/11/23	D-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	6
2138	8	2013/11/23	D-Rf-1	283	Insecta	Coleoptera	Elmidae	*Zaitzeviaria gotoi*	2
2139	8	2013/11/23	D-Rf-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	2
2140	8	2013/11/23	D-Rf-1	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	2
2141	8	2013/11/23	D-SP-1	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	202
2142	8	2013/11/23	D-SP-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	66
2143	8	2013/11/23	D-SP-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	1
2144	8	2013/11/23	D-SP-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	13
2145	8	2013/11/23	D-SP-1	49	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium nipponense*	1
2146	8	2013/11/23	D-SP-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	3
2147	8	2013/11/23	D-SP-1	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	1
2148	8	2013/11/23	D-SP-1	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	2
2149	8	2013/11/23	D-SP-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	3
2150	8	2013/11/23	D-SP-1	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	1
2151	8	2013/11/23	D-SP-1	59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J	136
2152	8	2013/11/23	D-SP-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	334
2153	8	2013/11/23	D-SP-1	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1
2154	8	2013/11/23	D-SP-1	68	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus bajkovae*	1
2155	8	2013/11/23	D-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	264
2156	8	2013/11/23	D-SP-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	67
2157	8	2013/11/23	D-SP-1	74	Insecta	Ephemeroptera	Heptageniidae	*Epeorus* sp.	2
2158	8	2013/11/23	D-SP-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	2
2159	8	2013/11/23	D-SP-1	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	7
2160	8	2013/11/23	D-SP-1	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	1
2161	8	2013/11/23	D-SP-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	68
2162	8	2013/11/23	D-SP-1	115	Insecta	Plecoptera	Capniidae	Capniidae	989
2163	8	2013/11/23	D-SP-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
2164	8	2013/11/23	D-SP-1	143	Insecta	Plecoptera	Perlodidae	Perlodidae	1
2165	8	2013/11/23	D-SP-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	78
2166	8	2013/11/23	D-SP-1	164	Insecta	Trichoptera	Psychomyiidae	*Psychomyia* sp.	1
2167	8	2013/11/23	D-SP-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	2
2168	8	2013/11/23	D-SP-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
2169	8	2013/11/23	D-SP-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	68
2170	8	2013/11/23	D-SP-1	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	1
2171	8	2013/11/23	D-SP-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	2459
2172	8	2013/11/23	D-SP-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	1
2173	8	2013/11/23	D-SP-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	128
2174	8	2013/11/23	D-SP-1	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	65
2175	8	2013/11/23	D-SP-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	405

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2176	8	2013/11/23	D-SP-1	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	1
2177	8	2013/11/23	D-SP-1	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	64
2178	8	2013/11/23	D-SP-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	2
2179	8	2013/11/23	D-SP-1	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	3
2180	8	2013/11/23	D-SP-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
2181	8	2013/11/23	D-SP-1	283	Insecta	Coleoptera	Elmidae	*Zaitzeviaria gotoi*	1
2182	8	2013/11/23	D-SP-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	2
2183	8	2013/11/23	U-Rf-1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	257
2184	8	2013/11/23	U-Rf-1	27	Oligochaeta	Lumbricida	-	LUMBRICIDA	1
2185	8	2013/11/23	U-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	66
2186	8	2013/11/23	U-Rf-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	2
2187	8	2013/11/23	U-Rf-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	71
2188	8	2013/11/23	U-Rf-1	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	3
2189	8	2013/11/23	U-Rf-1	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	69
2190	8	2013/11/23	U-Rf-1	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	5
2191	8	2013/11/23	U-Rf-1	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	66
2192	8	2013/11/23	U-Rf-1	59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J	797
2193	8	2013/11/23	U-Rf-1	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	325
2194	8	2013/11/23	U-Rf-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	131
2195	8	2013/11/23	U-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	20
2196	8	2013/11/23	U-Rf-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	78
2197	8	2013/11/23	U-Rf-1	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1
2198	8	2013/11/23	U-Rf-1	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	647
2199	8	2013/11/23	U-Rf-1	90	Insecta	Ephemeroptera	Ephemerellidae	*Drunella* sp.	64
2200	8	2013/11/23	U-Rf-1	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	65
2201	8	2013/11/23	U-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	257
2202	8	2013/11/23	U-Rf-1	115	Insecta	Plecoptera	Capniidae	Capniidae	526
2203	8	2013/11/23	U-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	1
2204	8	2013/11/23	U-Rf-1	135	Insecta	Plecoptera	Perlidae	*Paragnetina* sp.	1
2205	8	2013/11/23	U-Rf-1	143	Insecta	Plecoptera	Perlodidae	Perlodidae	194
2206	8	2013/11/23	U-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	343
2207	8	2013/11/23	U-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	209
2208	8	2013/11/23	U-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	8
2209	8	2013/11/23	U-Rf-1	166	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche sauteri*	1
2210	8	2013/11/23	U-Rf-1	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	1
2211	8	2013/11/23	U-Rf-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
2212	8	2013/11/23	U-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
2213	8	2013/11/23	U-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	8
2214	8	2013/11/23	U-Rf-1	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1
2215	8	2013/11/23	U-Rf-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	5
2216	8	2013/11/23	U-Rf-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	196
2217	8	2013/11/23	U-Rf-1	209	Insecta	Diptera	Chironomidae	*Brillia* sp.	1
2218	8	2013/11/23	U-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	144
2219	8	2013/11/23	U-Rf-1	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	385
2220	8	2013/11/23	U-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1443
2221	8	2013/11/23	U-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	329
2222	8	2013/11/23	U-Rf-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	64
2223	8	2013/11/23	U-Rf-1	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	137
2224	8	2013/11/23	U-Rf-1	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	1
2225	8	2013/11/23	U-Rf-1	280	Insecta	Coleoptera	Elmidae	*Zaitzevia awana*	1
2226	8	2013/11/23	U-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2
2227	8	2013/11/23	U-Rf-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	64
2228	8	2013/11/23	U-Rf-22	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	1167
2229	8	2013/11/23	U-Rf-22	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	128
2230	8	2013/11/23	U-Rf-22	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	2
2231	8	2013/11/23	U-Rf-22	29	Hirudinea	Rhynchobdellida	Piscicolidae	*Limnotrachelobdella* sp.	1
2232	8	2013/11/23	U-Rf-22	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
2233	8	2013/11/23	U-Rf-22	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	129
2234	8	2013/11/23	U-Rf-22	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1
2235	8	2013/11/23	U-Rf-22	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	1
2236	8	2013/11/23	U-Rf-22	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	581
2237	8	2013/11/23	U-Rf-22	54	Insecta	Ephemeroptera	Baetidae	*Acentrella sibirica*	66
2238	8	2013/11/23	U-Rf-22	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	4
2239	8	2013/11/23	U-Rf-22	56	Insecta	Ephemeroptera	Baetidae	*Baetis sahoensis*	68
2240	8	2013/11/23	U-Rf-22	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	67
2241	8	2013/11/23	U-Rf-22	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	4
2242	8	2013/11/23	U-Rf-22	59	Insecta	Ephemeroptera	Baetidae	*Baetis* sp. J	404
2243	8	2013/11/23	U-Rf-22	63	Insecta	Ephemeroptera	Baetidae	*Nigrobaetis* sp. D	207
2244	8	2013/11/23	U-Rf-22	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1
2245	8	2013/11/23	U-Rf-22	66	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis parvipterus*	2
2246	8	2013/11/23	U-Rf-22	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	68
2247	8	2013/11/23	U-Rf-22	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	6
2248	8	2013/11/23	U-Rf-22	74	Insecta	Ephemeroptera	Heptageniidae	*Epeorus* sp.	192
2249	8	2013/11/23	U-Rf-22	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	142
2250	8	2013/11/23	U-Rf-22	87	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella* sp.	199

Table 1.2 All survey data on macro-invertebrates. (continued)

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Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2251	8	2013/11/23	U-Rf-22	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	64
2252	8	2013/11/23	U-Rf-22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	132
2253	8	2013/11/23	U-Rf-22	115	Insecta	Plecoptera	Capniidae	Capniidae	410
2254	8	2013/11/23	U-Rf-22	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	1
2255	8	2013/11/23	U-Rf-22	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	6
2256	8	2013/11/23	U-Rf-22	143	Insecta	Plecoptera	Perlodidae	Perlodidae	4
2257	8	2013/11/23	U-Rf-22	152	Insecta	Odonata	Corydalidae	*Parachauliodes continentalis*	1
2258	8	2013/11/23	U-Rf-22	153	Insecta	Odonata	Corydalidae	*Protohermes grandis*	1
2259	8	2013/11/23	U-Rf-22	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	600
2260	8	2013/11/23	U-Rf-22	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	8
2261	8	2013/11/23	U-Rf-22	164	Insecta	Trichoptera	Psychomyiidae	*Psychomyia* sp.	1
2262	8	2013/11/23	U-Rf-22	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	13
2263	8	2013/11/23	U-Rf-22	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
2264	8	2013/11/23	U-Rf-22	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	7
2265	8	2013/11/23	U-Rf-22	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	65
2266	8	2013/11/23	U-Rf-22	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	68
2267	8	2013/11/23	U-Rf-22	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	140
2268	8	2013/11/23	U-Rf-22	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	5
2269	8	2013/11/23	U-Rf-22	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	261
2270	8	2013/11/23	U-Rf-22	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1264
2271	8	2013/11/23	U-Rf-22	231	Insecta	Diptera	Chironomidae	Orthocladiinae	78
2272	8	2013/11/23	U-Rf-22	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	1
2273	8	2013/11/23	U-Rf-22	278	Insecta	Coleoptera	Elmidae	*Ordobrevia* sp.	1
2274	8	2013/11/23	U-Rf-22	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	3
2275	8	2013/11/23	U-Rf-22	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	71
2276	8	2013/11/23	U-Rf-22	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	66
2277	8	2013/11/23	U-Rf-22	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	3
2278	8	2013/11/23	U-Rf-22	286	Insecta	Coleoptera	Psephenidae	*Macroeubria lewisi*	1
2279	8	2013/11/23	U-Rf-22	287	Insecta	Coleoptera	Psephenidae	*Mataeopsephus japonicus*	1
2280	8	2013/11/23	U-SP-1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	26
2281	8	2013/11/23	U-SP-1	7	Gastropoda	Basommatophora	Lymnaeidae	*Radix auricularia japonica*	8
2282	8	2013/11/23	U-SP-1	9	Gastropoda	Basommatophora	Planorbidae	*Gyraulus chinensis spirillus*	27
2283	8	2013/11/23	U-SP-1	11	Bivalvia	Veneroida	Corbiculidae	*Corbicula* sp.	8
2284	8	2013/11/23	U-SP-1	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	8
2285	8	2013/11/23	U-SP-1	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
2286	8	2013/11/23	U-SP-1	35	Arachnida	Acarina	Torrenticolidae	*Torrenticola* sp.	8
2287	8	2013/11/23	U-SP-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	8
2288	8	2013/11/23	U-SP-1	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	20
2289	8	2013/11/23	U-SP-1	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1
2290	8	2013/11/23	U-SP-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	13
2291	8	2013/11/23	U-SP-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	26
2292	8	2013/11/23	U-SP-1	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	8
2293	8	2013/11/23	U-SP-1	51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*	1
2294	8	2013/11/23	U-SP-1	53	Insecta	Ephemeroptera	Baetidae	*Acentrella gnom*	1
2295	8	2013/11/23	U-SP-1	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	1
2296	8	2013/11/23	U-SP-1	61	Insecta	Ephemeroptera	Baetidae	*Labiobaetis atrebatinus orientalis*	8
2297	8	2013/11/23	U-SP-1	64	Insecta	Ephemeroptera	Baetidae	*Procloeon* sp.	2
2298	8	2013/11/23	U-SP-1	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	25
2299	8	2013/11/23	U-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	108
2300	8	2013/11/23	U-SP-1	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	28
2301	8	2013/11/23	U-SP-1	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	27
2302	8	2013/11/23	U-SP-1	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	6
2303	8	2013/11/23	U-SP-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	74
2304	8	2013/11/23	U-SP-1	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	34
2305	8	2013/11/23	U-SP-1	102	Insecta	Odonata	Macromiidae	*Boyeria maclachlani*	1
2306	8	2013/11/23	U-SP-1	105	Insecta	Odonata	Gomphidae	*Davidius* sp.	1
2307	8	2013/11/23	U-SP-1	107	Insecta	Odonata	Gomphidae	*Onychogomphus viridicostus*	1
2308	8	2013/11/23	U-SP-1	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	1
2309	8	2013/11/23	U-SP-1	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	2
2310	8	2013/11/23	U-SP-1	111	Insecta	Odonata	Gomphidae	Gomphidae	1
2311	8	2013/11/23	U-SP-1	115	Insecta	Plecoptera	Capniidae	Capniidae	8
2312	8	2013/11/23	U-SP-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	1
2313	8	2013/11/23	U-SP-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	10
2314	8	2013/11/23	U-SP-1	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	24
2315	8	2013/11/23	U-SP-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	12
2316	8	2013/11/23	U-SP-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	8
2317	8	2013/11/23	U-SP-1	179	Insecta	Trichoptera	Leptoceridae	*Ceraclea* sp.	9
2318	8	2013/11/23	U-SP-1	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	3
2319	8	2013/11/23	U-SP-1	181	Insecta	Trichoptera	Leptoceridae	*Oecetis* sp.	33
2320	8	2013/11/23	U-SP-1	182	Insecta	Trichoptera	Sericostomatidae	*Gumaga orientalis*	1
2321	8	2013/11/23	U-SP-1	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4
2322	8	2013/11/23	U-SP-1	193	Insecta	Diptera	Chironomidae	*Ablabesmyia* sp.	1
2323	8	2013/11/23	U-SP-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	15
2324	8	2013/11/23	U-SP-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	131
2325	8	2013/11/23	U-SP-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	51

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2326	8	2013/11/23	U-SP-1	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	10
2327	8	2013/11/23	U-SP-1	223	Insecta	Diptera	Chironomidae	*Pseudorthocladius* sp.	1
2328	8	2013/11/23	U-SP-1	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	9
2329	8	2013/11/23	U-SP-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	24
2330	8	2013/11/23	U-SP-1	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1
2331	8	2013/11/23	U-SP-1	248	Insecta	Diptera	Chironomidae	Chironominae	16
2332	8	2013/11/23	U-SP-1	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	103
2333	8	2013/11/23	U-SP-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	12
2334	8	2013/11/23	U-SP-1	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	8
2335	8	2013/11/23	U-SP-1	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	2
2336	9	2013/12/01	U-BW-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
2337	9	2013/12/01	U-BW-11	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	2
2338	9	2013/12/01	U-BW-11	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	2
2339	9	2013/12/01	U-BW-11	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	3
2340	9	2013/12/01	U-BW-11	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2
2341	9	2013/12/01	U-BW-11	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	35
2342	9	2013/12/01	U-BW-11	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	36
2343	9	2013/12/01	U-BW-11	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	34
2344	9	2013/12/01	U-BW-11	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	104
2345	9	2013/12/01	U-BW-11	99	Insecta	Odonata	Calopterygidae	*Calopteryx atrata*	1
2346	9	2013/12/01	U-BW-11	106	Insecta	Odonata	Gomphidae	*Nihonogomphus viridis*	1
2347	9	2013/12/01	U-BW-11	111	Insecta	Odonata	Gomphidae	Gomphidae	17
2348	9	2013/12/01	U-BW-11	115	Insecta	Plecoptera	Capniidae	Capniidae	34
2349	9	2013/12/01	U-BW-11	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	5
2350	9	2013/12/01	U-BW-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	146
2351	9	2013/12/01	U-BW-11	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	2
2352	9	2013/12/01	U-BW-11	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
2353	9	2013/12/01	U-BW-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1
2354	9	2013/12/01	U-BW-11	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	1
2355	9	2013/12/01	U-BW-11	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	315
2356	9	2013/12/01	U-BW-11	208	Insecta	Diptera	Chironomidae	*Prodiamesa* sp.	147
2357	9	2013/12/01	U-BW-11	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	16
2358	9	2013/12/01	U-BW-11	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	136
2359	9	2013/12/01	U-BW-11	223	Insecta	Diptera	Chironomidae	*Pseudorthocladius* sp.	35
2360	9	2013/12/01	U-BW-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	1
2361	9	2013/12/01	U-BW-11	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	2
2362	9	2013/12/01	U-BW-11	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	16
2363	9	2013/12/01	U-BW-11	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1
2364	9	2013/12/01	U-BW-11	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	136
2365	9	2013/12/01	U-BW-11	277	Insecta	Coleoptera	Elmidae	*Grouvellinus* sp.	1
2366	9	2013/12/01	U-BW-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	5
2367	9	2013/12/01	U-BW-11	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
2368	9	2013/12/01	U-BW-11	287	Insecta	Coleoptera	Psephenidae	*Mataeopsephus japonicus*	1
2369	9	2013/12/01	U-BW-21	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1
2370	9	2013/12/01	U-BW-21	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	44
2371	9	2013/12/01	U-BW-21	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1
2372	9	2013/12/01	U-BW-21	115	Insecta	Plecoptera	Capniidae	Capniidae	1553
2373	9	2013/12/01	U-BW-21	200	Insecta	Diptera	Chironomidae	Tanypodinae	1
2374	9	2013/12/01	U-BW-21	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	592
2375	9	2013/12/01	U-BW-21	207	Insecta	Diptera	Chironomidae	Diamesinae	44
2376	9	2013/12/01	U-BW-21	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2
2377	9	2013/12/01	U-BW-21	214	Insecta	Diptera	Chironomidae	*Diplocladius* sp.	96
2378	9	2013/12/01	U-BW-21	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	777
2379	9	2013/12/01	U-BW-21	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	256
2380	9	2013/12/01	U-BW-21	231	Insecta	Diptera	Chironomidae	Orthocladiinae	73
2381	9	2013/12/01	U-BW-21	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	64
2382	9	2013/12/01	U-BW-21	248	Insecta	Diptera	Chironomidae	Chironominae	1
2383	9	2013/12/01	U-BW-22	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1
2384	9	2013/12/01	U-BW-22	11	Bivalvia	Veneroida	Corbiculidae	*Corbicula* sp.	1
2385	9	2013/12/01	U-BW-22	27	Oligochaeta	Lumbricida	-	LUMBRICIDA	1
2386	9	2013/12/01	U-BW-22	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	2
2387	9	2013/12/01	U-BW-22	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1
2388	9	2013/12/01	U-BW-22	44	Malacostraca	Isopoda	Asellidae	Asellidae	1
2389	9	2013/12/01	U-BW-22	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1
2390	9	2013/12/01	U-BW-22	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	3
2391	9	2013/12/01	U-BW-22	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	11
2392	9	2013/12/01	U-BW-22	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	2
2393	9	2013/12/01	U-BW-22	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1
2394	9	2013/12/01	U-BW-22	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	3
2395	9	2013/12/01	U-BW-22	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	3
2396	9	2013/12/01	U-BW-22	110	Insecta	Odonata	Gomphidae	*Stylogomphus suzukii*	1
2397	9	2013/12/01	U-BW-22	112	Insecta	Odonata	Corduliidae	*Macromia amphigena amphigena*	1
2398	9	2013/12/01	U-BW-22	115	Insecta	Plecoptera	Capniidae	Capniidae	2
2399	9	2013/12/01	U-BW-22	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	1
2400	9	2013/12/01	U-BW-22	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2401	9	2013/12/01	U-BW-22	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
2402	9	2013/12/01	U-BW-22	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	14
2403	9	2013/12/01	U-BW-22	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	10
2404	9	2013/12/01	U-BW-22	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1
2405	9	2013/12/01	U-BW-22	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2
2406	9	2013/12/01	U-BW-22	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	4
2407	9	2013/12/01	U-BW-22	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	1
2408	9	2013/12/01	U-BW-22	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	5
2409	9	2013/12/01	U-BW-22	208	Insecta	Diptera	Chironomidae	*Prodiamesa* sp.	10
2410	9	2013/12/01	U-BW-22	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	2
2411	9	2013/12/01	U-BW-22	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	4
2412	9	2013/12/01	U-BW-22	223	Insecta	Diptera	Chironomidae	*Pseudorthocladius* sp.	1
2413	9	2013/12/01	U-BW-22	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	1
2414	9	2013/12/01	U-BW-22	255	Insecta	Diptera	Athericidae	*Atrichops fontinalis*	1
2415	9	2013/12/01	U-BW-22	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2
2416	9	2013/12/01	U-BW-22	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	1
2417	9	2013/12/01	U-BW-22	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	25
2418	9	2013/12/01	U-BW-22	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	5
2419	9	2013/12/01	U-BW-22	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1
2420	9	2013/12/01	U-BW-22	287	Insecta	Coleoptera	Psephenidae	*Mataeopsephus japonicus*	1
2421	9	2013/12/01	U-SP-21	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	198
2422	9	2013/12/01	U-SP-21	37	Arachnida	Acarina	Axonopsidae	*Brachypoda* sp.	1
2423	9	2013/12/01	U-SP-21	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	2
2424	9	2013/12/01	U-SP-21	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	98
2425	9	2013/12/01	U-SP-21	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	34
2426	9	2013/12/01	U-SP-21	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	22
2427	9	2013/12/01	U-SP-21	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	48
2428	9	2013/12/01	U-SP-21	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	16
2429	9	2013/12/01	U-SP-21	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	16
2430	9	2013/12/01	U-SP-21	115	Insecta	Plecoptera	Capniidae	Capniidae	320
2431	9	2013/12/01	U-SP-21	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	19
2432	9	2013/12/01	U-SP-21	181	Insecta	Trichoptera	Leptoceridae	*Oecetis* sp.	1
2433	9	2013/12/01	U-SP-21	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
2434	9	2013/12/01	U-SP-21	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	1
2435	9	2013/12/01	U-SP-21	200	Insecta	Diptera	Chironomidae	Tanypodinae	1
2436	9	2013/12/01	U-SP-21	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	17
2437	9	2013/12/01	U-SP-21	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	456
2438	9	2013/12/01	U-SP-21	207	Insecta	Diptera	Chironomidae	Diamesinae	33
2439	9	2013/12/01	U-SP-21	208	Insecta	Diptera	Chironomidae	*Prodiamesa* sp.	358
2440	9	2013/12/01	U-SP-21	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	52
2441	9	2013/12/01	U-SP-21	220	Insecta	Diptera	Chironomidae	*Parakiefferiella* sp.	97
2442	9	2013/12/01	U-SP-21	223	Insecta	Diptera	Chironomidae	*Pseudorthocladius* sp.	3
2443	9	2013/12/01	U-SP-21	227	Insecta	Diptera	Chironomidae	*Stenochironomus* sp.	16
2444	9	2013/12/01	U-SP-21	231	Insecta	Diptera	Chironomidae	Orthocladiinae	4
2445	9	2013/12/01	U-SP-21	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	1
2446	9	2013/12/01	U-SP-21	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	17
2447	9	2013/12/01	U-SP-21	255	Insecta	Diptera	Athericidae	*Atrichops fontinalis*	1
2448	9	2013/12/01	U-SP-21	257	Insecta	Diptera	Athericidae	*Suragina satsumana*	1
2449	9	2013/12/01	U-SP-21	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	19
2450	9	2013/12/01	U-SP-21	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	66
2451	9	2013/12/01	U-SP-21	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1
2452	9	2013/12/01	U-SP-21	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	16
2453	9	2013/12/01	U-SP-21	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	2
2454	9	2013/12/15	D-SP-22	19	Oligochaeta	Tubificida	Naididae	*Nais* sp.	8
2455	9	2013/12/15	D-SP-22	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	29
2456	9	2013/12/15	D-SP-22	36	Arachnida	Acarina	Axonopsidae	*Axonopsis* sp.	24
2457	9	2013/12/15	D-SP-22	42	Malacostraca	Amphipoda	Crangonyctidae	*Crangonyx floridanus*	1
2458	9	2013/12/15	D-SP-22	44	Malacostraca	Isopoda	Asellidae	Asellidae	1
2459	9	2013/12/15	D-SP-22	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	19
2460	9	2013/12/15	D-SP-22	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	14
2461	9	2013/12/15	D-SP-22	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1
2462	9	2013/12/15	D-SP-22	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	1
2463	9	2013/12/15	D-SP-22	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	16
2464	9	2013/12/15	D-SP-22	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	2
2465	9	2013/12/15	D-SP-22	83	Insecta	Ephemeroptera	Ephemeridae	*Ephemera strigata*	2
2466	9	2013/12/15	D-SP-22	84	Insecta	Ephemeroptera	Ephemeridae	*Ephemera* sp.	24
2467	9	2013/12/15	D-SP-22	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	6
2468	9	2013/12/15	D-SP-22	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	11
2469	9	2013/12/15	D-SP-22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1
2470	9	2013/12/15	D-SP-22	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	23
2471	9	2013/12/15	D-SP-22	106	Insecta	Odonata	Gomphidae	*Nihonogomphus viridis*	1
2472	9	2013/12/15	D-SP-22	112	Insecta	Odonata	Corduliidae	*Macromia amphigena amphigena*	1
2473	9	2013/12/15	D-SP-22	115	Insecta	Plecoptera	Capniidae	Capniidae	24
2474	9	2013/12/15	D-SP-22	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1
2475	9	2013/12/15	D-SP-22	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2476	9	2013/12/15	D-SP-22	154	Insecta	Trichoptera	Ecnomidae	*Ecnomus* sp.	1
2477	9	2013/12/15	D-SP-22	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	137
2478	9	2013/12/15	D-SP-22	179	Insecta	Trichoptera	Leptoceridae	*Ceraclea* sp.	8
2479	9	2013/12/15	D-SP-22	181	Insecta	Trichoptera	Leptoceridae	*Oecetis* sp.	1
2480	9	2013/12/15	D-SP-22	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3
2481	9	2013/12/15	D-SP-22	186	Insecta	Diptera	Tipulidae	*Erioptera* sp.	19
2482	9	2013/12/15	D-SP-22	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	11
2483	9	2013/12/15	D-SP-22	200	Insecta	Diptera	Chironomidae	Tanypodinae	8
2484	9	2013/12/15	D-SP-22	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	27
2485	9	2013/12/15	D-SP-22	208	Insecta	Diptera	Chironomidae	*Prodiamesa* sp.	19
2486	9	2013/12/15	D-SP-22	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	1
2487	9	2013/12/15	D-SP-22	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	20
2488	9	2013/12/15	D-SP-22	223	Insecta	Diptera	Chironomidae	*Pseudorthocladius* sp.	88
2489	9	2013/12/15	D-SP-22	231	Insecta	Diptera	Chironomidae	Orthocladiinae	24
2490	9	2013/12/15	D-SP-22	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	8
2491	9	2013/12/15	D-SP-22	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	4
2492	9	2013/12/15	D-SP-22	263	Insecta	Diptera	Ephydridae	Ephydridae	1
2493	9	2013/12/15	D-SP-22	267	Insecta	Coleoptera	Dytiscidae	Colymbetinae	1
2494	9	2013/12/15	D-SP-22	272	Insecta	Coleoptera	Hydrophilidae	*Laccobius fragilis*	5
2495	9	2013/12/15	D-SP-22	273	Insecta	Coleoptera	Hydrophilidae	*Laccobius oscillans*	5
2496	9	2013/12/15	D-SP-22	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	10
2497	9	2013/12/15	D-SP-22	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	9
2498	10	2014/02/13	U-BW-11	13	Oligochaeta	Tubificida	Enchytraeidae	*Marionina* sp.	1
2499	10	2014/02/13	U-BW-11	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	1
2500	10	2014/02/13	U-BW-11	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	46
2501	10	2014/02/13	U-BW-11	37	Arachnida	Acarina	Axonopsidae	*Brachypoda* sp.	1
2502	10	2014/02/13	U-BW-11	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	70
2503	10	2014/02/13	U-BW-11	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	2
2504	10	2014/02/13	U-BW-11	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	112
2505	10	2014/02/13	U-BW-11	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	9
2506	10	2014/02/13	U-BW-11	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	76
2507	10	2014/02/13	U-BW-11	78	Insecta	Ephemeroptera	Siphlonuridae	*Siphlonurus* sp.	491
2508	10	2014/02/13	U-BW-11	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	11
2509	10	2014/02/13	U-BW-11	83	Insecta	Ephemeroptera	Ephemeridae	*Ephemera strigata*	1
2510	10	2014/02/13	U-BW-11	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	7
2511	10	2014/02/13	U-BW-11	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	4
2512	10	2014/02/13	U-BW-11	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	1
2513	10	2014/02/13	U-BW-11	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1
2514	10	2014/02/13	U-BW-11	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	108
2515	10	2014/02/13	U-BW-11	105	Insecta	Odonata	Gomphidae	*Davidius* sp.	1
2516	10	2014/02/13	U-BW-11	115	Insecta	Plecoptera	Capniidae	Capniidae	8
2517	10	2014/02/13	U-BW-11	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	1
2518	10	2014/02/13	U-BW-11	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	2
2519	10	2014/02/13	U-BW-11	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	4
2520	10	2014/02/13	U-BW-11	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	82
2521	10	2014/02/13	U-BW-11	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	32
2522	10	2014/02/13	U-BW-11	170	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila kawamurae*	1
2523	10	2014/02/13	U-BW-11	177	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma satoi*	32
2524	10	2014/02/13	U-BW-11	178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	1
2525	10	2014/02/13	U-BW-11	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	33
2526	10	2014/02/13	U-BW-11	181	Insecta	Trichoptera	Leptoceridae	*Oecetis* sp.	33
2527	10	2014/02/13	U-BW-11	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3
2528	10	2014/02/13	U-BW-11	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1
2529	10	2014/02/13	U-BW-11	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2
2530	10	2014/02/13	U-BW-11	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	1
2531	10	2014/02/13	U-BW-11	199	Insecta	Diptera	Chironomidae	*Trissopelopia* sp.	2
2532	10	2014/02/13	U-BW-11	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	403
2533	10	2014/02/13	U-BW-11	207	Insecta	Diptera	Chironomidae	Diamesinae	69
2534	10	2014/02/13	U-BW-11	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	1563
2535	10	2014/02/13	U-BW-11	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	690
2536	10	2014/02/13	U-BW-11	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	436
2537	10	2014/02/13	U-BW-11	231	Insecta	Diptera	Chironomidae	Orthocladiinae	39
2538	10	2014/02/13	U-BW-11	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	2
2539	10	2014/02/13	U-BW-11	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	32
2540	10	2014/02/13	U-BW-11	261	Insecta	Diptera	Empididae	Empididae	268
2541	10	2014/02/13	U-BW-11	281	Insecta	Coleoptera	Elmidae	*Zaitzevia nitida*	1
2542	10	2014/02/13	U-BW-11	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3
2543	10	2014/02/13	U-BW-11	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
2544	10	2014/02/13	U-BW-22	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	32
2545	10	2014/02/13	U-BW-22	11	Bivalvia	Veneroida	Corbiculidae	*Corbicula* sp.	1
2546	10	2014/02/13	U-BW-22	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	691
2547	10	2014/02/13	U-BW-22	18	Oligochaeta	Tubificida	Naididae	*Nais pardalis*	1209
2548	10	2014/02/13	U-BW-22	19	Oligochaeta	Tubificida	Naididae	*Nais* sp.	96
2549	10	2014/02/13	U-BW-22	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	169
2550	10	2014/02/13	U-BW-22	23	Oligochaeta	Tubificida	Naididae	*Stylaria fossularis*	32

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2551	10	2014/02/13	U-BW-22	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	73
2552	10	2014/02/13	U-BW-22	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	14
2553	10	2014/02/13	U-BW-22	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	2
2554	10	2014/02/13	U-BW-22	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	1
2555	10	2014/02/13	U-BW-22	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	3
2556	10	2014/02/13	U-BW-22	69	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus yoshidae*	4
2557	10	2014/02/13	U-BW-22	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	35
2558	10	2014/02/13	U-BW-22	78	Insecta	Ephemeroptera	Siphlonuridae	*Siphlonurus* sp.	33
2559	10	2014/02/13	U-BW-22	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	6
2560	10	2014/02/13	U-BW-22	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	44
2561	10	2014/02/13	U-BW-22	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	15
2562	10	2014/02/13	U-BW-22	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	96
2563	10	2014/02/13	U-BW-22	104	Insecta	Odonata	Gomphidae	*Davidius nanus*	2
2564	10	2014/02/13	U-BW-22	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	1
2565	10	2014/02/13	U-BW-22	115	Insecta	Plecoptera	Capniidae	Capniidae	1
2566	10	2014/02/13	U-BW-22	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2
2567	10	2014/02/13	U-BW-22	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1
2568	10	2014/02/13	U-BW-22	182	Insecta	Trichoptera	Sericostomatidae	*Gumaga orientalis*	1
2569	10	2014/02/13	U-BW-22	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2
2570	10	2014/02/13	U-BW-22	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	37
2571	10	2014/02/13	U-BW-22	199	Insecta	Diptera	Chironomidae	*Trissopelopia* sp.	2
2572	10	2014/02/13	U-BW-22	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	35
2573	10	2014/02/13	U-BW-22	207	Insecta	Diptera	Chironomidae	Diamesinae	1
2574	10	2014/02/13	U-BW-22	208	Insecta	Diptera	Chironomidae	*Prodiamesa* sp.	1
2575	10	2014/02/13	U-BW-22	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	5
2576	10	2014/02/13	U-BW-22	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	681
2577	10	2014/02/13	U-BW-22	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	67
2578	10	2014/02/13	U-BW-22	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	136
2579	10	2014/02/13	U-BW-22	231	Insecta	Diptera	Chironomidae	Orthocladiinae	361
2580	10	2014/02/13	U-BW-22	241	Insecta	Diptera	Chironomidae	*Paracladopelma* sp.	1
2581	10	2014/02/13	U-BW-22	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	2
2582	10	2014/02/13	U-BW-22	261	Insecta	Diptera	Empididae	Empididae	134
2583	10	2014/02/13	U-BW-22	285	Insecta	Coleoptera	Psephenidae	*Eubrianax granicollis*	1
2584	10	2014/02/13	U-BW-22	287	Insecta	Coleoptera	Psephenidae	*Mataeopsephus japonicus*	1
2585	10	2014/02/13	U-Rf-1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	3
2586	10	2014/02/13	U-Rf-1	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	52
2587	10	2014/02/13	U-Rf-1	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	208
2588	10	2014/02/13	U-Rf-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1
2589	10	2014/02/13	U-Rf-1	51	Malacostraca	Decapoda	Varunidae	*Eriocheir japonica*	3
2590	10	2014/02/13	U-Rf-1	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	3
2591	10	2014/02/13	U-Rf-1	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	20
2592	10	2014/02/13	U-Rf-1	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	37
2593	10	2014/02/13	U-Rf-1	67	Insecta	Ephemeroptera	Heptageniidae	*Cinygmula* sp.	1
2594	10	2014/02/13	U-Rf-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	50
2595	10	2014/02/13	U-Rf-1	72	Insecta	Ephemeroptera	Heptageniidae	*Epeorus ikanonis*	695
2596	10	2014/02/13	U-Rf-1	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	37
2597	10	2014/02/13	U-Rf-1	74	Insecta	Ephemeroptera	Heptageniidae	*Epeorus* sp.	18
2598	10	2014/02/13	U-Rf-1	75	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena tetrapunctigera*	32
2599	10	2014/02/13	U-Rf-1	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	4
2600	10	2014/02/13	U-Rf-1	86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*	177
2601	10	2014/02/13	U-Rf-1	89	Insecta	Ephemeroptera	Ephemerellidae	*Drunella sachalinensis*	2
2602	10	2014/02/13	U-Rf-1	90	Insecta	Ephemeroptera	Ephemerellidae	*Drunella* sp.	2
2603	10	2014/02/13	U-Rf-1	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	99
2604	10	2014/02/13	U-Rf-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	185
2605	10	2014/02/13	U-Rf-1	115	Insecta	Plecoptera	Capniidae	Capniidae	69
2606	10	2014/02/13	U-Rf-1	117	Insecta	Plecoptera	Nemouridae	*Amphinemura* sp.	19
2607	10	2014/02/13	U-Rf-1	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	69
2608	10	2014/02/13	U-Rf-1	119	Insecta	Plecoptera	Taeniopterygidae	*Obipteryx* sp.	20
2609	10	2014/02/13	U-Rf-1	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	23
2610	10	2014/02/13	U-Rf-1	128	Insecta	Plecoptera	Perlidae	*Kamimuria tibialis*	1
2611	10	2014/02/13	U-Rf-1	137	Insecta	Plecoptera	Perlodidae	*Isoperla nipponica*	109
2612	10	2014/02/13	U-Rf-1	139	Insecta	Plecoptera	Perlodidae	*Ostrovus* sp.	27
2613	10	2014/02/13	U-Rf-1	140	Insecta	Plecoptera	Perlodidae	*Stavsolus japonicus*	2
2614	10	2014/02/13	U-Rf-1	143	Insecta	Plecoptera	Perlodidae	Perlodidae	99
2615	10	2014/02/13	U-Rf-1	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	54
2616	10	2014/02/13	U-Rf-1	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	49
2617	10	2014/02/13	U-Rf-1	164	Insecta	Trichoptera	Psychomyiidae	*Psychomyia* sp.	1
2618	10	2014/02/13	U-Rf-1	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	10
2619	10	2014/02/13	U-Rf-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	32
2620	10	2014/02/13	U-Rf-1	171	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila kisoensis*	1
2621	10	2014/02/13	U-Rf-1	173	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila* sp.	1
2622	10	2014/02/13	U-Rf-1	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	24
2623	10	2014/02/13	U-Rf-1	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6
2624	10	2014/02/13	U-Rf-1	201	Insecta	Diptera	Chironomidae	*Diamesa* sp.	1
2625	10	2014/02/13	U-Rf-1	202	Insecta	Diptera	Chironomidae	*Pagastia* sp.	8

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2626	10	2014/02/13	U-Rf-1	204	Insecta	Diptera	Chironomidae	*Potthastia montium*	1
2627	10	2014/02/13	U-Rf-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	2
2628	10	2014/02/13	U-Rf-1	207	Insecta	Diptera	Chironomidae	Diamesinae	22
2629	10	2014/02/13	U-Rf-1	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	6
2630	10	2014/02/13	U-Rf-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	147
2631	10	2014/02/13	U-Rf-1	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	101
2632	10	2014/02/13	U-Rf-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1352
2633	10	2014/02/13	U-Rf-1	225	Insecta	Diptera	Chironomidae	*Rheocricotopus* sp.	16
2634	10	2014/02/13	U-Rf-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	728
2635	10	2014/02/13	U-Rf-1	251	Insecta	Diptera	Simuliidae	*Eusimulium* sp.	3
2636	10	2014/02/13	U-Rf-1	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	48
2637	10	2014/02/13	U-Rf-1	261	Insecta	Diptera	Empididae	Empididae	69
2638	10	2014/02/13	U-Rf-1	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3
2639	10	2014/02/13	U-Rf-21	19	Oligochaeta	Tubificida	Naididae	*Nais* sp.	64
2640	10	2014/02/13	U-Rf-21	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	26
2641	10	2014/02/13	U-Rf-21	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	2
2642	10	2014/02/13	U-Rf-21	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	28
2643	10	2014/02/13	U-Rf-21	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	3
2644	10	2014/02/13	U-Rf-21	72	Insecta	Ephemeroptera	Heptageniidae	*Epeorus ikanonis*	48
2645	10	2014/02/13	U-Rf-21	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	34
2646	10	2014/02/13	U-Rf-21	86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*	10
2647	10	2014/02/13	U-Rf-21	89	Insecta	Ephemeroptera	Ephemerellidae	*Drunella sachalinensis*	1
2648	10	2014/02/13	U-Rf-21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	32
2649	10	2014/02/13	U-Rf-21	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	114
2650	10	2014/02/13	U-Rf-21	115	Insecta	Plecoptera	Capniidae	Capniidae	20
2651	10	2014/02/13	U-Rf-21	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	19
2652	10	2014/02/13	U-Rf-21	119	Insecta	Plecoptera	Taeniopterygidae	*Obipteryx* sp.	2
2653	10	2014/02/13	U-Rf-21	121	Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	1
2654	10	2014/02/13	U-Rf-21	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	1
2655	10	2014/02/13	U-Rf-21	137	Insecta	Plecoptera	Perlodidae	*Isoperla nipponica*	19
2656	10	2014/02/13	U-Rf-21	139	Insecta	Plecoptera	Perlodidae	*Ostrovus* sp.	2
2657	10	2014/02/13	U-Rf-21	142	Insecta	Plecoptera	Perlodidae	*Tadamus* sp.	2
2658	10	2014/02/13	U-Rf-21	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	18
2659	10	2014/02/13	U-Rf-21	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1
2660	10	2014/02/13	U-Rf-21	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	1
2661	10	2014/02/13	U-Rf-21	178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	1
2662	10	2014/02/13	U-Rf-21	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1
2663	10	2014/02/13	U-Rf-21	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1
2664	10	2014/02/13	U-Rf-21	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	1
2665	10	2014/02/13	U-Rf-21	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	3
2666	10	2014/02/13	U-Rf-21	207	Insecta	Diptera	Chironomidae	Diamesinae	58
2667	10	2014/02/13	U-Rf-21	209	Insecta	Diptera	Chironomidae	*Brillia* sp.	1
2668	10	2014/02/13	U-Rf-21	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2
2669	10	2014/02/13	U-Rf-21	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	77
2670	10	2014/02/13	U-Rf-21	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	6
2671	10	2014/02/13	U-Rf-21	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	16
2672	10	2014/02/13	U-Rf-21	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	262
2673	10	2014/02/13	U-Rf-21	231	Insecta	Diptera	Chironomidae	Orthocladiinae	117
2674	10	2014/02/13	U-Rf-21	251	Insecta	Diptera	Simuliidae	*Eusimulium* sp.	1
2675	10	2014/02/13	U-Rf-21	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	3
2676	10	2014/02/13	U-Rf-21	261	Insecta	Diptera	Empididae	Empididae	37
2677	10	2014/02/13	U-Rf-23	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	3
2678	10	2014/02/13	U-Rf-23	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	7
2679	10	2014/02/13	U-Rf-23	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1
2680	10	2014/02/13	U-Rf-23	52	Insecta	Ephemeroptera	Ameletidae	*Ameletus* sp.	4
2681	10	2014/02/13	U-Rf-23	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	16
2682	10	2014/02/13	U-Rf-23	58	Insecta	Ephemeroptera	Baetidae	*Baetis thermicus*	2
2683	10	2014/02/13	U-Rf-23	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	48
2684	10	2014/02/13	U-Rf-23	72	Insecta	Ephemeroptera	Heptageniidae	*Epeorus ikanonis*	376
2685	10	2014/02/13	U-Rf-23	73	Insecta	Ephemeroptera	Heptageniidae	*Epeorus latifolium*	16
2686	10	2014/02/13	U-Rf-23	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	33
2687	10	2014/02/13	U-Rf-23	86	Insecta	Ephemeroptera	Ephemerellidae	*Cincticostella elongatula*	81
2688	10	2014/02/13	U-Rf-23	90	Insecta	Ephemeroptera	Ephemerellidae	*Drunella* sp.	81
2689	10	2014/02/13	U-Rf-23	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	50
2690	10	2014/02/13	U-Rf-23	115	Insecta	Plecoptera	Capniidae	Capniidae	30
2691	10	2014/02/13	U-Rf-23	117	Insecta	Plecoptera	Nemouridae	*Amphinemura* sp.	1
2692	10	2014/02/13	U-Rf-23	118	Insecta	Plecoptera	Nemouridae	*Nemoura* sp.	32
2693	10	2014/02/13	U-Rf-23	120	Insecta	Plecoptera	Taeniopterygidae	*Strophopteryx* sp.	1
2694	10	2014/02/13	U-Rf-23	125	Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	3
2695	10	2014/02/13	U-Rf-23	137	Insecta	Plecoptera	Perlodidae	*Isoperla nipponica*	48
2696	10	2014/02/13	U-Rf-23	139	Insecta	Plecoptera	Perlodidae	*Ostrovus* sp.	1
2697	10	2014/02/13	U-Rf-23	142	Insecta	Plecoptera	Perlodidae	*Tadamus* sp.	3
2698	10	2014/02/13	U-Rf-23	143	Insecta	Plecoptera	Perlodidae	Perlodidae	98
2699	10	2014/02/13	U-Rf-23	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	6
2700	10	2014/02/13	U-Rf-23	158	Insecta	Trichoptera	Hydropsychidae	*Diplectrona* sp.	1

Table 1.2 All survey data on macro-invertebrates. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site. Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species information					
All data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Reference number	Class	Order	Family	Name	Abundance
2701	10	2014/02/13	U-Rf-23	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	17
2702	10	2014/02/13	U-Rf-23	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	9
2703	10	2014/02/13	U-Rf-23	173	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila* sp.	1
2704	10	2014/02/13	U-Rf-23	178	Insecta	Trichoptera	Lepidostomatidae	*Lepidostoma* sp.	2
2705	10	2014/02/13	U-Rf-23	203	Insecta	Diptera	Chironomidae	*Potthastia longimana*	16
2706	10	2014/02/13	U-Rf-23	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	18
2707	10	2014/02/13	U-Rf-23	207	Insecta	Diptera	Chironomidae	Diamesinae	2
2708	10	2014/02/13	U-Rf-23	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	33
2709	10	2014/02/13	U-Rf-23	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	72
2710	10	2014/02/13	U-Rf-23	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	54
2711	10	2014/02/13	U-Rf-23	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	67
2712	10	2014/02/13	U-Rf-23	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	207
2713	10	2014/02/13	U-Rf-23	231	Insecta	Diptera	Chironomidae	Orthocladiinae	129
2714	10	2014/02/13	U-Rf-23	251	Insecta	Diptera	Simuliidae	*Eusimulium* sp.	1
2715	10	2014/02/13	U-Rf-23	252	Insecta	Diptera	Simuliidae	*Simulium* sp.	54
2716	10	2014/02/13	U-Rf-23	261	Insecta	Diptera	Empididae	Empididae	16
2717	10	2014/02/13	U-SP-1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	2
2718	10	2014/02/13	U-SP-1	13	Oligochaeta	Tubificida	Enchytraeidae	*Marionina* sp.	2
2719	10	2014/02/13	U-SP-1	24	Oligochaeta	Tubificida	Naididae	*Limnodrilus hoffmeisteri*	32
2720	10	2014/02/13	U-SP-1	27	Oligochaeta	Lumbricida	-	LUMBRICIDA	1
2721	10	2014/02/13	U-SP-1	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1
2722	10	2014/02/13	U-SP-1	45	Malacostraca	Decapoda	Atyidae	*Caridina leucosticta*	17
2723	10	2014/02/13	U-SP-1	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	3
2724	10	2014/02/13	U-SP-1	47	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium formosense*	3
2725	10	2014/02/13	U-SP-1	48	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium japonicum*	1
2726	10	2014/02/13	U-SP-1	50	Malacostraca	Decapoda	Palaemonidae	*Palaemon paucidens*	23
2727	10	2014/02/13	U-SP-1	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2
2728	10	2014/02/13	U-SP-1	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	1
2729	10	2014/02/13	U-SP-1	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1
2730	10	2014/02/13	U-SP-1	91	Insecta	Ephemeroptera	Ephemerellidae	*Ephacerella longicaudata*	46
2731	10	2014/02/13	U-SP-1	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1
2732	10	2014/02/13	U-SP-1	108	Insecta	Odonata	Gomphidae	*Sieboldius albardae*	2
2733	10	2014/02/13	U-SP-1	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1
2734	10	2014/02/13	U-SP-1	111	Insecta	Odonata	Gomphidae	Gomphidae	1
2735	10	2014/02/13	U-SP-1	115	Insecta	Plecoptera	Capniidae	Capniidae	2
2736	10	2014/02/13	U-SP-1	124	Insecta	Plecoptera	Chloroperlidae	*Sweltsa* sp.	2
2737	10	2014/02/13	U-SP-1	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2
2738	10	2014/02/13	U-SP-1	152	Insecta	Odonata	Corydalidae	*Parachauliodes continentalis*	1
2739	10	2014/02/13	U-SP-1	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	34
2740	10	2014/02/13	U-SP-1	194	Insecta	Diptera	Chironomidae	*Conchapelopia* sp.	35
2741	10	2014/02/13	U-SP-1	206	Insecta	Diptera	Chironomidae	*Sympotthastia* sp.	32
2742	10	2014/02/13	U-SP-1	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	221
2743	10	2014/02/13	U-SP-1	213	Insecta	Diptera	Chironomidae	*Diplocladius cultriger*	901
2744	10	2014/02/13	U-SP-1	215	Insecta	Diptera	Chironomidae	*Eukiefferiella* sp.	1
2745	10	2014/02/13	U-SP-1	216	Insecta	Diptera	Chironomidae	*Hydrobaenus* sp.	2
2746	10	2014/02/13	U-SP-1	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	32
2747	10	2014/02/13	U-SP-1	229	Insecta	Diptera	Chironomidae	*Thienemanniella* sp.	2
2748	10	2014/02/13	U-SP-1	231	Insecta	Diptera	Chironomidae	Orthocladiinae	200
2749	10	2014/02/13	U-SP-1	240	Insecta	Diptera	Chironomidae	*Microtendipes* sp.	2
2750	10	2014/02/13	U-SP-1	244	Insecta	Diptera	Chironomidae	*Polypedilum* sp.	1
2751	10	2014/02/13	U-SP-1	261	Insecta	Diptera	Empididae	Empididae	276

Table 2 Survey data on selected 50 macro-invertebrates for the analysis.

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1	1	2012/10/13	D-BW-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2	388	12	113	115	388	Swimmers	Swimmers	Swimmers
2	1	2012/10/13	D-BW-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	63	388	12	113	115	388	Creepers	Crawlers	Gliders
3	1	2012/10/13	D-BW-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	19	388	12	113	115	388	Creepers	Crawlers	Crawlers
4	1	2012/10/13	D-BW-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	18	388	12	113	115	388	Swimmers	Swimmers	Swimmers
5	1	2012/10/13	D-BW-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	2	388	12	113	115	388	Case-bearers	Crawlers	Case-bearers
6	1	2012/10/13	D-BW-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	22	388	12	113	115	388	Creepers	Crawlers	Crawlers
7	1	2012/10/13	D-BW-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	2	388	12	113	115	388	Creepers	Crawlers	Crawlers
8	1	2012/10/13	D-BW-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	388	12	113	115	388	Burrowers	Burrowers	Free burrowers
9	1	2012/10/13	D-BW-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	73	388	12	113	115	388	Creepers	Crawlers	Crawlers
10	1	2012/10/13	D-BW-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	1	388	12	113	115	388	Burrowers	Burrowers	Free burrowers
11	1	2012/10/13	D-BW-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	19	388	12	113	115	388	Burrowers	Burrowers	Tube burrowers
12	1	2012/10/13	D-BW-2	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1	388	12	113	115	388	Attachers	Attachers	Case builders
13	1	2012/10/13	D-BW-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	7	388	12	113	115	388	Creepers	Crawlers	Crawlers
14	1	2012/10/13	D-BW-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	388	12	113	115	388	Swimmers	Swimmers	Swimmers
15	1	2012/10/13	D-BW-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	4	388	12	113	115	388	Creepers	Crawlers	Gliders
16	1	2012/10/13	D-BW-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2	388	12	113	115	388	Creepers	Crawlers	Crawlers
17	1	2012/10/13	D-BW-2	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	388	12	113	115	388	Creepers	Crawlers	Crawlers
18	1	2012/10/13	D-BW-2	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1	388	12	113	115	388	Case-bearers	Crawlers	Case-bearers
19	1	2012/10/13	D-BW-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	20	388	12	113	115	388	Creepers	Crawlers	Crawlers
20	1	2012/10/13	D-BW-2	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	4	388	12	113	115	388	Creepers	Crawlers	Crawlers
21	1	2012/10/13	D-BW-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	388	12	113	115	388	Burrowers	Burrowers	Free burrowers
22	1	2012/10/13	D-BW-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	26	388	12	113	115	388	Creepers	Crawlers	Crawlers
23	1	2012/10/13	D-BW-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2	388	12	113	115	388	Burrowers	Burrowers	Free burrowers
24	1	2012/10/13	D-BW-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1	388	12	113	115	388	Burrowers	Burrowers	Free burrowers
25	1	2012/10/13	D-BW-2	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	36	388	12	113	115	388	Burrowers	Burrowers	Free burrowers
26	1	2012/10/13	D-BW-2	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	2	388	12	113	115	388	Burrowers	Burrowers	Tube burrowers
27	1	2012/10/13	D-BW-2	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1	388	12	113	115	388	Burrowers	Burrowers	Free burrowers
28	1	2012/10/13	D-BW-2	50	261	Insecta	Diptera	Empididae	Empididae	4	388	12	113	115	388	Burrowers	Burrowers	Free burrowers
29	1	2012/10/13	D-SP-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1	388	9	113	115	388	Attachers	Attachers	Case builders
30	1	2012/10/13	D-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	26	388	9	113	115	388	Creepers	Crawlers	Gliders
31	1	2012/10/13	D-SP-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	2	388	9	113	115	388	Net-spinners	Attachers	Net-spinners
32	1	2012/10/13	D-SP-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1	388	9	113	115	388	Case-bearers	Crawlers	Case-bearers
33	1	2012/10/13	D-SP-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	7	388	9	113	115	388	Creepers	Crawlers	Crawlers
34	1	2012/10/13	D-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	4	388	9	113	115	388	Creepers	Crawlers	Crawlers
35	1	2012/10/13	D-SP-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	3	388	9	113	115	388	Burrowers	Burrowers	Free burrowers
36	1	2012/10/13	D-SP-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1	388	9	113	115	388	Burrowers	Burrowers	Tube burrowers
37	1	2012/10/14	D-Rf-1	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	8	389	0	114	116	389	Creepers	Crawlers	Creepers
38	1	2012/10/14	D-Rf-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	9	389	0	114	116	389	Attachers	Attachers	Case builders
39	1	2012/10/14	D-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	8	389	0	114	116	389	Creepers	Crawlers	Crawlers
40	1	2012/10/14	D-Rf-1	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	8	389	0	114	116	389	Creepers	Crawlers	Crawlers
41	1	2012/10/14	D-Rf-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	19	389	0	114	116	389	Creepers	Crawlers	Crawlers
42	1	2012/10/14	D-Rf-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	52	389	0	114	116	389	Swimmers	Swimmers	Swimmers
43	1	2012/10/14	D-Rf-1	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	2	389	0	114	116	389	Swimmers	Swimmers	Swimmers
44	1	2012/10/14	D-Rf-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	12	389	0	114	116	389	Creepers	Crawlers	Gliders
45	1	2012/10/14	D-Rf-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	4	389	0	114	116	389	Creepers	Crawlers	Gliders
46	1	2012/10/14	D-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	62	389	0	114	116	389	Swimmers	Swimmers	Swimmers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

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Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
47	1	2012/10/14	D-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1	389	0	114	116	389	Creepers	Crawlers	Crawlers
48	1	2012/10/14	D-Rf-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	7	389	0	114	116	389	Creepers	Crawlers	Crawlers
49	1	2012/10/14	D-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	141	389	0	114	116	389	Net-spinners	Attachers	Net-spinners
50	1	2012/10/14	D-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	514	389	0	114	116	389	Net-spinners	Attachers	Net-spinners
51	1	2012/10/14	D-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	8	389	0	114	116	389	Net-spinners	Attachers	Net-spinners
52	1	2012/10/14	D-Rf-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	2	389	0	114	116	389	Case-bearers	Crawlers	Case-bearers
53	1	2012/10/14	D-Rf-1	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1	389	0	114	116	389	Case-bearers	Crawlers	Case-bearers
54	1	2012/10/14	D-Rf-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2	389	0	114	116	389	Creepers	Crawlers	Crawlers
55	1	2012/10/14	D-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3	389	0	114	116	389	Creepers	Crawlers	Crawlers
56	1	2012/10/14	D-Rf-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	19	389	0	114	116	389	Creepers	Crawlers	Crawlers
57	1	2012/10/14	D-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2	389	0	114	116	389	Attachers	Attachers	Net-spinners
58	1	2012/10/14	D-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	389	0	114	116	389	Burrowers	Burrowers	Free burrowers
59	1	2012/10/14	D-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	111	389	0	114	116	389	Creepers	Crawlers	Crawlers
60	1	2012/10/14	D-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	11	389	0	114	116	389	Burrowers	Burrowers	Free burrowers
61	1	2012/10/14	D-Rf-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	13	389	0	114	116	389	Burrowers	Burrowers	Free burrowers
62	1	2012/10/14	D-Rf-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	1	389	0	114	116	389	Burrowers	Burrowers	Free burrowers
63	1	2012/10/14	D-Rf-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	8	389	0	114	116	389	Burrowers	Burrowers	Tube burrowers
64	1	2012/10/14	U-BW-1	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	35	116	13	114	116	-	Creepers	Crawlers	Creepers
65	1	2012/10/14	U-BW-1	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	152	116	13	114	116	-	Swimmers	Swimmers	Swimmers
66	1	2012/10/14	U-BW-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	33	116	13	114	116	-	Creepers	Crawlers	Crawlers
67	1	2012/10/14	U-BW-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	212	116	13	114	116	-	Swimmers	Swimmers	Swimmers
68	1	2012/10/14	U-BW-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	10	116	13	114	116	-	Case-bearers	Crawlers	Case-bearers
69	1	2012/10/14	U-BW-1	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	2	116	13	114	116	-	Case-bearers	Crawlers	Case-bearers
70	1	2012/10/14	U-BW-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	116	13	114	116	-	Burrowers	Burrowers	Free burrowers
71	1	2012/10/14	U-BW-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1	116	13	114	116	-	Burrowers	Burrowers	Free burrowers
72	1	2012/10/14	U-BW-1	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	4	116	13	114	116	-	Burrowers	Burrowers	Free burrowers
73	1	2012/10/14	U-BW-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	13	116	13	114	116	-	Burrowers	Burrowers	Free burrowers
74	1	2012/10/14	U-BW-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	2	116	13	114	116	-	Burrowers	Burrowers	Tube burrowers
75	1	2012/10/14	U-Rf-2	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	2	116	0	114	116	-	Creepers	Crawlers	Creepers
76	1	2012/10/14	U-Rf-2	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1	116	0	114	116	-	Attachers	Attachers	Case builders
77	1	2012/10/14	U-Rf-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	116	0	114	116	-	Creepers	Crawlers	Crawlers
78	1	2012/10/14	U-Rf-2	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	18	116	0	114	116	-	Creepers	Crawlers	Crawlers
79	1	2012/10/14	U-Rf-2	11	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	1	116	0	114	116	-	Creepers	Crawlers	Crawlers
80	1	2012/10/14	U-Rf-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	116	0	114	116	-	Swimmers	Swimmers	Swimmers
81	1	2012/10/14	U-Rf-2	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1	116	0	114	116	-	Swimmers	Swimmers	Swimmers
82	1	2012/10/14	U-Rf-2	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	18	116	0	114	116	-	Creepers	Crawlers	Gliders
83	1	2012/10/14	U-Rf-2	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	24	116	0	114	116	-	Swimmers	Swimmers	Swimmers
84	1	2012/10/14	U-Rf-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1	116	0	114	116	-	Creepers	Crawlers	Crawlers
85	1	2012/10/14	U-Rf-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	8	116	0	114	116	-	Net-spinners	Attachers	Net-spinners
86	1	2012/10/14	U-Rf-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	975	116	0	114	116	-	Net-spinners	Attachers	Net-spinners
87	1	2012/10/14	U-Rf-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	2	116	0	114	116	-	Net-spinners	Attachers	Net-spinners
88	1	2012/10/14	U-Rf-2	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	16	116	0	114	116	-	Case-bearers	Crawlers	Case-bearers
89	1	2012/10/14	U-Rf-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	9	116	0	114	116	-	Creepers	Crawlers	Crawlers
90	1	2012/10/14	U-Rf-2	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	16	116	0	114	116	-	Creepers	Crawlers	Crawlers
91	1	2012/10/14	U-Rf-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2	116	0	114	116	-	Attachers	Attachers	Net-spinners
92	1	2012/10/14	U-Rf-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	116	0	114	116	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
93	1	2012/10/14	U-Rf-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	15	116	0	114	116	-	Creepers	Crawlers	Crawlers
94	1	2012/10/14	U-Rf-2	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	4	116	0	114	116	-	Burrowers	Burrowers	Free burrowers
95	1	2012/10/14	U-Rf-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	3	116	0	114	116	-	Burrowers	Burrowers	Free burrowers
96	1	2012/10/14	U-Rf-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	2	116	0	114	116	-	Burrowers	Burrowers	Free burrowers
97	1	2012/10/15	D-BW-21	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1	117	2	115	117	-	Creepers	Crawlers	Creepers
98	1	2012/10/15	D-BW-21	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	38	117	2	115	117	-	Attachers	Attachers	Case builders
99	1	2012/10/15	D-BW-21	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	15	117	2	115	117	-	Swimmers	Swimmers	Swimmers
100	1	2012/10/15	D-BW-21	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2	117	2	115	117	-	Creepers	Crawlers	Gliders
101	1	2012/10/15	D-BW-21	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	32	117	2	115	117	-	Creepers	Crawlers	Crawlers
102	1	2012/10/15	D-BW-21	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	3	117	2	115	117	-	Creepers	Crawlers	Crawlers
103	1	2012/10/15	D-BW-21	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	898	117	2	115	117	-	Swimmers	Swimmers	Swimmers
104	1	2012/10/15	D-BW-21	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1	117	2	115	117	-	Case-bearers	Crawlers	Case-bearers
105	1	2012/10/15	D-BW-21	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	2	117	2	115	117	-	Case-bearers	Crawlers	Case-bearers
106	1	2012/10/15	D-BW-21	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	45	117	2	115	117	-	Creepers	Crawlers	Crawlers
107	1	2012/10/15	D-BW-21	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	117	2	115	117	-	Creepers	Crawlers	Crawlers
108	1	2012/10/15	D-BW-21	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	192	117	2	115	117	-	Creepers	Crawlers	Crawlers
109	1	2012/10/15	D-BW-21	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	2	117	2	115	117	-	Burrowers	Burrowers	Free burrowers
110	1	2012/10/15	D-BW-21	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1	117	2	115	117	-	Burrowers	Burrowers	Free burrowers
111	1	2012/10/15	D-BW-21	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	162	117	2	115	117	-	Burrowers	Burrowers	Tube burrowers
112	1	2012/10/15	D-BW-21	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	4	117	2	115	117	-	Burrowers	Burrowers	Free burrowers
113	1	2012/10/15	D-BW-3	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	10	117	14	115	117	-	Swimmers	Swimmers	Swimmers
114	1	2012/10/15	D-BW-3	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	8	117	14	115	117	-	Burrowers	Burrowers	Gliding burrowers
115	1	2012/10/15	D-BW-3	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1	117	14	115	117	-	Swimmers	Swimmers	Swimmers
116	1	2012/10/15	D-BW-3	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1	117	14	115	117	-	Case-bearers	Crawlers	Case-bearers
117	1	2012/10/15	D-BW-3	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	8	117	14	115	117	-	Case-bearers	Crawlers	Case-bearers
118	1	2012/10/15	D-BW-3	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2	117	14	115	117	-	Creepers	Crawlers	Crawlers
119	1	2012/10/15	D-BW-3	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	62	117	14	115	117	-	Creepers	Crawlers	Crawlers
120	1	2012/10/15	D-BW-3	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	2	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
121	1	2012/10/15	D-BW-3	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
122	1	2012/10/15	D-BW-3	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	102	117	14	115	117	-	Burrowers	Burrowers	Tube burrowers
123	1	2012/10/15	D-SP-2	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	138	117	14	115	117	-	Creepers	Crawlers	Creepers
124	1	2012/10/15	D-SP-2	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	137	117	14	115	117	-	Attachers	Attachers	Case builders
125	1	2012/10/15	D-SP-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	4	117	14	115	117	-	Creepers	Crawlers	Crawlers
126	1	2012/10/15	D-SP-2	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	13	117	14	115	117	-	Swimmers	Swimmers	Swimmers
127	1	2012/10/15	D-SP-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2	117	14	115	117	-	Swimmers	Swimmers	Swimmers
128	1	2012/10/15	D-SP-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	20	117	14	115	117	-	Creepers	Crawlers	Gliders
129	1	2012/10/15	D-SP-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	8	117	14	115	117	-	Creepers	Crawlers	Crawlers
130	1	2012/10/15	D-SP-2	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	117	14	115	117	-	Creepers	Crawlers	Crawlers
131	1	2012/10/15	D-SP-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	272	117	14	115	117	-	Swimmers	Swimmers	Swimmers
132	1	2012/10/15	D-SP-2	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	192	117	14	115	117	-	Case-bearers	Crawlers	Case-bearers
133	1	2012/10/15	D-SP-2	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	11	117	14	115	117	-	Case-bearers	Crawlers	Case-bearers
134	1	2012/10/15	D-SP-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	471	117	14	115	117	-	Creepers	Crawlers	Crawlers
135	1	2012/10/15	D-SP-2	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	5	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
136	1	2012/10/15	D-SP-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
137	1	2012/10/15	D-SP-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	862	117	14	115	117	-	Creepers	Crawlers	Crawlers
138	1	2012/10/15	D-SP-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	128	117	14	115	117	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
139	1	2012/10/15	D-SP-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
140	1	2012/10/15	D-SP-2	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	2	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
141	1	2012/10/15	D-SP-2	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	413	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
142	1	2012/10/15	D-SP-2	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	264	117	14	115	117	-	Burrowers	Burrowers	Tube burrowers
143	1	2012/10/15	D-SP-2	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	5	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
144	1	2012/10/15	U-BW-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1	117	14	115	117	-	Creepers	Crawlers	Creepers
145	1	2012/10/15	U-BW-1	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	2	117	14	115	117	-	Burrowers	Burrowers	Gliding burrowers
146	1	2012/10/15	U-BW-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	33	117	14	115	117	-	Creepers	Crawlers	Crawlers
147	1	2012/10/15	U-BW-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2	117	14	115	117	-	Creepers	Crawlers	Crawlers
148	1	2012/10/15	U-BW-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	100	117	14	115	117	-	Swimmers	Swimmers	Swimmers
149	1	2012/10/15	U-BW-1	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	32	117	14	115	117	-	Case-bearers	Crawlers	Case-bearers
150	1	2012/10/15	U-BW-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	399	117	14	115	117	-	Creepers	Crawlers	Crawlers
151	1	2012/10/15	U-BW-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	7	117	14	115	117	-	Creepers	Crawlers	Crawlers
152	1	2012/10/15	U-BW-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	214	117	14	115	117	-	Creepers	Crawlers	Crawlers
153	1	2012/10/15	U-BW-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	1	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
154	1	2012/10/15	U-BW-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
155	1	2012/10/15	U-BW-1	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
156	1	2012/10/15	U-BW-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	37	117	14	115	117	-	Burrowers	Burrowers	Tube burrowers
157	1	2012/10/15	U-BW-1	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
158	1	2012/10/15	U-Rf-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2	390	0	115	117	390	Creepers	Crawlers	Creepers
159	1	2012/10/15	U-Rf-1	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1	390	0	115	117	390	Creepers	Crawlers	Creepers
160	1	2012/10/15	U-Rf-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	70	390	0	115	117	390	Attachers	Attachers	Case builders
161	1	2012/10/15	U-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	2	390	0	115	117	390	Creepers	Crawlers	Crawlers
162	1	2012/10/15	U-Rf-1	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	20	390	0	115	117	390	Creepers	Crawlers	Crawlers
163	1	2012/10/15	U-Rf-1	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	1	390	0	115	117	390	Swimmers	Attachers	Exposed attachers
164	1	2012/10/15	U-Rf-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	13	390	0	115	117	390	Swimmers	Swimmers	Swimmers
165	1	2012/10/15	U-Rf-1	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	76	390	0	115	117	390	Swimmers	Swimmers	Swimmers
166	1	2012/10/15	U-Rf-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	10	390	0	115	117	390	Creepers	Crawlers	Gliders
167	1	2012/10/15	U-Rf-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	16	390	0	115	117	390	Creepers	Crawlers	Gliders
168	1	2012/10/15	U-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	9	390	0	115	117	390	Swimmers	Swimmers	Swimmers
169	1	2012/10/15	U-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	2	390	0	115	117	390	Creepers	Crawlers	Crawlers
170	1	2012/10/15	U-Rf-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1	390	0	115	117	390	Creepers	Crawlers	Crawlers
171	1	2012/10/15	U-Rf-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	4	390	0	115	117	390	Creepers	Crawlers	Crawlers
172	1	2012/10/15	U-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	167	390	0	115	117	390	Net-spinners	Attachers	Net-spinners
173	1	2012/10/15	U-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	711	390	0	115	117	390	Net-spinners	Attachers	Net-spinners
174	1	2012/10/15	U-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	8	390	0	115	117	390	Net-spinners	Attachers	Net-spinners
175	1	2012/10/15	U-Rf-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	66	390	0	115	117	390	Case-bearers	Crawlers	Case-bearers
176	1	2012/10/15	U-Rf-1	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1	390	0	115	117	390	Case-bearers	Crawlers	Case-bearers
177	1	2012/10/15	U-Rf-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	6	390	0	115	117	390	Creepers	Crawlers	Crawlers
178	1	2012/10/15	U-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2	390	0	115	117	390	Creepers	Crawlers	Crawlers
179	1	2012/10/15	U-Rf-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	390	0	115	117	390	Creepers	Crawlers	Crawlers
180	1	2012/10/15	U-Rf-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	390	0	115	117	390	Burrowers	Burrowers	Free burrowers
181	1	2012/10/15	U-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	10	390	0	115	117	390	Attachers	Attachers	Net-spinners
182	1	2012/10/15	U-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3	390	0	115	117	390	Burrowers	Burrowers	Free burrowers
183	1	2012/10/15	U-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	63	390	0	115	117	390	Creepers	Crawlers	Crawlers
184	1	2012/10/15	U-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	23	390	0	115	117	390	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
185	1	2012/10/15	U-Rf-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	12	390	0	115	117	390	Burrowers	Burrowers	Free burrowers
186	1	2012/10/15	U-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1	390	0	115	117	390	Burrowers	Burrowers	Free burrowers
187	1	2012/10/15	U-Rf-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	12	390	0	115	117	390	Burrowers	Burrowers	Free burrowers
188	1	2012/10/15	U-SP-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	32	117	114	115	117	-	Creepers	Crawlers	Creepers
189	1	2012/10/15	U-SP-1	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	240	117	114	115	117	-	Creepers	Crawlers	Creepers
190	1	2012/10/15	U-SP-1	11	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	17	117	114	115	117	-	Creepers	Crawlers	Crawlers
191	1	2012/10/15	U-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	21	117	114	115	117	-	Creepers	Crawlers	Gliders
192	1	2012/10/15	U-SP-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	34	117	114	115	117	-	Creepers	Crawlers	Crawlers
193	1	2012/10/15	U-SP-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2	117	114	115	117	-	Creepers	Crawlers	Crawlers
194	1	2012/10/15	U-SP-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	577	117	114	115	117	-	Swimmers	Swimmers	Swimmers
195	1	2012/10/15	U-SP-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	19	117	114	115	117	-	Case-bearers	Crawlers	Case-bearers
196	1	2012/10/15	U-SP-1	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	2	117	114	115	117	-	Case-bearers	Crawlers	Case-bearers
197	1	2012/10/15	U-SP-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	117	117	114	115	117	-	Creepers	Crawlers	Crawlers
198	1	2012/10/15	U-SP-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	16	117	114	115	117	-	Creepers	Crawlers	Crawlers
199	1	2012/10/15	U-SP-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	117	114	115	117	-	Creepers	Crawlers	Crawlers
200	1	2012/10/15	U-SP-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	117	114	115	117	-	Burrowers	Burrowers	Free burrowers
201	1	2012/10/15	U-SP-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	117	114	115	117	-	Burrowers	Burrowers	Free burrowers
202	1	2012/10/15	U-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	180	117	114	115	117	-	Creepers	Crawlers	Crawlers
203	1	2012/10/15	U-SP-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	16	117	114	115	117	-	Burrowers	Burrowers	Free burrowers
204	1	2012/10/15	U-SP-1	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	35	117	114	115	117	-	Burrowers	Burrowers	Free burrowers
205	1	2012/10/15	U-SP-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	33	117	114	115	117	-	Burrowers	Burrowers	Tube burrowers
206	1	2012/10/15	U-SP-1	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	3	117	114	115	117	-	Burrowers	Burrowers	Free burrowers
207	1	2012/10/15	U-SP-2	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2	117	14	115	117	-	Creepers	Crawlers	Creepers
208	1	2012/10/15	U-SP-2	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	68	117	14	115	117	-	Creepers	Crawlers	Creepers
209	1	2012/10/15	U-SP-2	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1	117	14	115	117	-	Creepers	Crawlers	Crawlers
210	1	2012/10/15	U-SP-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	68	117	14	115	117	-	Creepers	Crawlers	Crawlers
211	1	2012/10/15	U-SP-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	5	117	14	115	117	-	Creepers	Crawlers	Gliders
212	1	2012/10/15	U-SP-2	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	1	117	14	115	117	-	Creepers	Crawlers	Crawlers
213	1	2012/10/15	U-SP-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	5	117	14	115	117	-	Creepers	Crawlers	Crawlers
214	1	2012/10/15	U-SP-2	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	5	117	14	115	117	-	Creepers	Crawlers	Crawlers
215	1	2012/10/15	U-SP-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1	117	14	115	117	-	Net-spinners	Attachers	Net-spinners
216	1	2012/10/15	U-SP-2	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1	117	14	115	117	-	Case-bearers	Crawlers	Case-bearers
217	1	2012/10/15	U-SP-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	273	117	14	115	117	-	Creepers	Crawlers	Crawlers
218	1	2012/10/15	U-SP-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	117	14	115	117	-	Creepers	Crawlers	Crawlers
219	1	2012/10/15	U-SP-2	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	33	117	14	115	117	-	Creepers	Crawlers	Crawlers
220	1	2012/10/15	U-SP-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	117	14	115	117	-	Attachers	Attachers	Net-spinners
221	1	2012/10/15	U-SP-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	339	117	14	115	117	-	Creepers	Crawlers	Crawlers
222	1	2012/10/15	U-SP-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	65	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
223	1	2012/10/15	U-SP-2	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	194	117	14	115	117	-	Burrowers	Burrowers	Free burrowers
224	1	2012/10/15	U-SP-3	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	65	390	14	115	117	390	Attachers	Attachers	Case builders
225	1	2012/10/15	U-SP-3	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	26	390	14	115	117	390	Creepers	Crawlers	Crawlers
226	1	2012/10/15	U-SP-3	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	14	390	14	115	117	390	Swimmers	Swimmers	Swimmers
227	1	2012/10/15	U-SP-3	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	29	390	14	115	117	390	Creepers	Crawlers	Gliders
228	1	2012/10/15	U-SP-3	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	56	390	14	115	117	390	Creepers	Crawlers	Crawlers
229	1	2012/10/15	U-SP-3	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	93	390	14	115	117	390	Swimmers	Swimmers	Swimmers
230	1	2012/10/15	U-SP-3	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	24	390	14	115	117	390	Case-bearers	Crawlers	Case-bearers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

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Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
231	1	2012/10/15	U-SP-3	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	19	390	14	115	117	390	Case-bearers	Crawlers	Case-bearers
232	1	2012/10/15	U-SP-3	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	69	390	14	115	117	390	Creepers	Crawlers	Crawlers
233	1	2012/10/15	U-SP-3	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4	390	14	115	117	390	Creepers	Crawlers	Crawlers
234	1	2012/10/15	U-SP-3	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	390	14	115	117	390	Burrowers	Burrowers	Free burrowers
235	1	2012/10/15	U-SP-3	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	177	390	14	115	117	390	Creepers	Crawlers	Crawlers
236	1	2012/10/15	U-SP-3	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	90	390	14	115	117	390	Burrowers	Burrowers	Free burrowers
237	1	2012/10/15	U-SP-3	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	8	390	14	115	117	390	Burrowers	Burrowers	Free burrowers
238	1	2012/10/15	U-SP-3	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	42	390	14	115	117	390	Burrowers	Burrowers	Free burrowers
239	1	2012/10/15	U-SP-3	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	141	390	14	115	117	390	Burrowers	Burrowers	Tube burrowers
240	1	2012/10/15	U-SP-3	50	261	Insecta	Diptera	Empididae	Empididae	8	390	14	115	117	390	Burrowers	Burrowers	Free burrowers
241	2	2012/11/17	D-BW-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32	423	47	148	150	423	Creepers	Crawlers	Crawlers
242	2	2012/11/17	D-BW-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	106	423	47	148	150	423	Swimmers	Swimmers	Swimmers
243	2	2012/11/17	D-BW-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	12	423	47	148	150	423	Creepers	Crawlers	Gliders
244	2	2012/11/17	D-BW-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	423	47	148	150	423	Creepers	Crawlers	Crawlers
245	2	2012/11/17	D-BW-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	32	423	47	148	150	423	Swimmers	Swimmers	Swimmers
246	2	2012/11/17	D-BW-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	3	423	47	148	150	423	Net-spinners	Attachers	Net-spinners
247	2	2012/11/17	D-BW-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2	423	47	148	150	423	Creepers	Crawlers	Crawlers
248	2	2012/11/17	D-BW-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	9	423	47	148	150	423	Creepers	Crawlers	Crawlers
249	2	2012/11/17	D-BW-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	423	47	148	150	423	Burrowers	Burrowers	Free burrowers
250	2	2012/11/17	D-BW-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	19	423	47	148	150	423	Creepers	Crawlers	Crawlers
251	2	2012/11/17	D-BW-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	162	423	47	148	150	423	Burrowers	Burrowers	Free burrowers
252	2	2012/11/17	D-BW-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	76	423	47	148	150	423	Burrowers	Burrowers	Free burrowers
253	2	2012/11/17	D-BW-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	17	423	47	148	150	423	Burrowers	Burrowers	Free burrowers
254	2	2012/11/17	D-BW-2	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2	423	24	148	150	423	Creepers	Crawlers	Creepers
255	2	2012/11/17	D-BW-2	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	50	423	24	148	150	423	Burrowers	Burrowers	Free burrowers
256	2	2012/11/17	D-BW-2	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	48	423	24	148	150	423	Burrowers	Burrowers	Free burrowers
257	2	2012/11/17	D-BW-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	17	423	24	148	150	423	Creepers	Crawlers	Crawlers
258	2	2012/11/17	D-BW-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2	423	24	148	150	423	Swimmers	Swimmers	Swimmers
259	2	2012/11/17	D-BW-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	5	423	24	148	150	423	Creepers	Crawlers	Gliders
260	2	2012/11/17	D-BW-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1	423	24	148	150	423	Creepers	Crawlers	Crawlers
261	2	2012/11/17	D-BW-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1	423	24	148	150	423	Net-spinners	Attachers	Net-spinners
262	2	2012/11/17	D-BW-2	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1	423	24	148	150	423	Case-bearers	Crawlers	Case-bearers
263	2	2012/11/17	D-BW-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	10	423	24	148	150	423	Creepers	Crawlers	Crawlers
264	2	2012/11/17	D-BW-2	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	423	24	148	150	423	Creepers	Crawlers	Crawlers
265	2	2012/11/17	D-BW-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2	423	24	148	150	423	Attachers	Attachers	Net-spinners
266	2	2012/11/17	D-BW-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	38	423	24	148	150	423	Creepers	Crawlers	Crawlers
267	2	2012/11/17	D-BW-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	325	423	24	148	150	423	Burrowers	Burrowers	Free burrowers
268	2	2012/11/17	D-BW-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	238	423	24	148	150	423	Burrowers	Burrowers	Free burrowers
269	2	2012/11/17	D-BW-2	50	261	Insecta	Diptera	Empididae	Empididae	16	423	24	148	150	423	Burrowers	Burrowers	Free burrowers
270	2	2012/11/17	D-Rf-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1	423	0	148	150	423	Creepers	Crawlers	Creepers
271	2	2012/11/17	D-Rf-1	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	33	423	0	148	150	423	Creepers	Crawlers	Crawlers
272	2	2012/11/17	D-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	142	423	0	148	150	423	Creepers	Crawlers	Crawlers
273	2	2012/11/17	D-Rf-1	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	64	423	0	148	150	423	Creepers	Crawlers	Crawlers
274	2	2012/11/17	D-Rf-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32	423	0	148	150	423	Creepers	Crawlers	Crawlers
275	2	2012/11/17	D-Rf-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	35	423	0	148	150	423	Swimmers	Swimmers	Swimmers
276	2	2012/11/17	D-Rf-1	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	2	423	0	148	150	423	Swimmers	Swimmers	Swimmers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

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Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
277	2	2012/11/17	D-Rf-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2	423	0	148	150	423	Creepers	Crawlers	Gliders
278	2	2012/11/17	D-Rf-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	33	423	0	148	150	423	Creepers	Crawlers	Gliders
279	2	2012/11/17	D-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	92	423	0	148	150	423	Swimmers	Swimmers	Swimmers
280	2	2012/11/17	D-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	129	423	0	148	150	423	Creepers	Crawlers	Crawlers
281	2	2012/11/17	D-Rf-1	24	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1	423	0	148	150	423	Burrowers	Burrowers	Free burrowers
282	2	2012/11/17	D-Rf-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	8	423	0	148	150	423	Creepers	Crawlers	Crawlers
283	2	2012/11/17	D-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	108	423	0	148	150	423	Net-spinners	Attachers	Net-spinners
284	2	2012/11/17	D-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	807	423	0	148	150	423	Net-spinners	Attachers	Net-spinners
285	2	2012/11/17	D-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	4	423	0	148	150	423	Net-spinners	Attachers	Net-spinners
286	2	2012/11/17	D-Rf-1	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	3	423	0	148	150	423	Creepers	Crawlers	Crawlers
287	2	2012/11/17	D-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	8	423	0	148	150	423	Creepers	Crawlers	Crawlers
288	2	2012/11/17	D-Rf-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	65	423	0	148	150	423	Creepers	Crawlers	Crawlers
289	2	2012/11/17	D-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	71	423	0	148	150	423	Attachers	Attachers	Net-spinners
290	2	2012/11/17	D-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3	423	0	148	150	423	Burrowers	Burrowers	Free burrowers
291	2	2012/11/17	D-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	1	423	0	148	150	423	Creepers	Crawlers	Crawlers
292	2	2012/11/17	D-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	110	423	0	148	150	423	Burrowers	Burrowers	Free burrowers
293	2	2012/11/17	D-Rf-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	992	423	0	148	150	423	Burrowers	Burrowers	Free burrowers
294	2	2012/11/17	D-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	496	423	0	148	150	423	Burrowers	Burrowers	Free burrowers
295	2	2012/11/17	D-SP-1	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	32	423	11	148	150	423	Creepers	Crawlers	Crawlers
296	2	2012/11/17	D-SP-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	2	423	11	148	150	423	Creepers	Crawlers	Crawlers
297	2	2012/11/17	D-SP-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2	423	11	148	150	423	Swimmers	Swimmers	Swimmers
298	2	2012/11/17	D-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	38	423	11	148	150	423	Creepers	Crawlers	Gliders
299	2	2012/11/17	D-SP-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1	423	11	148	150	423	Swimmers	Swimmers	Swimmers
300	2	2012/11/17	D-SP-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	2	423	11	148	150	423	Swimmers	Swimmers	Swimmers
301	2	2012/11/17	D-SP-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1	423	11	148	150	423	Net-spinners	Attachers	Net-spinners
302	2	2012/11/17	D-SP-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	2	423	11	148	150	423	Case-bearers	Crawlers	Case-bearers
303	2	2012/11/17	D-SP-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	3	423	11	148	150	423	Creepers	Crawlers	Crawlers
304	2	2012/11/17	D-SP-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2	423	11	148	150	423	Creepers	Crawlers	Crawlers
305	2	2012/11/17	D-SP-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	423	11	148	150	423	Burrowers	Burrowers	Free burrowers
306	2	2012/11/17	D-SP-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2	423	11	148	150	423	Attachers	Attachers	Net-spinners
307	2	2012/11/17	D-SP-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	423	11	148	150	423	Burrowers	Burrowers	Free burrowers
308	2	2012/11/17	D-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	42	423	11	148	150	423	Creepers	Crawlers	Crawlers
309	2	2012/11/17	D-SP-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	276	423	11	148	150	423	Burrowers	Burrowers	Free burrowers
310	2	2012/11/17	D-SP-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	35	423	11	148	150	423	Burrowers	Burrowers	Free burrowers
311	2	2012/11/17	D-SP-1	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1	423	11	148	150	423	Burrowers	Burrowers	Free burrowers
312	2	2012/11/17	D-SP-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1	423	11	148	150	423	Burrowers	Burrowers	Tube burrowers
313	2	2012/11/18	U-BW-1	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1	151	1	149	151	-	Creepers	Crawlers	Crawlers
314	2	2012/11/18	U-BW-1	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1	151	1	149	151	-	Swimmers	Swimmers	Swimmers
315	2	2012/11/18	U-BW-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	151	1	149	151	-	Creepers	Crawlers	Gliders
316	2	2012/11/18	U-BW-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	591	151	1	149	151	-	Swimmers	Swimmers	Swimmers
317	2	2012/11/18	U-BW-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4	151	1	149	151	-	Burrowers	Burrowers	Free burrowers
318	2	2012/11/18	U-BW-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	151	1	149	151	-	Attachers	Attachers	Net-spinners
319	2	2012/11/18	U-BW-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	2	151	1	149	151	-	Creepers	Crawlers	Crawlers
320	2	2012/11/18	U-BW-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	96	151	1	149	151	-	Burrowers	Burrowers	Free burrowers
321	2	2012/11/18	U-BW-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	121	151	1	149	151	-	Burrowers	Burrowers	Free burrowers
322	2	2012/11/18	U-BW-1	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1	151	1	149	151	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
323	2	2012/11/18	U-BW-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	32	151	1	149	151	-	Burrowers	Burrowers	Tube burrowers
324	2	2012/11/18	U-BW-1	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1	151	1	149	151	-	Burrowers	Burrowers	Free burrowers
325	2	2012/11/18	U-BW-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	134	48	48	-	-	-	Creepers	Crawlers	Creepers
326	2	2012/11/18	U-BW-11	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	33	48	48	-	-	-	Attachers	Attachers	Case builders
327	2	2012/11/18	U-BW-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	32	48	48	-	-	-	Creepers	Crawlers	Crawlers
328	2	2012/11/18	U-BW-11	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	48	48	-	-	-	Creepers	Crawlers	Crawlers
329	2	2012/11/18	U-BW-11	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1	48	48	-	-	-	Creepers	Crawlers	Crawlers
330	2	2012/11/18	U-BW-11	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	48	48	-	-	-	Swimmers	Swimmers	Swimmers
331	2	2012/11/18	U-BW-11	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	48	48	-	-	-	Creepers	Crawlers	Crawlers
332	2	2012/11/18	U-BW-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	164	48	48	-	-	-	Swimmers	Swimmers	Swimmers
333	2	2012/11/18	U-BW-11	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	2	48	48	-	-	-	Net-spinners	Attachers	Net-spinners
334	2	2012/11/18	U-BW-11	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	66	48	48	-	-	-	Net-spinners	Attachers	Net-spinners
335	2	2012/11/18	U-BW-11	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1	48	48	-	-	-	Net-spinners	Attachers	Net-spinners
336	2	2012/11/18	U-BW-11	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	1	48	48	-	-	-	Net-spinners	Attachers	Net-spinners
337	2	2012/11/18	U-BW-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	139	48	48	-	-	-	Creepers	Crawlers	Crawlers
338	2	2012/11/18	U-BW-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	101	48	48	-	-	-	Creepers	Crawlers	Crawlers
339	2	2012/11/18	U-BW-11	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	98	48	48	-	-	-	Creepers	Crawlers	Crawlers
340	2	2012/11/18	U-BW-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	6	48	48	-	-	-	Burrowers	Burrowers	Free burrowers
341	2	2012/11/18	U-BW-11	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	4	48	48	-	-	-	Burrowers	Burrowers	Free burrowers
342	2	2012/11/18	U-BW-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	5	48	48	-	-	-	Creepers	Crawlers	Crawlers
343	2	2012/11/18	U-BW-11	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	66	48	48	-	-	-	Burrowers	Burrowers	Free burrowers
344	2	2012/11/18	U-BW-11	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	68	48	48	-	-	-	Burrowers	Burrowers	Free burrowers
345	2	2012/11/18	U-BW-11	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	121	48	48	-	-	-	Burrowers	Burrowers	Free burrowers
346	2	2012/11/18	U-BW-11	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	3	48	48	-	-	-	Burrowers	Burrowers	Free burrowers
347	2	2012/11/18	U-Rf-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	19	424	0	149	151	424	Creepers	Crawlers	Creepers
348	2	2012/11/18	U-Rf-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	15	424	0	149	151	424	Attachers	Attachers	Case builders
349	2	2012/11/18	U-Rf-1	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	18	424	0	149	151	424	Burrowers	Burrowers	Free burrowers
350	2	2012/11/18	U-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	36	424	0	149	151	424	Creepers	Crawlers	Crawlers
351	2	2012/11/18	U-Rf-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1	424	0	149	151	424	Creepers	Crawlers	Crawlers
352	2	2012/11/18	U-Rf-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	7	424	0	149	151	424	Swimmers	Swimmers	Swimmers
353	2	2012/11/18	U-Rf-1	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	22	424	0	149	151	424	Swimmers	Swimmers	Swimmers
354	2	2012/11/18	U-Rf-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	13	424	0	149	151	424	Creepers	Crawlers	Gliders
355	2	2012/11/18	U-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	62	424	0	149	151	424	Swimmers	Swimmers	Swimmers
356	2	2012/11/18	U-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	97	424	0	149	151	424	Creepers	Crawlers	Crawlers
357	2	2012/11/18	U-Rf-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2	424	0	149	151	424	Creepers	Crawlers	Crawlers
358	2	2012/11/18	U-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	80	424	0	149	151	424	Net-spinners	Attachers	Net-spinners
359	2	2012/11/18	U-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	213	424	0	149	151	424	Net-spinners	Attachers	Net-spinners
360	2	2012/11/18	U-Rf-1	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2	424	0	149	151	424	Creepers	Crawlers	Crawlers
361	2	2012/11/18	U-Rf-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2	424	0	149	151	424	Creepers	Crawlers	Crawlers
362	2	2012/11/18	U-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3	424	0	149	151	424	Creepers	Crawlers	Crawlers
363	2	2012/11/18	U-Rf-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	424	0	149	151	424	Creepers	Crawlers	Crawlers
364	2	2012/11/18	U-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	49	424	0	149	151	424	Attachers	Attachers	Net-spinners
365	2	2012/11/18	U-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	424	0	149	151	424	Burrowers	Burrowers	Free burrowers
366	2	2012/11/18	U-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	7	424	0	149	151	424	Creepers	Crawlers	Crawlers
367	2	2012/11/18	U-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	8	424	0	149	151	424	Burrowers	Burrowers	Free burrowers
368	2	2012/11/18	U-Rf-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	25	424	0	149	151	424	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
369	2	2012/11/18	U-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	439	424	0	149	151	424	Burrowers	Burrowers	Free burrowers
370	2	2012/11/18	U-Rf-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	3	151	0	149	151	-	Creepers	Crawlers	Crawlers
371	2	2012/11/18	U-Rf-2	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1	151	0	149	151	-	Creepers	Crawlers	Crawlers
372	2	2012/11/18	U-Rf-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1	151	0	149	151	-	Creepers	Crawlers	Crawlers
373	2	2012/11/18	U-Rf-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	2	151	0	149	151	-	Swimmers	Swimmers	Swimmers
374	2	2012/11/18	U-Rf-2	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	2	151	0	149	151	-	Creepers	Crawlers	Gliders
375	2	2012/11/18	U-Rf-2	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	75	151	0	149	151	-	Swimmers	Swimmers	Swimmers
376	2	2012/11/18	U-Rf-2	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	460	151	0	149	151	-	Creepers	Crawlers	Crawlers
377	2	2012/11/18	U-Rf-2	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	2	151	0	149	151	-	Net-spinners	Attachers	Net-spinners
378	2	2012/11/18	U-Rf-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	142	151	0	149	151	-	Net-spinners	Attachers	Net-spinners
379	2	2012/11/18	U-Rf-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	117	151	0	149	151	-	Net-spinners	Attachers	Net-spinners
380	2	2012/11/18	U-Rf-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	5	151	0	149	151	-	Net-spinners	Attachers	Net-spinners
381	2	2012/11/18	U-Rf-2	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2	151	0	149	151	-	Creepers	Crawlers	Crawlers
382	2	2012/11/18	U-Rf-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	1	151	0	149	151	-	Creepers	Crawlers	Crawlers
383	2	2012/11/18	U-Rf-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4	151	0	149	151	-	Creepers	Crawlers	Crawlers
384	2	2012/11/18	U-Rf-2	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	6	151	0	149	151	-	Creepers	Crawlers	Crawlers
385	2	2012/11/18	U-Rf-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	4	151	0	149	151	-	Attachers	Attachers	Net-spinners
386	2	2012/11/18	U-Rf-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	4	151	0	149	151	-	Burrowers	Burrowers	Free burrowers
387	2	2012/11/18	U-Rf-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	38	151	0	149	151	-	Creepers	Crawlers	Crawlers
388	2	2012/11/18	U-Rf-2	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	8	151	0	149	151	-	Burrowers	Burrowers	Free burrowers
389	2	2012/11/18	U-Rf-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	322	151	0	149	151	-	Burrowers	Burrowers	Free burrowers
390	2	2012/11/18	U-Rf-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	43	151	0	149	151	-	Burrowers	Burrowers	Free burrowers
391	2	2012/11/18	U-Rf-2	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	66	151	0	149	151	-	Burrowers	Burrowers	Free burrowers
392	2	2012/11/18	U-Rf-2	50	261	Insecta	Diptera	Empididae	Empididae	1	151	0	149	151	-	Burrowers	Burrowers	Free burrowers
393	2	2012/11/18	U-SP-1	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	151	148	149	151	-	Creepers	Crawlers	Crawlers
394	2	2012/11/18	U-SP-1	11	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	1	151	148	149	151	-	Creepers	Crawlers	Crawlers
395	2	2012/11/18	U-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	151	148	149	151	-	Creepers	Crawlers	Gliders
396	2	2012/11/18	U-SP-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	151	148	149	151	-	Creepers	Crawlers	Crawlers
397	2	2012/11/18	U-SP-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	656	151	148	149	151	-	Swimmers	Swimmers	Swimmers
398	2	2012/11/18	U-SP-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	1	151	148	149	151	-	Case-bearers	Crawlers	Case-bearers
399	2	2012/11/18	U-SP-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	5	151	148	149	151	-	Creepers	Crawlers	Crawlers
400	2	2012/11/18	U-SP-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3	151	148	149	151	-	Burrowers	Burrowers	Free burrowers
401	2	2012/11/18	U-SP-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2	151	148	149	151	-	Attachers	Attachers	Net-spinners
402	2	2012/11/18	U-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	1	151	148	149	151	-	Creepers	Crawlers	Crawlers
403	2	2012/11/18	U-SP-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	390	151	148	149	151	-	Burrowers	Burrowers	Free burrowers
404	2	2012/11/18	U-SP-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	72	151	148	149	151	-	Burrowers	Burrowers	Free burrowers
405	2	2012/11/18	U-SP-1	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2	151	148	149	151	-	Burrowers	Burrowers	Free burrowers
406	2	2012/11/18	U-SP-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	34	424	48	149	151	424	Creepers	Crawlers	Creepers
407	2	2012/11/18	U-SP-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	11	424	48	149	151	424	Creepers	Crawlers	Crawlers
408	2	2012/11/18	U-SP-11	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	8	424	48	149	151	424	Creepers	Crawlers	Crawlers
409	2	2012/11/18	U-SP-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	34	424	48	149	151	424	Swimmers	Swimmers	Swimmers
410	2	2012/11/18	U-SP-11	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1	424	48	149	151	424	Net-spinners	Attachers	Net-spinners
411	2	2012/11/18	U-SP-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	162	424	48	149	151	424	Creepers	Crawlers	Crawlers
412	2	2012/11/18	U-SP-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	38	424	48	149	151	424	Burrowers	Burrowers	Free burrowers
413	2	2012/11/18	U-SP-11	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	424	48	149	151	424	Burrowers	Burrowers	Free burrowers
414	2	2012/11/18	U-SP-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	9	424	48	149	151	424	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
415	2	2012/11/18	U-SP-11	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	19	424	48	149	151	424	Burrowers	Burrowers	Free burrowers
416	2	2012/11/18	U-SP-11	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	35	424	48	149	151	424	Burrowers	Burrowers	Free burrowers
417	3	2013/02/12	U-BW-11	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2	134	134	-	-	-	Creepers	Crawlers	Creepers
418	3	2013/02/12	U-BW-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1	134	134	-	-	-	Creepers	Crawlers	Creepers
419	3	2013/02/12	U-BW-11	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1	134	134	-	-	-	Attachers	Attachers	Case builders
420	3	2013/02/12	U-BW-11	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	1	134	134	-	-	-	Burrowers	Burrowers	Free burrowers
421	3	2013/02/12	U-BW-11	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	8	134	134	-	-	-	Burrowers	Burrowers	Free burrowers
422	3	2013/02/12	U-BW-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	2	134	134	-	-	-	Creepers	Crawlers	Crawlers
423	3	2013/02/12	U-BW-11	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	64	134	134	-	-	-	Creepers	Crawlers	Crawlers
424	3	2013/02/12	U-BW-11	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	22	134	134	-	-	-	Swimmers	Swimmers	Swimmers
425	3	2013/02/12	U-BW-11	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	4	134	134	-	-	-	Swimmers	Swimmers	Swimmers
426	3	2013/02/12	U-BW-11	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	134	134	-	-	-	Creepers	Crawlers	Gliders
427	3	2013/02/12	U-BW-11	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1	134	134	-	-	-	Swimmers	Swimmers	Swimmers
428	3	2013/02/12	U-BW-11	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	134	134	-	-	-	Creepers	Crawlers	Crawlers
429	3	2013/02/12	U-BW-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	3878	134	134	-	-	-	Swimmers	Swimmers	Swimmers
430	3	2013/02/12	U-BW-11	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	69	134	134	-	-	-	Case-bearers	Crawlers	Case-bearers
431	3	2013/02/12	U-BW-11	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	2	134	134	-	-	-	Case-bearers	Crawlers	Case-bearers
432	3	2013/02/12	U-BW-11	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	2	134	134	-	-	-	Attachers	Attachers	Net-spinners
433	3	2013/02/12	U-BW-11	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	165	134	134	-	-	-	Burrowers	Burrowers	Free burrowers
434	3	2013/02/12	U-BW-11	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	65	134	134	-	-	-	Burrowers	Burrowers	Tube burrowers
435	3	2013/02/12	U-BW-11	50	261	Insecta	Diptera	Empididae	Empididae	71	134	134	-	-	-	Burrowers	Burrowers	Free burrowers
436	3	2013/02/12	U-BW-2	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	73	237	21	235	237	-	Creepers	Crawlers	Creepers
437	3	2013/02/12	U-BW-2	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	74	237	21	235	237	-	Creepers	Crawlers	Creepers
438	3	2013/02/12	U-BW-2	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	265	237	21	235	237	-	Creepers	Crawlers	Creepers
439	3	2013/02/12	U-BW-2	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	1	237	21	235	237	-	Burrowers	Burrowers	Free burrowers
440	3	2013/02/12	U-BW-2	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	66	237	21	235	237	-	Burrowers	Burrowers	Free burrowers
441	3	2013/02/12	U-BW-2	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	237	21	235	237	-	Creepers	Crawlers	Crawlers
442	3	2013/02/12	U-BW-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	237	21	235	237	-	Creepers	Crawlers	Crawlers
443	3	2013/02/12	U-BW-2	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1	237	21	235	237	-	Creepers	Crawlers	Crawlers
444	3	2013/02/12	U-BW-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	131	237	21	235	237	-	Creepers	Crawlers	Crawlers
445	3	2013/02/12	U-BW-2	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	6	237	21	235	237	-	Swimmers	Swimmers	Swimmers
446	3	2013/02/12	U-BW-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	392	237	21	235	237	-	Swimmers	Swimmers	Swimmers
447	3	2013/02/12	U-BW-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	72	237	21	235	237	-	Creepers	Crawlers	Gliders
448	3	2013/02/12	U-BW-2	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	3	237	21	235	237	-	Creepers	Crawlers	Crawlers
449	3	2013/02/12	U-BW-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	129	237	21	235	237	-	Creepers	Crawlers	Crawlers
450	3	2013/02/12	U-BW-2	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	7	237	21	235	237	-	Creepers	Crawlers	Crawlers
451	3	2013/02/12	U-BW-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	65	237	21	235	237	-	Swimmers	Swimmers	Swimmers
452	3	2013/02/12	U-BW-2	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	74	237	21	235	237	-	Net-spinners	Attachers	Net-spinners
453	3	2013/02/12	U-BW-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	8	237	21	235	237	-	Net-spinners	Attachers	Net-spinners
454	3	2013/02/12	U-BW-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	2	237	21	235	237	-	Net-spinners	Attachers	Net-spinners
455	3	2013/02/12	U-BW-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	1	237	21	235	237	-	Net-spinners	Attachers	Net-spinners
456	3	2013/02/12	U-BW-2	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	143	237	21	235	237	-	Case-bearers	Crawlers	Case-bearers
457	3	2013/02/12	U-BW-2	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1	237	21	235	237	-	Case-bearers	Crawlers	Case-bearers
458	3	2013/02/12	U-BW-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	1	237	21	235	237	-	Creepers	Crawlers	Crawlers
459	3	2013/02/12	U-BW-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	201	237	21	235	237	-	Creepers	Crawlers	Crawlers
460	3	2013/02/12	U-BW-2	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	237	21	235	237	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
461	3	2013/02/12	U-BW-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	996	237	21	235	237	-	Attachers	Attachers	Net-spinners
462	3	2013/02/12	U-BW-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6	237	21	235	237	-	Burrowers	Burrowers	Free burrowers
463	3	2013/02/12	U-BW-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	402	237	21	235	237	-	Creepers	Crawlers	Crawlers
464	3	2013/02/12	U-BW-2	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	64	237	21	235	237	-	Burrowers	Burrowers	Free burrowers
465	3	2013/02/12	U-BW-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2	237	21	235	237	-	Burrowers	Burrowers	Free burrowers
466	3	2013/02/12	U-BW-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	585	237	21	235	237	-	Burrowers	Burrowers	Free burrowers
467	3	2013/02/12	U-BW-2	50	261	Insecta	Diptera	Empididae	Empididae	340	237	21	235	237	-	Burrowers	Burrowers	Free burrowers
468	3	2013/02/12	U-Rf-1	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	4	510	0	235	237	510	Creepers	Crawlers	Creepers
469	3	2013/02/12	U-Rf-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	89	510	0	235	237	510	Creepers	Crawlers	Creepers
470	3	2013/02/12	U-Rf-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	686	510	0	235	237	510	Attachers	Attachers	Case builders
471	3	2013/02/12	U-Rf-1	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	66	510	0	235	237	510	Burrowers	Burrowers	Free burrowers
472	3	2013/02/12	U-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	510	0	235	237	510	Creepers	Crawlers	Crawlers
473	3	2013/02/12	U-Rf-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1	510	0	235	237	510	Creepers	Crawlers	Crawlers
474	3	2013/02/12	U-Rf-1	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	3	510	0	235	237	510	Swimmers	Attachers	Exposed attachers
475	3	2013/02/12	U-Rf-1	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	64	510	0	235	237	510	Swimmers	Swimmers	Swimmers
476	3	2013/02/12	U-Rf-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	9	510	0	235	237	510	Creepers	Crawlers	Gliders
477	3	2013/02/12	U-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	272	510	0	235	237	510	Swimmers	Swimmers	Swimmers
478	3	2013/02/12	U-Rf-1	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	2	510	0	235	237	510	Creepers	Crawlers	Crawlers
479	3	2013/02/12	U-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1178	510	0	235	237	510	Creepers	Crawlers	Crawlers
480	3	2013/02/12	U-Rf-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	64	510	0	235	237	510	Creepers	Crawlers	Crawlers
481	3	2013/02/12	U-Rf-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	5	510	0	235	237	510	Creepers	Crawlers	Crawlers
482	3	2013/02/12	U-Rf-1	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1	510	0	235	237	510	Net-spinners	Attachers	Net-spinners
483	3	2013/02/12	U-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	497	510	0	235	237	510	Net-spinners	Attachers	Net-spinners
484	3	2013/02/12	U-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1133	510	0	235	237	510	Net-spinners	Attachers	Net-spinners
485	3	2013/02/12	U-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	17	510	0	235	237	510	Net-spinners	Attachers	Net-spinners
486	3	2013/02/12	U-Rf-1	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2	510	0	235	237	510	Creepers	Crawlers	Crawlers
487	3	2013/02/12	U-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4	510	0	235	237	510	Creepers	Crawlers	Crawlers
488	3	2013/02/12	U-Rf-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	510	0	235	237	510	Creepers	Crawlers	Crawlers
489	3	2013/02/12	U-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	459	510	0	235	237	510	Attachers	Attachers	Net-spinners
490	3	2013/02/12	U-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6	510	0	235	237	510	Burrowers	Burrowers	Free burrowers
491	3	2013/02/12	U-Rf-1	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1	510	0	235	237	510	Burrowers	Burrowers	Free burrowers
492	3	2013/02/12	U-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	84	510	0	235	237	510	Creepers	Crawlers	Crawlers
493	3	2013/02/12	U-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	220	510	0	235	237	510	Burrowers	Burrowers	Free burrowers
494	3	2013/02/12	U-Rf-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	9	510	0	235	237	510	Burrowers	Burrowers	Free burrowers
495	3	2013/02/12	U-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1244	510	0	235	237	510	Burrowers	Burrowers	Free burrowers
496	3	2013/02/12	U-Rf-1	50	261	Insecta	Diptera	Empididae	Empididae	6	510	0	235	237	510	Burrowers	Burrowers	Free burrowers
497	3	2013/02/12	U-Rf-2	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	37	237	0	235	237	-	Burrowers	Burrowers	Free burrowers
498	3	2013/02/12	U-Rf-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	3	237	0	235	237	-	Creepers	Crawlers	Crawlers
499	3	2013/02/12	U-Rf-2	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	1	237	0	235	237	-	Creepers	Crawlers	Crawlers
500	3	2013/02/12	U-Rf-2	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	1	237	0	235	237	-	Swimmers	Attachers	Exposed attachers
501	3	2013/02/12	U-Rf-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	3	237	0	235	237	-	Swimmers	Swimmers	Swimmers
502	3	2013/02/12	U-Rf-2	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	38	237	0	235	237	-	Swimmers	Swimmers	Swimmers
503	3	2013/02/12	U-Rf-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	237	0	235	237	-	Creepers	Crawlers	Gliders
504	3	2013/02/12	U-Rf-2	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	36	237	0	235	237	-	Creepers	Crawlers	Gliders
505	3	2013/02/12	U-Rf-2	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	41	237	0	235	237	-	Swimmers	Swimmers	Swimmers
506	3	2013/02/12	U-Rf-2	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	102	237	0	235	237	-	Creepers	Crawlers	Crawlers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
507	3	2013/02/12	U-Rf-2	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1	237	0	235	237	-	Net-spinners	Attachers	Net-spinners
508	3	2013/02/12	U-Rf-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	8	237	0	235	237	-	Net-spinners	Attachers	Net-spinners
509	3	2013/02/12	U-Rf-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	201	237	0	235	237	-	Net-spinners	Attachers	Net-spinners
510	3	2013/02/12	U-Rf-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	15	237	0	235	237	-	Net-spinners	Attachers	Net-spinners
511	3	2013/02/12	U-Rf-2	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2	237	0	235	237	-	Creepers	Crawlers	Crawlers
512	3	2013/02/12	U-Rf-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	237	0	235	237	-	Creepers	Crawlers	Crawlers
513	3	2013/02/12	U-Rf-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	85	237	0	235	237	-	Attachers	Attachers	Net-spinners
514	3	2013/02/12	U-Rf-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	237	0	235	237	-	Burrowers	Burrowers	Free burrowers
515	3	2013/02/12	U-Rf-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	9	237	0	235	237	-	Creepers	Crawlers	Crawlers
516	3	2013/02/12	U-Rf-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	658	237	0	235	237	-	Burrowers	Burrowers	Free burrowers
517	3	2013/02/12	U-Rf-2	50	261	Insecta	Diptera	Empididae	Empididae	4	237	0	235	237	-	Burrowers	Burrowers	Free burrowers
518	3	2013/02/12	U-SP-1	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	6	237	234	235	237	-	Creepers	Crawlers	Creepers
519	3	2013/02/12	U-SP-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3	237	234	235	237	-	Creepers	Crawlers	Creepers
520	3	2013/02/12	U-SP-1	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	15	237	234	235	237	-	Creepers	Crawlers	Creepers
521	3	2013/02/12	U-SP-1	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	1	237	234	235	237	-	Burrowers	Burrowers	Free burrowers
522	3	2013/02/12	U-SP-1	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	32	237	234	235	237	-	Burrowers	Burrowers	Free burrowers
523	3	2013/02/12	U-SP-1	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	2	237	234	235	237	-	Creepers	Crawlers	Crawlers
524	3	2013/02/12	U-SP-1	11	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	8	237	234	235	237	-	Creepers	Crawlers	Crawlers
525	3	2013/02/12	U-SP-1	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1	237	234	235	237	-	Swimmers	Swimmers	Swimmers
526	3	2013/02/12	U-SP-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	237	234	235	237	-	Swimmers	Swimmers	Swimmers
527	3	2013/02/12	U-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	21	237	234	235	237	-	Creepers	Crawlers	Gliders
528	3	2013/02/12	U-SP-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1	237	234	235	237	-	Creepers	Crawlers	Crawlers
529	3	2013/02/12	U-SP-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	13	237	234	235	237	-	Creepers	Crawlers	Crawlers
530	3	2013/02/12	U-SP-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	874	237	234	235	237	-	Swimmers	Swimmers	Swimmers
531	3	2013/02/12	U-SP-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	62	237	234	235	237	-	Case-bearers	Crawlers	Case-bearers
532	3	2013/02/12	U-SP-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4	237	234	235	237	-	Burrowers	Burrowers	Free burrowers
533	3	2013/02/12	U-SP-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	17	237	234	235	237	-	Attachers	Attachers	Net-spinners
534	3	2013/02/12	U-SP-1	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	8	237	234	235	237	-	Burrowers	Burrowers	Free burrowers
535	3	2013/02/12	U-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	4	237	234	235	237	-	Creepers	Crawlers	Crawlers
536	3	2013/02/12	U-SP-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2	237	234	235	237	-	Burrowers	Burrowers	Free burrowers
537	3	2013/02/12	U-SP-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	70	237	234	235	237	-	Burrowers	Burrowers	Free burrowers
538	3	2013/02/12	U-SP-1	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1	237	234	235	237	-	Burrowers	Burrowers	Free burrowers
539	3	2013/02/12	U-SP-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	23	237	234	235	237	-	Burrowers	Burrowers	Tube burrowers
540	3	2013/02/12	U-SP-1	50	261	Insecta	Diptera	Empididae	Empididae	19	237	234	235	237	-	Burrowers	Burrowers	Free burrowers
541	3	2013/02/12	U-SP-11	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	44	510	134	235	237	510	Creepers	Crawlers	Creepers
542	3	2013/02/12	U-SP-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	18	510	134	235	237	510	Creepers	Crawlers	Creepers
543	3	2013/02/12	U-SP-11	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1	510	134	235	237	510	Net-spinners	Attachers	Net-spinners
544	3	2013/02/12	U-SP-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	5	510	134	235	237	510	Creepers	Crawlers	Crawlers
545	3	2013/02/12	U-SP-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	9	510	134	235	237	510	Creepers	Crawlers	Crawlers
546	3	2013/02/12	U-SP-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	10	510	134	235	237	510	Burrowers	Burrowers	Free burrowers
547	3	2013/02/12	U-SP-11	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	510	134	235	237	510	Burrowers	Burrowers	Free burrowers
548	3	2013/02/12	U-SP-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	55	510	134	235	237	510	Burrowers	Burrowers	Free burrowers
549	3	2013/02/12	U-SP-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	1	510	134	235	237	510	Creepers	Crawlers	Crawlers
550	3	2013/02/12	U-SP-11	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	2	510	134	235	237	510	Burrowers	Burrowers	Free burrowers
551	3	2013/02/12	U-SP-11	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	153	510	134	235	237	510	Burrowers	Burrowers	Free burrowers
552	3	2013/02/12	U-SP-11	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	29	510	134	235	237	510	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

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Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
553	3	2013/02/12	U-SP-11	50	261	Insecta	Diptera	Empididae	Empididae	52	510	134	235	237	510	Burrowers	Burrowers	Free burrowers
554	4	2013/04/23	U-BW-2	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	1	307	4	305	307	-	Burrowers	Burrowers	Free burrowers
555	4	2013/04/23	U-BW-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	307	4	305	307	-	Creepers	Crawlers	Crawlers
556	4	2013/04/23	U-BW-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	4	307	4	305	307	-	Creepers	Crawlers	Crawlers
557	4	2013/04/23	U-BW-2	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	2	307	4	305	307	-	Swimmers	Swimmers	Swimmers
558	4	2013/04/23	U-BW-2	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1	307	4	305	307	-	Swimmers	Swimmers	Swimmers
559	4	2013/04/23	U-BW-2	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	2	307	4	305	307	-	Creepers	Crawlers	Crawlers
560	4	2013/04/23	U-BW-2	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	307	4	305	307	-	Creepers	Crawlers	Crawlers
561	4	2013/04/23	U-BW-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	5	307	4	305	307	-	Swimmers	Swimmers	Swimmers
562	4	2013/04/23	U-BW-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	261	307	4	305	307	-	Swimmers	Swimmers	Swimmers
563	4	2013/04/23	U-BW-2	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1	307	4	305	307	-	Case-bearers	Crawlers	Case-bearers
564	4	2013/04/23	U-BW-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	1	307	4	305	307	-	Creepers	Crawlers	Crawlers
565	4	2013/04/23	U-BW-2	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1	307	4	305	307	-	Burrowers	Burrowers	Free burrowers
566	4	2013/04/23	U-BW-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	3	307	4	305	307	-	Creepers	Crawlers	Crawlers
567	4	2013/04/23	U-BW-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	263	307	4	305	307	-	Burrowers	Burrowers	Free burrowers
568	4	2013/04/23	U-BW-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	583	307	4	305	307	-	Burrowers	Burrowers	Free burrowers
569	4	2013/04/23	U-BW-2	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	2	307	4	305	307	-	Burrowers	Burrowers	Free burrowers
570	4	2013/04/23	U-BW-2	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	64	307	4	305	307	-	Burrowers	Burrowers	Tube burrowers
571	4	2013/04/23	U-BW-2	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2	307	4	305	307	-	Burrowers	Burrowers	Free burrowers
572	4	2013/04/23	U-Rf-2	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	1	307	0	305	307	-	Swimmers	Attachers	Exposed attachers
573	4	2013/04/23	U-Rf-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	307	0	305	307	-	Swimmers	Swimmers	Swimmers
574	4	2013/04/23	U-Rf-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	64	307	0	305	307	-	Creepers	Crawlers	Gliders
575	4	2013/04/23	U-Rf-2	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	4	307	0	305	307	-	Creepers	Crawlers	Gliders
576	4	2013/04/23	U-Rf-2	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	4	307	0	305	307	-	Swimmers	Swimmers	Swimmers
577	4	2013/04/23	U-Rf-2	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	137	307	0	305	307	-	Creepers	Crawlers	Crawlers
578	4	2013/04/23	U-Rf-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	1	307	0	305	307	-	Creepers	Crawlers	Crawlers
579	4	2013/04/23	U-Rf-2	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	2	307	0	305	307	-	Net-spinners	Attachers	Net-spinners
580	4	2013/04/23	U-Rf-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	71	307	0	305	307	-	Net-spinners	Attachers	Net-spinners
581	4	2013/04/23	U-Rf-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	71	307	0	305	307	-	Net-spinners	Attachers	Net-spinners
582	4	2013/04/23	U-Rf-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	5	307	0	305	307	-	Net-spinners	Attachers	Net-spinners
583	4	2013/04/23	U-Rf-2	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	4	307	0	305	307	-	Creepers	Crawlers	Crawlers
584	4	2013/04/23	U-Rf-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2	307	0	305	307	-	Creepers	Crawlers	Crawlers
585	4	2013/04/23	U-Rf-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	270	307	0	305	307	-	Attachers	Attachers	Net-spinners
586	4	2013/04/23	U-Rf-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	307	0	305	307	-	Burrowers	Burrowers	Free burrowers
587	4	2013/04/23	U-Rf-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	71	307	0	305	307	-	Creepers	Crawlers	Crawlers
588	4	2013/04/23	U-Rf-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	198	307	0	305	307	-	Burrowers	Burrowers	Free burrowers
589	4	2013/04/23	U-Rf-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	463	307	0	305	307	-	Burrowers	Burrowers	Free burrowers
590	5	2013/05/17	U-BW-11	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	2	228	59	-	-	-	Creepers	Crawlers	Creepers
591	5	2013/05/17	U-BW-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	69	228	59	-	-	-	Creepers	Crawlers	Creepers
592	5	2013/05/17	U-BW-11	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1	228	59	-	-	-	Attachers	Attachers	Case builders
593	5	2013/05/17	U-BW-11	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	160	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
594	5	2013/05/17	U-BW-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	32	228	59	-	-	-	Creepers	Crawlers	Crawlers
595	5	2013/05/17	U-BW-11	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	228	59	-	-	-	Creepers	Crawlers	Crawlers
596	5	2013/05/17	U-BW-11	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	136	228	59	-	-	-	Creepers	Crawlers	Crawlers
597	5	2013/05/17	U-BW-11	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	3	228	59	-	-	-	Swimmers	Swimmers	Swimmers
598	5	2013/05/17	U-BW-11	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	33	228	59	-	-	-	Swimmers	Swimmers	Swimmers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

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Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
599	5	2013/05/17	U-BW-11	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	137	228	59	-	-	-	Creepers	Crawlers	Gliders
600	5	2013/05/17	U-BW-11	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	1	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
601	5	2013/05/17	U-BW-11	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1	228	59	-	-	-	Burrowers	Burrowers	Gliding burrowers
602	5	2013/05/17	U-BW-11	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	32	228	59	-	-	-	Creepers	Crawlers	Crawlers
603	5	2013/05/17	U-BW-11	24	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
604	5	2013/05/17	U-BW-11	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	65	228	59	-	-	-	Case-bearers	Crawlers	Case-bearers
605	5	2013/05/17	U-BW-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	71	228	59	-	-	-	Creepers	Crawlers	Crawlers
606	5	2013/05/17	U-BW-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	7	228	59	-	-	-	Creepers	Crawlers	Crawlers
607	5	2013/05/17	U-BW-11	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	228	59	-	-	-	Attachers	Attachers	Net-spinners
608	5	2013/05/17	U-BW-11	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
609	5	2013/05/17	U-BW-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	36	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
610	5	2013/05/17	U-BW-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	475	228	59	-	-	-	Creepers	Crawlers	Crawlers
611	5	2013/05/17	U-BW-11	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	1	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
612	5	2013/05/17	U-BW-11	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	35	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
613	5	2013/05/17	U-BW-11	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	99	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
614	5	2013/05/17	U-BW-11	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	3	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
615	5	2013/05/17	U-BW-11	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	338	228	59	-	-	-	Burrowers	Burrowers	Free burrowers
616	5	2013/05/17	U-BW-12	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	7	331	0	329	331	-	Creepers	Crawlers	Creepers
617	5	2013/05/17	U-BW-12	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1	331	0	329	331	-	Creepers	Crawlers	Creepers
618	5	2013/05/17	U-BW-12	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	1	331	0	329	331	-	Attachers	Attachers	Case builders
619	5	2013/05/17	U-BW-12	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1	331	0	329	331	-	Creepers	Crawlers	Crawlers
620	5	2013/05/17	U-BW-12	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	9	331	0	329	331	-	Creepers	Crawlers	Gliders
621	5	2013/05/17	U-BW-12	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	2	331	0	329	331	-	Creepers	Crawlers	Gliders
622	5	2013/05/17	U-BW-12	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1	331	0	329	331	-	Swimmers	Swimmers	Swimmers
623	5	2013/05/17	U-BW-12	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	1	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
624	5	2013/05/17	U-BW-12	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2	331	0	329	331	-	Creepers	Crawlers	Crawlers
625	5	2013/05/17	U-BW-12	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2	331	0	329	331	-	Creepers	Crawlers	Crawlers
626	5	2013/05/17	U-BW-12	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	3	331	0	329	331	-	Creepers	Crawlers	Crawlers
627	5	2013/05/17	U-BW-12	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	331	0	329	331	-	Creepers	Crawlers	Crawlers
628	5	2013/05/17	U-BW-12	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	196	331	0	329	331	-	Creepers	Crawlers	Crawlers
629	5	2013/05/17	U-BW-12	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
630	5	2013/05/17	U-BW-12	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	849	331	0	329	331	-	Creepers	Crawlers	Crawlers
631	5	2013/05/17	U-BW-12	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	194	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
632	5	2013/05/17	U-BW-12	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	2	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
633	5	2013/05/17	U-BW-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2	331	6	329	331	-	Creepers	Crawlers	Crawlers
634	5	2013/05/17	U-BW-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	522	331	6	329	331	-	Swimmers	Swimmers	Swimmers
635	5	2013/05/17	U-BW-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	1	331	6	329	331	-	Creepers	Crawlers	Crawlers
636	5	2013/05/17	U-BW-2	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	331	6	329	331	-	Creepers	Crawlers	Crawlers
637	5	2013/05/17	U-BW-2	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3	331	6	329	331	-	Burrowers	Burrowers	Free burrowers
638	5	2013/05/17	U-BW-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	331	6	329	331	-	Burrowers	Burrowers	Free burrowers
639	5	2013/05/17	U-BW-2	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1	331	6	329	331	-	Burrowers	Burrowers	Free burrowers
640	5	2013/05/17	U-BW-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	67	331	6	329	331	-	Creepers	Crawlers	Crawlers
641	5	2013/05/17	U-BW-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	268	331	6	329	331	-	Burrowers	Burrowers	Free burrowers
642	5	2013/05/17	U-BW-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	329	331	6	329	331	-	Burrowers	Burrowers	Free burrowers
643	5	2013/05/17	U-BW-2	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	131	331	6	329	331	-	Burrowers	Burrowers	Free burrowers
644	5	2013/05/17	U-BW-2	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	4	331	6	329	331	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
645	5	2013/05/17	U-BW-2	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	194	331	6	329	331	-	Burrowers	Burrowers	Tube burrowers
646	5	2013/05/17	U-Rf-1	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1	604	0	329	331	604	Creepers	Crawlers	Creepers
647	5	2013/05/17	U-Rf-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	64	604	0	329	331	604	Attachers	Attachers	Case builders
648	5	2013/05/17	U-Rf-1	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	198	604	0	329	331	604	Burrowers	Burrowers	Free burrowers
649	5	2013/05/17	U-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	67	604	0	329	331	604	Creepers	Crawlers	Crawlers
650	5	2013/05/17	U-Rf-1	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	66	604	0	329	331	604	Creepers	Crawlers	Crawlers
651	5	2013/05/17	U-Rf-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	604	0	329	331	604	Creepers	Crawlers	Gliders
652	5	2013/05/17	U-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	5	604	0	329	331	604	Swimmers	Swimmers	Swimmers
653	5	2013/05/17	U-Rf-1	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1	604	0	329	331	604	Burrowers	Burrowers	Gliding burrowers
654	5	2013/05/17	U-Rf-1	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	1	604	0	329	331	604	Creepers	Crawlers	Crawlers
655	5	2013/05/17	U-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	132	604	0	329	331	604	Creepers	Crawlers	Crawlers
656	5	2013/05/17	U-Rf-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2	604	0	329	331	604	Creepers	Crawlers	Crawlers
657	5	2013/05/17	U-Rf-1	24	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	2	604	0	329	331	604	Burrowers	Burrowers	Free burrowers
658	5	2013/05/17	U-Rf-1	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	1	604	0	329	331	604	Net-spinners	Attachers	Net-spinners
659	5	2013/05/17	U-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	7	604	0	329	331	604	Net-spinners	Attachers	Net-spinners
660	5	2013/05/17	U-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	11	604	0	329	331	604	Net-spinners	Attachers	Net-spinners
661	5	2013/05/17	U-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	131	604	0	329	331	604	Net-spinners	Attachers	Net-spinners
662	5	2013/05/17	U-Rf-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2	604	0	329	331	604	Creepers	Crawlers	Crawlers
663	5	2013/05/17	U-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	70	604	0	329	331	604	Creepers	Crawlers	Crawlers
664	5	2013/05/17	U-Rf-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	4	604	0	329	331	604	Creepers	Crawlers	Crawlers
665	5	2013/05/17	U-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	23	604	0	329	331	604	Attachers	Attachers	Net-spinners
666	5	2013/05/17	U-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3	604	0	329	331	604	Burrowers	Burrowers	Free burrowers
667	5	2013/05/17	U-Rf-1	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	3	604	0	329	331	604	Burrowers	Burrowers	Free burrowers
668	5	2013/05/17	U-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	504	604	0	329	331	604	Creepers	Crawlers	Crawlers
669	5	2013/05/17	U-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	68	604	0	329	331	604	Burrowers	Burrowers	Free burrowers
670	5	2013/05/17	U-Rf-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	581	604	0	329	331	604	Burrowers	Burrowers	Free burrowers
671	5	2013/05/17	U-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	193	604	0	329	331	604	Burrowers	Burrowers	Free burrowers
672	5	2013/05/17	U-Rf-2	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	256	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
673	5	2013/05/17	U-Rf-2	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	128	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
674	5	2013/05/17	U-Rf-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	389	331	0	329	331	-	Creepers	Crawlers	Crawlers
675	5	2013/05/17	U-Rf-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	128	331	0	329	331	-	Creepers	Crawlers	Crawlers
676	5	2013/05/17	U-Rf-2	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	3	331	0	329	331	-	Swimmers	Attachers	Exposed attachers
677	5	2013/05/17	U-Rf-2	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	128	331	0	329	331	-	Swimmers	Swimmers	Swimmers
678	5	2013/05/17	U-Rf-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	331	0	329	331	-	Creepers	Crawlers	Gliders
679	5	2013/05/17	U-Rf-2	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	266	331	0	329	331	-	Creepers	Crawlers	Gliders
680	5	2013/05/17	U-Rf-2	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	1	331	0	329	331	-	Creepers	Crawlers	Crawlers
681	5	2013/05/17	U-Rf-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1	331	0	329	331	-	Net-spinners	Attachers	Net-spinners
682	5	2013/05/17	U-Rf-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	136	331	0	329	331	-	Net-spinners	Attachers	Net-spinners
683	5	2013/05/17	U-Rf-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4	331	0	329	331	-	Creepers	Crawlers	Crawlers
684	5	2013/05/17	U-Rf-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	3	331	0	329	331	-	Attachers	Attachers	Net-spinners
685	5	2013/05/17	U-Rf-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	408	331	0	329	331	-	Creepers	Crawlers	Crawlers
686	5	2013/05/17	U-Rf-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	772	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
687	5	2013/05/17	U-Rf-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	388	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
688	5	2013/05/17	U-Rf-2	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	259	331	0	329	331	-	Burrowers	Burrowers	Free burrowers
689	5	2013/05/17	U-SP-1	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	232	331	328	329	331	-	Creepers	Crawlers	Creepers
690	5	2013/05/17	U-SP-1	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	32	331	328	329	331	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
691	5	2013/05/17	U-SP-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32	331	328	329	331	-	Creepers	Crawlers	Crawlers
692	5	2013/05/17	U-SP-1	11	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	39	331	328	329	331	-	Creepers	Crawlers	Crawlers
693	5	2013/05/17	U-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	39	331	328	329	331	-	Creepers	Crawlers	Gliders
694	5	2013/05/17	U-SP-1	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	1	331	328	329	331	-	Burrowers	Burrowers	Free burrowers
695	5	2013/05/17	U-SP-1	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	33	331	328	329	331	-	Burrowers	Burrowers	Gliding burrowers
696	5	2013/05/17	U-SP-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	132	331	328	329	331	-	Creepers	Crawlers	Crawlers
697	5	2013/05/17	U-SP-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1309	331	328	329	331	-	Swimmers	Swimmers	Swimmers
698	5	2013/05/17	U-SP-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	250	331	328	329	331	-	Case-bearers	Crawlers	Case-bearers
699	5	2013/05/17	U-SP-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	38	331	328	329	331	-	Creepers	Crawlers	Crawlers
700	5	2013/05/17	U-SP-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	34	331	328	329	331	-	Creepers	Crawlers	Crawlers
701	5	2013/05/17	U-SP-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	2	331	328	329	331	-	Creepers	Crawlers	Crawlers
702	5	2013/05/17	U-SP-1	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	36	331	328	329	331	-	Burrowers	Burrowers	Free burrowers
703	5	2013/05/17	U-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	81	331	328	329	331	-	Creepers	Crawlers	Crawlers
704	5	2013/05/17	U-SP-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	34	331	328	329	331	-	Burrowers	Burrowers	Free burrowers
705	5	2013/05/17	U-SP-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	135	331	328	329	331	-	Burrowers	Burrowers	Free burrowers
706	5	2013/05/17	U-SP-1	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1	331	328	329	331	-	Burrowers	Burrowers	Free burrowers
707	5	2013/05/17	U-SP-1	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	4	331	328	329	331	-	Burrowers	Burrowers	Free burrowers
708	5	2013/05/17	U-SP-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1	331	328	329	331	-	Burrowers	Burrowers	Tube burrowers
709	5	2013/05/17	U-SP-11	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	57	604	59	329	331	604	Creepers	Crawlers	Creepers
710	5	2013/05/17	U-SP-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	4	604	59	329	331	604	Creepers	Crawlers	Creepers
711	5	2013/05/17	U-SP-11	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	16	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
712	5	2013/05/17	U-SP-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	2	604	59	329	331	604	Creepers	Crawlers	Crawlers
713	5	2013/05/17	U-SP-11	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	19	604	59	329	331	604	Creepers	Crawlers	Crawlers
714	5	2013/05/17	U-SP-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	262	604	59	329	331	604	Swimmers	Swimmers	Swimmers
715	5	2013/05/17	U-SP-11	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	3	604	59	329	331	604	Case-bearers	Crawlers	Case-bearers
716	5	2013/05/17	U-SP-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	157	604	59	329	331	604	Creepers	Crawlers	Crawlers
717	5	2013/05/17	U-SP-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	24	604	59	329	331	604	Creepers	Crawlers	Crawlers
718	5	2013/05/17	U-SP-11	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	604	59	329	331	604	Creepers	Crawlers	Crawlers
719	5	2013/05/17	U-SP-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	18	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
720	5	2013/05/17	U-SP-11	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
721	5	2013/05/17	U-SP-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	42	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
722	5	2013/05/17	U-SP-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	49	604	59	329	331	604	Creepers	Crawlers	Crawlers
723	5	2013/05/17	U-SP-11	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	103	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
724	5	2013/05/17	U-SP-11	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	72	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
725	5	2013/05/17	U-SP-11	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	1	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
726	5	2013/05/17	U-SP-11	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	34	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
727	5	2013/05/17	U-SP-11	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
728	5	2013/05/17	U-SP-11	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	99	604	59	329	331	604	Burrowers	Burrowers	Tube burrowers
729	5	2013/05/17	U-SP-11	50	261	Insecta	Diptera	Empididae	Empididae	1	604	59	329	331	604	Burrowers	Burrowers	Free burrowers
730	6	2013/07/17	U-BW-11	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	65	289	120	-	-	-	Creepers	Crawlers	Creepers
731	6	2013/07/17	U-BW-11	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	70	289	120	-	-	-	Creepers	Crawlers	Creepers
732	6	2013/07/17	U-BW-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	141	289	120	-	-	-	Creepers	Crawlers	Creepers
733	6	2013/07/17	U-BW-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	289	120	-	-	-	Creepers	Crawlers	Crawlers
734	6	2013/07/17	U-BW-11	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	3	289	120	-	-	-	Creepers	Crawlers	Crawlers
735	6	2013/07/17	U-BW-11	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	9	289	120	-	-	-	Swimmers	Swimmers	Swimmers
736	6	2013/07/17	U-BW-11	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	289	120	-	-	-	Creepers	Crawlers	Gliders

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
737	6	2013/07/17	U-BW-11	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	2	289	120	-	-	-	Burrowers	Burrowers	Free burrowers
738	6	2013/07/17	U-BW-11	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	209	289	120	-	-	-	Creepers	Crawlers	Crawlers
739	6	2013/07/17	U-BW-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	211	289	120	-	-	-	Swimmers	Swimmers	Swimmers
740	6	2013/07/17	U-BW-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	64	289	120	-	-	-	Swimmers	Swimmers	Swimmers
741	6	2013/07/17	U-BW-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	988	289	120	-	-	-	Creepers	Crawlers	Crawlers
742	6	2013/07/17	U-BW-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	142	289	120	-	-	-	Creepers	Crawlers	Crawlers
743	6	2013/07/17	U-BW-11	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	195	289	120	-	-	-	Creepers	Crawlers	Crawlers
744	6	2013/07/17	U-BW-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	7	289	120	-	-	-	Burrowers	Burrowers	Free burrowers
745	6	2013/07/17	U-BW-11	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	134	289	120	-	-	-	Attachers	Attachers	Net-spinners
746	6	2013/07/17	U-BW-11	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	289	120	-	-	-	Burrowers	Burrowers	Free burrowers
747	6	2013/07/17	U-BW-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	988	289	120	-	-	-	Creepers	Crawlers	Crawlers
748	6	2013/07/17	U-BW-11	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	133	289	120	-	-	-	Burrowers	Burrowers	Free burrowers
749	6	2013/07/17	U-BW-11	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	386	289	120	-	-	-	Burrowers	Burrowers	Tube burrowers
750	6	2013/07/17	U-BW-11	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	65	289	120	-	-	-	Burrowers	Burrowers	Free burrowers
751	6	2013/07/17	U-BW-12	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	128	392	1	390	392	-	Creepers	Crawlers	Creepers
752	6	2013/07/17	U-BW-12	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	256	392	1	390	392	-	Creepers	Crawlers	Creepers
753	6	2013/07/17	U-BW-12	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	8	392	1	390	392	-	Creepers	Crawlers	Creepers
754	6	2013/07/17	U-BW-12	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	132	392	1	390	392	-	Attachers	Attachers	Case builders
755	6	2013/07/17	U-BW-12	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	131	392	1	390	392	-	Burrowers	Burrowers	Free burrowers
756	6	2013/07/17	U-BW-12	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	392	1	390	392	-	Creepers	Crawlers	Crawlers
757	6	2013/07/17	U-BW-12	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	5	392	1	390	392	-	Creepers	Crawlers	Crawlers
758	6	2013/07/17	U-BW-12	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	3	392	1	390	392	-	Creepers	Crawlers	Crawlers
759	6	2013/07/17	U-BW-12	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	128	392	1	390	392	-	Creepers	Crawlers	Crawlers
760	6	2013/07/17	U-BW-12	11	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	396	392	1	390	392	-	Creepers	Crawlers	Crawlers
761	6	2013/07/17	U-BW-12	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1560	392	1	390	392	-	Creepers	Crawlers	Gliders
762	6	2013/07/17	U-BW-12	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	1	392	1	390	392	-	Creepers	Crawlers	Gliders
763	6	2013/07/17	U-BW-12	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	129	392	1	390	392	-	Creepers	Crawlers	Crawlers
764	6	2013/07/17	U-BW-12	24	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1	392	1	390	392	-	Burrowers	Burrowers	Free burrowers
765	6	2013/07/17	U-BW-12	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	3	392	1	390	392	-	Creepers	Crawlers	Crawlers
766	6	2013/07/17	U-BW-12	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	143	392	1	390	392	-	Swimmers	Swimmers	Swimmers
767	6	2013/07/17	U-BW-12	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	5	392	1	390	392	-	Net-spinners	Attachers	Net-spinners
768	6	2013/07/17	U-BW-12	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	128	392	1	390	392	-	Net-spinners	Attachers	Net-spinners
769	6	2013/07/17	U-BW-12	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	1	392	1	390	392	-	Net-spinners	Attachers	Net-spinners
770	6	2013/07/17	U-BW-12	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	1	392	1	390	392	-	Creepers	Crawlers	Crawlers
771	6	2013/07/17	U-BW-12	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	525	392	1	390	392	-	Creepers	Crawlers	Crawlers
772	6	2013/07/17	U-BW-12	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3	392	1	390	392	-	Creepers	Crawlers	Crawlers
773	6	2013/07/17	U-BW-12	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	386	392	1	390	392	-	Creepers	Crawlers	Crawlers
774	6	2013/07/17	U-BW-12	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4	392	1	390	392	-	Burrowers	Burrowers	Free burrowers
775	6	2013/07/17	U-BW-12	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	133	392	1	390	392	-	Attachers	Attachers	Net-spinners
776	6	2013/07/17	U-BW-12	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	7	392	1	390	392	-	Burrowers	Burrowers	Free burrowers
777	6	2013/07/17	U-BW-12	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	1167	392	1	390	392	-	Creepers	Crawlers	Crawlers
778	6	2013/07/17	U-BW-12	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	131	392	1	390	392	-	Burrowers	Burrowers	Free burrowers
779	6	2013/07/17	U-BW-12	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	3	392	1	390	392	-	Burrowers	Burrowers	Free burrowers
780	6	2013/07/17	U-BW-12	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	128	392	1	390	392	-	Burrowers	Burrowers	Free burrowers
781	6	2013/07/17	U-BW-2	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3	392	19	390	392	-	Creepers	Crawlers	Creepers
782	6	2013/07/17	U-BW-2	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	3	392	19	390	392	-	Creepers	Crawlers	Creepers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
783	6	2013/07/17	U-BW-2	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	128	392	19	390	392	-	Burrowers	Burrowers	Free burrowers
784	6	2013/07/17	U-BW-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	392	19	390	392	-	Creepers	Crawlers	Crawlers
785	6	2013/07/17	U-BW-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	132	392	19	390	392	-	Creepers	Crawlers	Crawlers
786	6	2013/07/17	U-BW-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	392	19	390	392	-	Swimmers	Swimmers	Swimmers
787	6	2013/07/17	U-BW-2	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	76	392	19	390	392	-	Burrowers	Burrowers	Free burrowers
788	6	2013/07/17	U-BW-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	588	392	19	390	392	-	Creepers	Crawlers	Crawlers
789	6	2013/07/17	U-BW-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	2030	392	19	390	392	-	Swimmers	Swimmers	Swimmers
790	6	2013/07/17	U-BW-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	3136	392	19	390	392	-	Swimmers	Swimmers	Swimmers
791	6	2013/07/17	U-BW-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1	392	19	390	392	-	Net-spinners	Attachers	Net-spinners
792	6	2013/07/17	U-BW-2	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	196	392	19	390	392	-	Case-bearers	Crawlers	Case-bearers
793	6	2013/07/17	U-BW-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	349	392	19	390	392	-	Creepers	Crawlers	Crawlers
794	6	2013/07/17	U-BW-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	392	19	390	392	-	Creepers	Crawlers	Crawlers
795	6	2013/07/17	U-BW-2	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	3	392	19	390	392	-	Burrowers	Burrowers	Free burrowers
796	6	2013/07/17	U-BW-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	150	392	19	390	392	-	Creepers	Crawlers	Crawlers
797	6	2013/07/17	U-BW-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	70	392	19	390	392	-	Burrowers	Burrowers	Free burrowers
798	6	2013/07/17	U-BW-2	45	236	Insecta	Diptera	Chironomidae	*Cryptochironomus* sp.	66	392	19	390	392	-	Burrowers	Burrowers	Free burrowers
799	6	2013/07/17	U-BW-2	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1	392	19	390	392	-	Burrowers	Burrowers	Free burrowers
800	6	2013/07/17	U-BW-2	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	405	392	19	390	392	-	Burrowers	Burrowers	Tube burrowers
801	6	2013/07/17	U-BW-2	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	3	392	19	390	392	-	Burrowers	Burrowers	Free burrowers
802	6	2013/07/17	U-Rf-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	8	665	0	390	392	665	Attachers	Attachers	Case builders
803	6	2013/07/17	U-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	69	665	0	390	392	665	Creepers	Crawlers	Crawlers
804	6	2013/07/17	U-Rf-1	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	2	665	0	390	392	665	Creepers	Crawlers	Crawlers
805	6	2013/07/17	U-Rf-1	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	4	665	0	390	392	665	Swimmers	Attachers	Exposed attachers
806	6	2013/07/17	U-Rf-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	67	665	0	390	392	665	Swimmers	Swimmers	Swimmers
807	6	2013/07/17	U-Rf-1	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	68	665	0	390	392	665	Swimmers	Swimmers	Swimmers
808	6	2013/07/17	U-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	134	665	0	390	392	665	Swimmers	Swimmers	Swimmers
809	6	2013/07/17	U-Rf-1	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1	665	0	390	392	665	Burrowers	Burrowers	Gliding burrowers
810	6	2013/07/17	U-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	353	665	0	390	392	665	Creepers	Crawlers	Crawlers
811	6	2013/07/17	U-Rf-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	5	665	0	390	392	665	Creepers	Crawlers	Crawlers
812	6	2013/07/17	U-Rf-1	24	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1	665	0	390	392	665	Burrowers	Burrowers	Free burrowers
813	6	2013/07/17	U-Rf-1	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	3	665	0	390	392	665	Net-spinners	Attachers	Net-spinners
814	6	2013/07/17	U-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	154	665	0	390	392	665	Net-spinners	Attachers	Net-spinners
815	6	2013/07/17	U-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	240	665	0	390	392	665	Net-spinners	Attachers	Net-spinners
816	6	2013/07/17	U-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	148	665	0	390	392	665	Net-spinners	Attachers	Net-spinners
817	6	2013/07/17	U-Rf-1	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	2	665	0	390	392	665	Creepers	Crawlers	Crawlers
818	6	2013/07/17	U-Rf-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	7	665	0	390	392	665	Creepers	Crawlers	Crawlers
819	6	2013/07/17	U-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	78	665	0	390	392	665	Creepers	Crawlers	Crawlers
820	6	2013/07/17	U-Rf-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	2	665	0	390	392	665	Burrowers	Burrowers	Free burrowers
821	6	2013/07/17	U-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	16	665	0	390	392	665	Attachers	Attachers	Net-spinners
822	6	2013/07/17	U-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	8	665	0	390	392	665	Burrowers	Burrowers	Free burrowers
823	6	2013/07/17	U-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	287	665	0	390	392	665	Creepers	Crawlers	Crawlers
824	6	2013/07/17	U-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	2	665	0	390	392	665	Burrowers	Burrowers	Free burrowers
825	6	2013/07/17	U-Rf-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	74	665	0	390	392	665	Burrowers	Burrowers	Free burrowers
826	6	2013/07/17	U-Rf-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	1	665	0	390	392	665	Burrowers	Burrowers	Free burrowers
827	6	2013/07/17	U-Rf-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	66	665	0	390	392	665	Burrowers	Burrowers	Tube burrowers
828	6	2013/07/17	U-Rf-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	392	0	390	392	-	Creepers	Crawlers	Crawlers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

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Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)					Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
829	6	2013/07/17	U-Rf-2	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	38	392	0	390	392	-	Creepers	Crawlers	Crawlers
830	6	2013/07/17	U-Rf-2	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	33	392	0	390	392	-	Swimmers	Attachers	Exposed attachers
831	6	2013/07/17	U-Rf-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	392	0	390	392	-	Swimmers	Swimmers	Swimmers
832	6	2013/07/17	U-Rf-2	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	33	392	0	390	392	-	Swimmers	Swimmers	Swimmers
833	6	2013/07/17	U-Rf-2	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	3	392	0	390	392	-	Swimmers	Swimmers	Swimmers
834	6	2013/07/17	U-Rf-2	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	2	392	0	390	392	-	Creepers	Crawlers	Crawlers
835	6	2013/07/17	U-Rf-2	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	136	392	0	390	392	-	Creepers	Crawlers	Crawlers
836	6	2013/07/17	U-Rf-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	32	392	0	390	392	-	Creepers	Crawlers	Crawlers
837	6	2013/07/17	U-Rf-2	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	65	392	0	390	392	-	Net-spinners	Attachers	Net-spinners
838	6	2013/07/17	U-Rf-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	487	392	0	390	392	-	Net-spinners	Attachers	Net-spinners
839	6	2013/07/17	U-Rf-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	362	392	0	390	392	-	Net-spinners	Attachers	Net-spinners
840	6	2013/07/17	U-Rf-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	342	392	0	390	392	-	Net-spinners	Attachers	Net-spinners
841	6	2013/07/17	U-Rf-2	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	35	392	0	390	392	-	Creepers	Crawlers	Crawlers
842	6	2013/07/17	U-Rf-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	6	392	0	390	392	-	Creepers	Crawlers	Crawlers
843	6	2013/07/17	U-Rf-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4	392	0	390	392	-	Creepers	Crawlers	Crawlers
844	6	2013/07/17	U-Rf-2	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	392	0	390	392	-	Creepers	Crawlers	Crawlers
845	6	2013/07/17	U-Rf-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	39	392	0	390	392	-	Attachers	Attachers	Net-spinners
846	6	2013/07/17	U-Rf-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6	392	0	390	392	-	Burrowers	Burrowers	Free burrowers
847	6	2013/07/17	U-Rf-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	265	392	0	390	392	-	Creepers	Crawlers	Crawlers
848	6	2013/07/17	U-Rf-2	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	48	392	0	390	392	-	Burrowers	Burrowers	Free burrowers
849	6	2013/07/17	U-Rf-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	96	392	0	390	392	-	Burrowers	Burrowers	Free burrowers
850	6	2013/07/17	U-Rf-2	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	32	392	0	390	392	-	Burrowers	Burrowers	Tube burrowers
851	6	2013/07/17	U-Rf-2	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2	392	0	390	392	-	Burrowers	Burrowers	Free burrowers
852	6	2013/07/17	U-SP-1	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	45	392	389	390	392	-	Creepers	Crawlers	Creepers
853	6	2013/07/17	U-SP-1	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1	392	389	390	392	-	Burrowers	Burrowers	Gliding burrowers
854	6	2013/07/17	U-SP-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	651	392	389	390	392	-	Swimmers	Swimmers	Swimmers
855	6	2013/07/17	U-SP-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	75	392	389	390	392	-	Creepers	Crawlers	Crawlers
856	6	2013/07/17	U-SP-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	6	392	389	390	392	-	Creepers	Crawlers	Crawlers
857	6	2013/07/17	U-SP-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	392	389	390	392	-	Creepers	Crawlers	Crawlers
858	6	2013/07/17	U-SP-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	392	389	390	392	-	Burrowers	Burrowers	Free burrowers
859	6	2013/07/17	U-SP-1	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2	392	389	390	392	-	Burrowers	Burrowers	Free burrowers
860	6	2013/07/17	U-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	2	392	389	390	392	-	Creepers	Crawlers	Crawlers
861	6	2013/07/17	U-SP-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	65	392	389	390	392	-	Burrowers	Burrowers	Free burrowers
862	6	2013/07/17	U-SP-11	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1	665	120	390	392	665	Creepers	Crawlers	Creepers
863	6	2013/07/17	U-SP-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1948	665	120	390	392	665	Creepers	Crawlers	Creepers
864	6	2013/07/17	U-SP-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	665	120	390	392	665	Creepers	Crawlers	Crawlers
865	6	2013/07/17	U-SP-11	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	15	665	120	390	392	665	Case-bearers	Crawlers	Case-bearers
866	6	2013/07/17	U-SP-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	292	665	120	390	392	665	Creepers	Crawlers	Crawlers
867	6	2013/07/17	U-SP-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	665	120	390	392	665	Creepers	Crawlers	Crawlers
868	6	2013/07/17	U-SP-11	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	4	665	120	390	392	665	Creepers	Crawlers	Crawlers
869	6	2013/07/17	U-SP-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	150	665	120	390	392	665	Burrowers	Burrowers	Free burrowers
870	6	2013/07/17	U-SP-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2	665	120	390	392	665	Burrowers	Burrowers	Free burrowers
871	6	2013/07/17	U-SP-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	282	665	120	390	392	665	Creepers	Crawlers	Crawlers
872	6	2013/07/17	U-SP-11	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	4	665	120	390	392	665	Burrowers	Burrowers	Free burrowers
873	6	2013/07/17	U-SP-11	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1	665	120	390	392	665	Burrowers	Burrowers	Tube burrowers
874	6	2013/07/17	U-SP-11	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1	665	120	390	392	665	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
875	7	2013/08/30	U-BW-11	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	8	333	164	-	-	-	Creepers	Crawlers	Creepers
876	7	2013/08/30	U-BW-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	342	333	164	-	-	-	Creepers	Crawlers	Creepers
877	7	2013/08/30	U-BW-11	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32	333	164	-	-	-	Creepers	Crawlers	Crawlers
878	7	2013/08/30	U-BW-11	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	2	333	164	-	-	-	Swimmers	Swimmers	Swimmers
879	7	2013/08/30	U-BW-11	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1	333	164	-	-	-	Creepers	Crawlers	Crawlers
880	7	2013/08/30	U-BW-11	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	142	333	164	-	-	-	Creepers	Crawlers	Crawlers
881	7	2013/08/30	U-BW-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	70	333	164	-	-	-	Swimmers	Swimmers	Swimmers
882	7	2013/08/30	U-BW-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	759	333	164	-	-	-	Swimmers	Swimmers	Swimmers
883	7	2013/08/30	U-BW-11	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	143	333	164	-	-	-	Net-spinners	Attachers	Net-spinners
884	7	2013/08/30	U-BW-11	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	2	333	164	-	-	-	Net-spinners	Attachers	Net-spinners
885	7	2013/08/30	U-BW-11	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	5	333	164	-	-	-	Case-bearers	Crawlers	Case-bearers
886	7	2013/08/30	U-BW-11	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	1	333	164	-	-	-	Case-bearers	Crawlers	Case-bearers
887	7	2013/08/30	U-BW-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	89	333	164	-	-	-	Creepers	Crawlers	Crawlers
888	7	2013/08/30	U-BW-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	14	333	164	-	-	-	Creepers	Crawlers	Crawlers
889	7	2013/08/30	U-BW-11	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	333	164	-	-	-	Creepers	Crawlers	Crawlers
890	7	2013/08/30	U-BW-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	2	333	164	-	-	-	Burrowers	Burrowers	Free burrowers
891	7	2013/08/30	U-BW-11	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	6	333	164	-	-	-	Attachers	Attachers	Net-spinners
892	7	2013/08/30	U-BW-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1	333	164	-	-	-	Burrowers	Burrowers	Free burrowers
893	7	2013/08/30	U-BW-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	38	333	164	-	-	-	Creepers	Crawlers	Crawlers
894	7	2013/08/30	U-BW-11	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	162	333	164	-	-	-	Burrowers	Burrowers	Free burrowers
895	7	2013/08/30	U-BW-11	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	34	333	164	-	-	-	Burrowers	Burrowers	Free burrowers
896	7	2013/08/30	U-BW-12	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	169	436	23	434	436	-	Creepers	Crawlers	Creepers
897	7	2013/08/30	U-BW-12	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	891	436	23	434	436	-	Creepers	Crawlers	Creepers
898	7	2013/08/30	U-BW-12	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	64	436	23	434	436	-	Burrowers	Burrowers	Free burrowers
899	7	2013/08/30	U-BW-12	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	6	436	23	434	436	-	Creepers	Crawlers	Crawlers
900	7	2013/08/30	U-BW-12	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1	436	23	434	436	-	Swimmers	Swimmers	Swimmers
901	7	2013/08/30	U-BW-12	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	3	436	23	434	436	-	Creepers	Crawlers	Gliders
902	7	2013/08/30	U-BW-12	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	3	436	23	434	436	-	Swimmers	Swimmers	Swimmers
903	7	2013/08/30	U-BW-12	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	4	436	23	434	436	-	Creepers	Crawlers	Crawlers
904	7	2013/08/30	U-BW-12	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	146	436	23	434	436	-	Creepers	Crawlers	Crawlers
905	7	2013/08/30	U-BW-12	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	399	436	23	434	436	-	Swimmers	Swimmers	Swimmers
906	7	2013/08/30	U-BW-12	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	109	436	23	434	436	-	Net-spinners	Attachers	Net-spinners
907	7	2013/08/30	U-BW-12	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1	436	23	434	436	-	Net-spinners	Attachers	Net-spinners
908	7	2013/08/30	U-BW-12	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1	436	23	434	436	-	Net-spinners	Attachers	Net-spinners
909	7	2013/08/30	U-BW-12	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	8	436	23	434	436	-	Net-spinners	Attachers	Net-spinners
910	7	2013/08/30	U-BW-12	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	36	436	23	434	436	-	Case-bearers	Crawlers	Case-bearers
911	7	2013/08/30	U-BW-12	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	3	436	23	434	436	-	Creepers	Crawlers	Crawlers
912	7	2013/08/30	U-BW-12	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	179	436	23	434	436	-	Creepers	Crawlers	Crawlers
913	7	2013/08/30	U-BW-12	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	111	436	23	434	436	-	Creepers	Crawlers	Crawlers
914	7	2013/08/30	U-BW-12	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4	436	23	434	436	-	Burrowers	Burrowers	Free burrowers
915	7	2013/08/30	U-BW-12	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	18	436	23	434	436	-	Attachers	Attachers	Net-spinners
916	7	2013/08/30	U-BW-12	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	5	436	23	434	436	-	Burrowers	Burrowers	Free burrowers
917	7	2013/08/30	U-BW-12	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	116	436	23	434	436	-	Creepers	Crawlers	Crawlers
918	7	2013/08/30	U-BW-12	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	432	436	23	434	436	-	Burrowers	Burrowers	Free burrowers
919	7	2013/08/30	U-BW-12	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	33	436	23	434	436	-	Burrowers	Burrowers	Tube burrowers
920	7	2013/08/30	U-BW-12	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2	436	23	434	436	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
921	7	2013/08/30	U-BW-2	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	134	436	63	434	436	-	Creepers	Crawlers	Creepers
922	7	2013/08/30	U-BW-2	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	509	436	63	434	436	-	Creepers	Crawlers	Creepers
923	7	2013/08/30	U-BW-2	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	32	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
924	7	2013/08/30	U-BW-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1	436	63	434	436	-	Creepers	Crawlers	Crawlers
925	7	2013/08/30	U-BW-2	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	148	436	63	434	436	-	Swimmers	Swimmers	Swimmers
926	7	2013/08/30	U-BW-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	6	436	63	434	436	-	Swimmers	Swimmers	Swimmers
927	7	2013/08/30	U-BW-2	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	3	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
928	7	2013/08/30	U-BW-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	240	436	63	434	436	-	Creepers	Crawlers	Crawlers
929	7	2013/08/30	U-BW-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	211	436	63	434	436	-	Swimmers	Swimmers	Swimmers
930	7	2013/08/30	U-BW-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1005	436	63	434	436	-	Swimmers	Swimmers	Swimmers
931	7	2013/08/30	U-BW-2	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	8	436	63	434	436	-	Case-bearers	Crawlers	Case-bearers
932	7	2013/08/30	U-BW-2	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	5	436	63	434	436	-	Case-bearers	Crawlers	Case-bearers
933	7	2013/08/30	U-BW-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	46	436	63	434	436	-	Creepers	Crawlers	Crawlers
934	7	2013/08/30	U-BW-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	4	436	63	434	436	-	Creepers	Crawlers	Crawlers
935	7	2013/08/30	U-BW-2	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
936	7	2013/08/30	U-BW-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	436	63	434	436	-	Attachers	Attachers	Net-spinners
937	7	2013/08/30	U-BW-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	3	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
938	7	2013/08/30	U-BW-2	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	32	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
939	7	2013/08/30	U-BW-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	13	436	63	434	436	-	Creepers	Crawlers	Crawlers
940	7	2013/08/30	U-BW-2	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	32	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
941	7	2013/08/30	U-BW-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	2	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
942	7	2013/08/30	U-BW-2	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	96	436	63	434	436	-	Burrowers	Burrowers	Tube burrowers
943	7	2013/08/30	U-BW-2	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	32	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
944	7	2013/08/30	U-BW-2	50	261	Insecta	Diptera	Empididae	Empididae	32	436	63	434	436	-	Burrowers	Burrowers	Free burrowers
945	7	2013/08/30	U-Rf-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	128	709	0	434	436	709	Creepers	Crawlers	Creepers
946	7	2013/08/30	U-Rf-1	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	5	709	0	434	436	709	Creepers	Crawlers	Creepers
947	7	2013/08/30	U-Rf-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	134	709	0	434	436	709	Attachers	Attachers	Case builders
948	7	2013/08/30	U-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	256	709	0	434	436	709	Creepers	Crawlers	Crawlers
949	7	2013/08/30	U-Rf-1	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	128	709	0	434	436	709	Creepers	Crawlers	Crawlers
950	7	2013/08/30	U-Rf-1	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	7	709	0	434	436	709	Swimmers	Swimmers	Swimmers
951	7	2013/08/30	U-Rf-1	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1931	709	0	434	436	709	Swimmers	Swimmers	Swimmers
952	7	2013/08/30	U-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	3	709	0	434	436	709	Swimmers	Swimmers	Swimmers
953	7	2013/08/30	U-Rf-1	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	261	709	0	434	436	709	Creepers	Crawlers	Crawlers
954	7	2013/08/30	U-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1931	709	0	434	436	709	Creepers	Crawlers	Crawlers
955	7	2013/08/30	U-Rf-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	391	709	0	434	436	709	Creepers	Crawlers	Crawlers
956	7	2013/08/30	U-Rf-1	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	130	709	0	434	436	709	Net-spinners	Attachers	Net-spinners
957	7	2013/08/30	U-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1411	709	0	434	436	709	Net-spinners	Attachers	Net-spinners
958	7	2013/08/30	U-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1	709	0	434	436	709	Net-spinners	Attachers	Net-spinners
959	7	2013/08/30	U-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	270	709	0	434	436	709	Net-spinners	Attachers	Net-spinners
960	7	2013/08/30	U-Rf-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	392	709	0	434	436	709	Case-bearers	Crawlers	Case-bearers
961	7	2013/08/30	U-Rf-1	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	1	709	0	434	436	709	Creepers	Crawlers	Crawlers
962	7	2013/08/30	U-Rf-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	651	709	0	434	436	709	Creepers	Crawlers	Crawlers
963	7	2013/08/30	U-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	12	709	0	434	436	709	Creepers	Crawlers	Crawlers
964	7	2013/08/30	U-Rf-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	131	709	0	434	436	709	Burrowers	Burrowers	Free burrowers
965	7	2013/08/30	U-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	389	709	0	434	436	709	Attachers	Attachers	Net-spinners
966	7	2013/08/30	U-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	3	709	0	434	436	709	Creepers	Crawlers	Crawlers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
967	7	2013/08/30	U-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	2	709	0	434	436	709	Burrowers	Burrowers	Free burrowers
968	7	2013/08/30	U-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	4	709	0	434	436	709	Burrowers	Burrowers	Free burrowers
969	7	2013/08/30	U-Rf-1	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1	709	0	434	436	709	Burrowers	Burrowers	Free burrowers
970	7	2013/08/30	U-Rf-2	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	18	436	0	434	436	-	Creepers	Crawlers	Creepers
971	7	2013/08/30	U-Rf-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	388	436	0	434	436	-	Creepers	Crawlers	Crawlers
972	7	2013/08/30	U-Rf-2	9	38	Arachnida	Acarina	Hygrobatidae	*Atractides* sp.	4	436	0	434	436	-	Creepers	Crawlers	Crawlers
973	7	2013/08/30	U-Rf-2	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1038	436	0	434	436	-	Swimmers	Swimmers	Swimmers
974	7	2013/08/30	U-Rf-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	385	436	0	434	436	-	Creepers	Crawlers	Gliders
975	7	2013/08/30	U-Rf-2	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	129	436	0	434	436	-	Swimmers	Swimmers	Swimmers
976	7	2013/08/30	U-Rf-2	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	133	436	0	434	436	-	Creepers	Crawlers	Crawlers
977	7	2013/08/30	U-Rf-2	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	8330	436	0	434	436	-	Creepers	Crawlers	Crawlers
978	7	2013/08/30	U-Rf-2	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2324	436	0	434	436	-	Creepers	Crawlers	Crawlers
979	7	2013/08/30	U-Rf-2	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	390	436	0	434	436	-	Swimmers	Swimmers	Swimmers
980	7	2013/08/30	U-Rf-2	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	387	436	0	434	436	-	Net-spinners	Attachers	Net-spinners
981	7	2013/08/30	U-Rf-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	385	436	0	434	436	-	Net-spinners	Attachers	Net-spinners
982	7	2013/08/30	U-Rf-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	269	436	0	434	436	-	Net-spinners	Attachers	Net-spinners
983	7	2013/08/30	U-Rf-2	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	524	436	0	434	436	-	Case-bearers	Crawlers	Case-bearers
984	7	2013/08/30	U-Rf-2	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	4	436	0	434	436	-	Creepers	Crawlers	Crawlers
985	7	2013/08/30	U-Rf-2	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	780	436	0	434	436	-	Creepers	Crawlers	Crawlers
986	7	2013/08/30	U-Rf-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3	436	0	434	436	-	Creepers	Crawlers	Crawlers
987	7	2013/08/30	U-Rf-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	5	436	0	434	436	-	Attachers	Attachers	Net-spinners
988	7	2013/08/30	U-Rf-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	522	436	0	434	436	-	Creepers	Crawlers	Crawlers
989	7	2013/08/30	U-Rf-2	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	4	436	0	434	436	-	Burrowers	Burrowers	Free burrowers
990	7	2013/08/30	U-Rf-2	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1	436	0	434	436	-	Burrowers	Burrowers	Free burrowers
991	7	2013/08/30	U-SP-1	11	43	Malacostraca	Isopoda	Asellidae	*Asellus hilgendorfi*	2	436	433	434	436	-	Creepers	Crawlers	Crawlers
992	7	2013/08/30	U-SP-1	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1	436	433	434	436	-	Swimmers	Swimmers	Swimmers
993	7	2013/08/30	U-SP-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	2	436	433	434	436	-	Creepers	Crawlers	Crawlers
994	7	2013/08/30	U-SP-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1	436	433	434	436	-	Swimmers	Swimmers	Swimmers
995	7	2013/08/30	U-SP-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	3	436	433	434	436	-	Creepers	Crawlers	Crawlers
996	7	2013/08/30	U-SP-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	68	436	433	434	436	-	Creepers	Crawlers	Crawlers
997	7	2013/08/30	U-SP-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3	436	433	434	436	-	Burrowers	Burrowers	Free burrowers
998	7	2013/08/30	U-SP-1	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	34	436	433	434	436	-	Burrowers	Burrowers	Free burrowers
999	7	2013/08/30	U-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	7	436	433	434	436	-	Creepers	Crawlers	Crawlers
1000	7	2013/08/30	U-SP-1	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	1	436	433	434	436	-	Burrowers	Burrowers	Free burrowers
1001	7	2013/08/30	U-SP-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	34	436	433	434	436	-	Burrowers	Burrowers	Tube burrowers
1002	7	2013/08/30	U-SP-1	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1	436	433	434	436	-	Burrowers	Burrowers	Free burrowers
1003	7	2013/08/30	U-SP-11	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	7	709	164	434	436	709	Creepers	Crawlers	Creepers
1004	7	2013/08/30	U-SP-11	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	34	709	164	434	436	709	Creepers	Crawlers	Creepers
1005	7	2013/08/30	U-SP-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	7	709	164	434	436	709	Swimmers	Swimmers	Swimmers
1006	7	2013/08/30	U-SP-11	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	2	709	164	434	436	709	Case-bearers	Crawlers	Case-bearers
1007	7	2013/08/30	U-SP-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	2	709	164	434	436	709	Creepers	Crawlers	Crawlers
1008	7	2013/08/30	U-SP-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	5	709	164	434	436	709	Creepers	Crawlers	Crawlers
1009	7	2013/08/30	U-SP-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	8	709	164	434	436	709	Burrowers	Burrowers	Free burrowers
1010	7	2013/08/30	U-SP-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1	709	164	434	436	709	Burrowers	Burrowers	Free burrowers
1011	7	2013/08/30	U-SP-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	10	709	164	434	436	709	Creepers	Crawlers	Crawlers
1012	8	2013/11/22	U-Rf-2	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	73	520	0	27	67	-	Creepers	Crawlers	Creepers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1013	8	2013/11/22	U-Rf-2	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	96	520	0	27	67	-	Creepers	Crawlers	Creepers
1014	8	2013/11/22	U-Rf-2	3	8	Gastropoda	Basommatophora	Physidae	*Physa acuta*	1	520	0	27	67	-	Creepers	Crawlers	Creepers
1015	8	2013/11/22	U-Rf-2	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	5	520	0	27	67	-	Attachers	Attachers	Case builders
1016	8	2013/11/22	U-Rf-2	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	232	520	0	27	67	-	Creepers	Crawlers	Crawlers
1017	8	2013/11/22	U-Rf-2	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	32	520	0	27	67	-	Creepers	Crawlers	Crawlers
1018	8	2013/11/22	U-Rf-2	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	73	520	0	27	67	-	Swimmers	Attachers	Exposed attachers
1019	8	2013/11/22	U-Rf-2	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	520	0	27	67	-	Swimmers	Swimmers	Swimmers
1020	8	2013/11/22	U-Rf-2	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	33	520	0	27	67	-	Creepers	Crawlers	Gliders
1021	8	2013/11/22	U-Rf-2	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	3	520	0	27	67	-	Creepers	Crawlers	Gliders
1022	8	2013/11/22	U-Rf-2	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1	520	0	27	67	-	Swimmers	Swimmers	Swimmers
1023	8	2013/11/22	U-Rf-2	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	64	520	0	27	67	-	Burrowers	Burrowers	Gliding burrowers
1024	8	2013/11/22	U-Rf-2	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	193	520	0	27	67	-	Creepers	Crawlers	Crawlers
1025	8	2013/11/22	U-Rf-2	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1994	520	0	27	67	-	Creepers	Crawlers	Crawlers
1026	8	2013/11/22	U-Rf-2	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2	520	0	27	67	-	Creepers	Crawlers	Crawlers
1027	8	2013/11/22	U-Rf-2	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	64	520	0	27	67	-	Net-spinners	Attachers	Net-spinners
1028	8	2013/11/22	U-Rf-2	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	1748	520	0	27	67	-	Net-spinners	Attachers	Net-spinners
1029	8	2013/11/22	U-Rf-2	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	326	520	0	27	67	-	Net-spinners	Attachers	Net-spinners
1030	8	2013/11/22	U-Rf-2	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	57	520	0	27	67	-	Net-spinners	Attachers	Net-spinners
1031	8	2013/11/22	U-Rf-2	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	130	520	0	27	67	-	Creepers	Crawlers	Crawlers
1032	8	2013/11/22	U-Rf-2	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	32	520	0	27	67	-	Creepers	Crawlers	Crawlers
1033	8	2013/11/22	U-Rf-2	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	520	0	27	67	-	Attachers	Attachers	Net-spinners
1034	8	2013/11/22	U-Rf-2	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	520	0	27	67	-	Burrowers	Burrowers	Free burrowers
1035	8	2013/11/22	U-Rf-2	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	1	520	0	27	67	-	Creepers	Crawlers	Crawlers
1036	8	2013/11/22	U-Rf-2	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	216	520	0	27	67	-	Burrowers	Burrowers	Free burrowers
1037	8	2013/11/22	U-Rf-2	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1107	520	0	27	67	-	Burrowers	Burrowers	Free burrowers
1038	8	2013/11/22	U-Rf-21	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	1	67	0	27	67	-	Creepers	Crawlers	Creepers
1039	8	2013/11/22	U-Rf-21	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3	67	0	27	67	-	Creepers	Crawlers	Creepers
1040	8	2013/11/22	U-Rf-21	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	2	67	0	27	67	-	Attachers	Attachers	Case builders
1041	8	2013/11/22	U-Rf-21	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	67	0	27	67	-	Creepers	Crawlers	Crawlers
1042	8	2013/11/22	U-Rf-21	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	103	67	0	27	67	-	Creepers	Crawlers	Crawlers
1043	8	2013/11/22	U-Rf-21	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	6	67	0	27	67	-	Swimmers	Attachers	Exposed attachers
1044	8	2013/11/22	U-Rf-21	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1	67	0	27	67	-	Swimmers	Swimmers	Swimmers
1045	8	2013/11/22	U-Rf-21	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	98	67	0	27	67	-	Creepers	Crawlers	Gliders
1046	8	2013/11/22	U-Rf-21	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	7	67	0	27	67	-	Creepers	Crawlers	Gliders
1047	8	2013/11/22	U-Rf-21	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	33	67	0	27	67	-	Creepers	Crawlers	Crawlers
1048	8	2013/11/22	U-Rf-21	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	648	67	0	27	67	-	Creepers	Crawlers	Crawlers
1049	8	2013/11/22	U-Rf-21	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	67	0	27	67	-	Creepers	Crawlers	Crawlers
1050	8	2013/11/22	U-Rf-21	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	812	67	0	27	67	-	Net-spinners	Attachers	Net-spinners
1051	8	2013/11/22	U-Rf-21	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	138	67	0	27	67	-	Net-spinners	Attachers	Net-spinners
1052	8	2013/11/22	U-Rf-21	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	15	67	0	27	67	-	Net-spinners	Attachers	Net-spinners
1053	8	2013/11/22	U-Rf-21	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	33	67	0	27	67	-	Creepers	Crawlers	Crawlers
1054	8	2013/11/22	U-Rf-21	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2	67	0	27	67	-	Creepers	Crawlers	Crawlers
1055	8	2013/11/22	U-Rf-21	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1056	8	2013/11/22	U-Rf-21	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	67	0	27	67	-	Attachers	Attachers	Net-spinners
1057	8	2013/11/22	U-Rf-21	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1058	8	2013/11/22	U-Rf-21	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	75	67	0	27	67	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1059	8	2013/11/22	U-Rf-21	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	102	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1060	8	2013/11/22	U-Rf-21	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1056	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1061	8	2013/11/22	U-Rf-23	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	265	67	0	27	67	-	Creepers	Crawlers	Creepers
1062	8	2013/11/22	U-Rf-23	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3	67	0	27	67	-	Creepers	Crawlers	Creepers
1063	8	2013/11/22	U-Rf-23	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	8	67	0	27	67	-	Creepers	Crawlers	Crawlers
1064	8	2013/11/22	U-Rf-23	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	71	67	0	27	67	-	Swimmers	Attachers	Exposed attachers
1065	8	2013/11/22	U-Rf-23	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2	67	0	27	67	-	Creepers	Crawlers	Gliders
1066	8	2013/11/22	U-Rf-23	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	7	67	0	27	67	-	Creepers	Crawlers	Gliders
1067	8	2013/11/22	U-Rf-23	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	129	67	0	27	67	-	Creepers	Crawlers	Crawlers
1068	8	2013/11/22	U-Rf-23	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	78	67	0	27	67	-	Net-spinners	Attachers	Net-spinners
1069	8	2013/11/22	U-Rf-23	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	44	67	0	27	67	-	Net-spinners	Attachers	Net-spinners
1070	8	2013/11/22	U-Rf-23	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	4	67	0	27	67	-	Net-spinners	Attachers	Net-spinners
1071	8	2013/11/22	U-Rf-23	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	71	67	0	27	67	-	Creepers	Crawlers	Crawlers
1072	8	2013/11/22	U-Rf-23	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	67	0	27	67	-	Creepers	Crawlers	Crawlers
1073	8	2013/11/22	U-Rf-23	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	67	0	27	67	-	Creepers	Crawlers	Crawlers
1074	8	2013/11/22	U-Rf-23	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1075	8	2013/11/22	U-Rf-23	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1076	8	2013/11/22	U-Rf-23	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	5	67	0	27	67	-	Creepers	Crawlers	Crawlers
1077	8	2013/11/22	U-Rf-23	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	44	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1078	8	2013/11/22	U-Rf-23	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	411	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1079	8	2013/11/22	U-Rf-23	50	261	Insecta	Diptera	Empididae	Empididae	32	67	0	27	67	-	Burrowers	Burrowers	Free burrowers
1080	8	2013/11/23	D-Rf-1	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	105	794	0	28	68	794	Creepers	Crawlers	Creepers
1081	8	2013/11/23	D-Rf-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	3	794	0	28	68	794	Creepers	Crawlers	Creepers
1082	8	2013/11/23	D-Rf-1	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	3	794	0	28	68	794	Attachers	Attachers	Case builders
1083	8	2013/11/23	D-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	56	794	0	28	68	794	Creepers	Crawlers	Crawlers
1084	8	2013/11/23	D-Rf-1	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	69	794	0	28	68	794	Swimmers	Attachers	Exposed attachers
1085	8	2013/11/23	D-Rf-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	1	794	0	28	68	794	Swimmers	Swimmers	Swimmers
1086	8	2013/11/23	D-Rf-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	794	0	28	68	794	Creepers	Crawlers	Gliders
1087	8	2013/11/23	D-Rf-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	69	794	0	28	68	794	Creepers	Crawlers	Gliders
1088	8	2013/11/23	D-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	3	794	0	28	68	794	Swimmers	Swimmers	Swimmers
1089	8	2013/11/23	D-Rf-1	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	65	794	0	28	68	794	Creepers	Crawlers	Crawlers
1090	8	2013/11/23	D-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	616	794	0	28	68	794	Creepers	Crawlers	Crawlers
1091	8	2013/11/23	D-Rf-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	6	794	0	28	68	794	Creepers	Crawlers	Crawlers
1092	8	2013/11/23	D-Rf-1	27	155	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche brevilineata*	64	794	0	28	68	794	Net-spinners	Attachers	Net-spinners
1093	8	2013/11/23	D-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	465	794	0	28	68	794	Net-spinners	Attachers	Net-spinners
1094	8	2013/11/23	D-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	39	794	0	28	68	794	Net-spinners	Attachers	Net-spinners
1095	8	2013/11/23	D-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	18	794	0	28	68	794	Net-spinners	Attachers	Net-spinners
1096	8	2013/11/23	D-Rf-1	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	36	794	0	28	68	794	Creepers	Crawlers	Crawlers
1097	8	2013/11/23	D-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	6	794	0	28	68	794	Creepers	Crawlers	Crawlers
1098	8	2013/11/23	D-Rf-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	2	794	0	28	68	794	Creepers	Crawlers	Crawlers
1099	8	2013/11/23	D-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	794	0	28	68	794	Attachers	Attachers	Net-spinners
1100	8	2013/11/23	D-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6	794	0	28	68	794	Burrowers	Burrowers	Free burrowers
1101	8	2013/11/23	D-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	2	794	0	28	68	794	Creepers	Crawlers	Crawlers
1102	8	2013/11/23	D-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	55	794	0	28	68	794	Burrowers	Burrowers	Free burrowers
1103	8	2013/11/23	D-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	476	794	0	28	68	794	Burrowers	Burrowers	Free burrowers
1104	8	2013/11/23	D-SP-1	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	202	794	4	28	68	794	Creepers	Crawlers	Crawlers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1105	8	2013/11/23	D-SP-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	66	794	4	28	68	794	Creepers	Crawlers	Crawlers
1106	8	2013/11/23	D-SP-1	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	2	794	4	28	68	794	Swimmers	Attachers	Exposed attachers
1107	8	2013/11/23	D-SP-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	3	794	4	28	68	794	Swimmers	Swimmers	Swimmers
1108	8	2013/11/23	D-SP-1	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1	794	4	28	68	794	Swimmers	Swimmers	Swimmers
1109	8	2013/11/23	D-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	264	794	4	28	68	794	Creepers	Crawlers	Gliders
1110	8	2013/11/23	D-SP-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	2	794	4	28	68	794	Creepers	Crawlers	Gliders
1111	8	2013/11/23	D-SP-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	68	794	4	28	68	794	Creepers	Crawlers	Crawlers
1112	8	2013/11/23	D-SP-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	794	4	28	68	794	Creepers	Crawlers	Crawlers
1113	8	2013/11/23	D-SP-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	78	794	4	28	68	794	Net-spinners	Attachers	Net-spinners
1114	8	2013/11/23	D-SP-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	2	794	4	28	68	794	Net-spinners	Attachers	Net-spinners
1115	8	2013/11/23	D-SP-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	794	4	28	68	794	Creepers	Crawlers	Crawlers
1116	8	2013/11/23	D-SP-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	2	794	4	28	68	794	Creepers	Crawlers	Crawlers
1117	8	2013/11/23	D-SP-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	794	4	28	68	794	Burrowers	Burrowers	Free burrowers
1118	8	2013/11/23	D-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	68	794	4	28	68	794	Creepers	Crawlers	Crawlers
1119	8	2013/11/23	D-SP-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	1	794	4	28	68	794	Burrowers	Burrowers	Free burrowers
1120	8	2013/11/23	D-SP-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	128	794	4	28	68	794	Burrowers	Burrowers	Free burrowers
1121	8	2013/11/23	D-SP-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	405	794	4	28	68	794	Burrowers	Burrowers	Free burrowers
1122	8	2013/11/23	D-SP-1	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	3	794	4	28	68	794	Burrowers	Burrowers	Free burrowers
1123	8	2013/11/23	U-Rf-1	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	257	794	0	28	68	794	Creepers	Crawlers	Creepers
1124	8	2013/11/23	U-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	66	794	0	28	68	794	Creepers	Crawlers	Crawlers
1125	8	2013/11/23	U-Rf-1	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	69	794	0	28	68	794	Swimmers	Attachers	Exposed attachers
1126	8	2013/11/23	U-Rf-1	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	5	794	0	28	68	794	Swimmers	Swimmers	Swimmers
1127	8	2013/11/23	U-Rf-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	131	794	0	28	68	794	Creepers	Crawlers	Gliders
1128	8	2013/11/23	U-Rf-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	78	794	0	28	68	794	Creepers	Crawlers	Gliders
1129	8	2013/11/23	U-Rf-1	18	77	Insecta	Ephemeroptera	Isonychiidae	*Isonychia japonica*	1	794	0	28	68	794	Swimmers	Swimmers	Swimmers
1130	8	2013/11/23	U-Rf-1	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	65	794	0	28	68	794	Creepers	Crawlers	Crawlers
1131	8	2013/11/23	U-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	257	794	0	28	68	794	Creepers	Crawlers	Crawlers
1132	8	2013/11/23	U-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	343	794	0	28	68	794	Net-spinners	Attachers	Net-spinners
1133	8	2013/11/23	U-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	209	794	0	28	68	794	Net-spinners	Attachers	Net-spinners
1134	8	2013/11/23	U-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	8	794	0	28	68	794	Net-spinners	Attachers	Net-spinners
1135	8	2013/11/23	U-Rf-1	32	172	Insecta	Trichoptera	Rhyacophilidae	*Rhyacophila nigrocephala*	1	794	0	28	68	794	Creepers	Crawlers	Crawlers
1136	8	2013/11/23	U-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	2	794	0	28	68	794	Creepers	Crawlers	Crawlers
1137	8	2013/11/23	U-Rf-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	64	794	0	28	68	794	Creepers	Crawlers	Crawlers
1138	8	2013/11/23	U-Rf-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	794	0	28	68	794	Burrowers	Burrowers	Free burrowers
1139	8	2013/11/23	U-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	794	0	28	68	794	Attachers	Attachers	Net-spinners
1140	8	2013/11/23	U-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	8	794	0	28	68	794	Burrowers	Burrowers	Free burrowers
1141	8	2013/11/23	U-Rf-1	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1	794	0	28	68	794	Burrowers	Burrowers	Free burrowers
1142	8	2013/11/23	U-Rf-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	5	794	0	28	68	794	Creepers	Crawlers	Crawlers
1143	8	2013/11/23	U-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	144	794	0	28	68	794	Burrowers	Burrowers	Free burrowers
1144	8	2013/11/23	U-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1443	794	0	28	68	794	Burrowers	Burrowers	Free burrowers
1145	8	2013/11/23	U-Rf-22	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	1167	68	0	28	68	-	Creepers	Crawlers	Creepers
1146	8	2013/11/23	U-Rf-22	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	128	68	0	28	68	-	Creepers	Crawlers	Creepers
1147	8	2013/11/23	U-Rf-22	4	10	Bivalvia	Mytiloida	Mytilidae	*Limnoperna fortunei*	2	68	0	28	68	-	Attachers	Attachers	Case builders
1148	8	2013/11/23	U-Rf-22	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	68	0	28	68	-	Creepers	Crawlers	Crawlers
1149	8	2013/11/23	U-Rf-22	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	129	68	0	28	68	-	Creepers	Crawlers	Crawlers
1150	8	2013/11/23	U-Rf-22	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	4	68	0	28	68	-	Swimmers	Attachers	Exposed attachers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1151	8	2013/11/23	U-Rf-22	14	57	Insecta	Ephemeroptera	Baetidae	*Baetis taiwanensis*	67	68	0	28	68	-	Swimmers	Swimmers	Swimmers
1152	8	2013/11/23	U-Rf-22	15	65	Insecta	Ephemeroptera	Baetidae	*Tenuibaetis flexifemora*	1	68	0	28	68	-	Swimmers	Swimmers	Swimmers
1153	8	2013/11/23	U-Rf-22	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	68	68	0	28	68	-	Creepers	Crawlers	Gliders
1154	8	2013/11/23	U-Rf-22	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	142	68	0	28	68	-	Creepers	Crawlers	Gliders
1155	8	2013/11/23	U-Rf-22	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	64	68	0	28	68	-	Creepers	Crawlers	Crawlers
1156	8	2013/11/23	U-Rf-22	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	132	68	0	28	68	-	Creepers	Crawlers	Crawlers
1157	8	2013/11/23	U-Rf-22	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	600	68	0	28	68	-	Net-spinners	Attachers	Net-spinners
1158	8	2013/11/23	U-Rf-22	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	8	68	0	28	68	-	Net-spinners	Attachers	Net-spinners
1159	8	2013/11/23	U-Rf-22	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	13	68	0	28	68	-	Net-spinners	Attachers	Net-spinners
1160	8	2013/11/23	U-Rf-22	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	71	68	0	28	68	-	Creepers	Crawlers	Crawlers
1161	8	2013/11/23	U-Rf-22	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	66	68	0	28	68	-	Creepers	Crawlers	Crawlers
1162	8	2013/11/23	U-Rf-22	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	68	0	28	68	-	Attachers	Attachers	Net-spinners
1163	8	2013/11/23	U-Rf-22	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	7	68	0	28	68	-	Burrowers	Burrowers	Free burrowers
1164	8	2013/11/23	U-Rf-22	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	65	68	0	28	68	-	Creepers	Crawlers	Crawlers
1165	8	2013/11/23	U-Rf-22	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	140	68	0	28	68	-	Burrowers	Burrowers	Free burrowers
1166	8	2013/11/23	U-Rf-22	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	5	68	0	28	68	-	Burrowers	Burrowers	Free burrowers
1167	8	2013/11/23	U-Rf-22	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1264	68	0	28	68	-	Burrowers	Burrowers	Free burrowers
1168	8	2013/11/23	U-SP-1	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	26	521	27	28	68	-	Creepers	Crawlers	Creepers
1169	8	2013/11/23	U-SP-1	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	8	521	27	28	68	-	Burrowers	Burrowers	Free burrowers
1170	8	2013/11/23	U-SP-1	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	521	27	28	68	-	Creepers	Crawlers	Crawlers
1171	8	2013/11/23	U-SP-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	8	521	27	28	68	-	Creepers	Crawlers	Crawlers
1172	8	2013/11/23	U-SP-1	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1	521	27	28	68	-	Swimmers	Swimmers	Swimmers
1173	8	2013/11/23	U-SP-1	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	1	521	27	28	68	-	Swimmers	Attachers	Exposed attachers
1174	8	2013/11/23	U-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	108	521	27	28	68	-	Creepers	Crawlers	Gliders
1175	8	2013/11/23	U-SP-1	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	28	521	27	28	68	-	Burrowers	Burrowers	Free burrowers
1176	8	2013/11/23	U-SP-1	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	27	521	27	28	68	-	Burrowers	Burrowers	Gliding burrowers
1177	8	2013/11/23	U-SP-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	74	521	27	28	68	-	Creepers	Crawlers	Crawlers
1178	8	2013/11/23	U-SP-1	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	34	521	27	28	68	-	Creepers	Crawlers	Crawlers
1179	8	2013/11/23	U-SP-1	24	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	2	521	27	28	68	-	Burrowers	Burrowers	Free burrowers
1180	8	2013/11/23	U-SP-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	10	521	27	28	68	-	Creepers	Crawlers	Crawlers
1181	8	2013/11/23	U-SP-1	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	24	521	27	28	68	-	Swimmers	Swimmers	Swimmers
1182	8	2013/11/23	U-SP-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	12	521	27	28	68	-	Net-spinners	Attachers	Net-spinners
1183	8	2013/11/23	U-SP-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	8	521	27	28	68	-	Case-bearers	Crawlers	Case-bearers
1184	8	2013/11/23	U-SP-1	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	3	521	27	28	68	-	Case-bearers	Crawlers	Case-bearers
1185	8	2013/11/23	U-SP-1	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	103	521	27	28	68	-	Creepers	Crawlers	Crawlers
1186	8	2013/11/23	U-SP-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	12	521	27	28	68	-	Creepers	Crawlers	Crawlers
1187	8	2013/11/23	U-SP-1	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	8	521	27	28	68	-	Creepers	Crawlers	Crawlers
1188	8	2013/11/23	U-SP-1	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	4	521	27	28	68	-	Burrowers	Burrowers	Free burrowers
1189	8	2013/11/23	U-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	16	521	27	28	68	-	Creepers	Crawlers	Crawlers
1190	8	2013/11/23	U-SP-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	51	521	27	28	68	-	Burrowers	Burrowers	Free burrowers
1191	8	2013/11/23	U-SP-1	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	9	521	27	28	68	-	Burrowers	Burrowers	Free burrowers
1192	8	2013/11/23	U-SP-1	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	1	521	27	28	68	-	Burrowers	Burrowers	Tube burrowers
1193	9	2013/12/01	U-BW-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	426	35	36	76	-	Creepers	Crawlers	Crawlers
1194	9	2013/12/01	U-BW-11	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2	426	35	36	76	-	Creepers	Crawlers	Gliders
1195	9	2013/12/01	U-BW-11	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	35	426	35	36	76	-	Burrowers	Burrowers	Free burrowers
1196	9	2013/12/01	U-BW-11	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	36	426	35	36	76	-	Burrowers	Burrowers	Gliding burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1197	9	2013/12/01	U-BW-11	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	104	426	35	36	76	-	Creepers	Crawlers	Crawlers
1198	9	2013/12/01	U-BW-11	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	5	426	35	36	76	-	Creepers	Crawlers	Crawlers
1199	9	2013/12/01	U-BW-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	146	426	35	36	76	-	Swimmers	Swimmers	Swimmers
1200	9	2013/12/01	U-BW-11	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	2	426	35	36	76	-	Net-spinners	Attachers	Net-spinners
1201	9	2013/12/01	U-BW-11	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	136	426	35	36	76	-	Creepers	Crawlers	Crawlers
1202	9	2013/12/01	U-BW-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	5	426	35	36	76	-	Creepers	Crawlers	Crawlers
1203	9	2013/12/01	U-BW-11	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	426	35	36	76	-	Burrowers	Burrowers	Free burrowers
1204	9	2013/12/01	U-BW-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1	426	35	36	76	-	Burrowers	Burrowers	Free burrowers
1205	9	2013/12/01	U-BW-11	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	16	426	35	36	76	-	Burrowers	Burrowers	Free burrowers
1206	9	2013/12/01	U-BW-11	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	1	426	35	36	76	-	Burrowers	Burrowers	Free burrowers
1207	9	2013/12/01	U-BW-21	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	1	370	6	36	76	-	Creepers	Crawlers	Crawlers
1208	9	2013/12/01	U-BW-21	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	44	370	6	36	76	-	Creepers	Crawlers	Crawlers
1209	9	2013/12/01	U-BW-21	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	1	370	6	36	76	-	Creepers	Crawlers	Gliders
1210	9	2013/12/01	U-BW-21	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	1	370	6	36	76	-	Creepers	Crawlers	Crawlers
1211	9	2013/12/01	U-BW-21	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2	370	6	36	76	-	Burrowers	Burrowers	Free burrowers
1212	9	2013/12/01	U-BW-21	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	777	370	6	36	76	-	Burrowers	Burrowers	Free burrowers
1213	9	2013/12/01	U-BW-22	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	1	76	6	36	76	-	Creepers	Crawlers	Creepers
1214	9	2013/12/01	U-BW-22	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	2	76	6	36	76	-	Creepers	Crawlers	Crawlers
1215	9	2013/12/01	U-BW-22	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	1	76	6	36	76	-	Creepers	Crawlers	Crawlers
1216	9	2013/12/01	U-BW-22	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	1	76	6	36	76	-	Swimmers	Swimmers	Swimmers
1217	9	2013/12/01	U-BW-22	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	2	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1218	9	2013/12/01	U-BW-22	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1	76	6	36	76	-	Burrowers	Burrowers	Gliding burrowers
1219	9	2013/12/01	U-BW-22	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	3	76	6	36	76	-	Creepers	Crawlers	Crawlers
1220	9	2013/12/01	U-BW-22	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	76	6	36	76	-	Creepers	Crawlers	Crawlers
1221	9	2013/12/01	U-BW-22	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	14	76	6	36	76	-	Swimmers	Swimmers	Swimmers
1222	9	2013/12/01	U-BW-22	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	26	76	6	36	76	-	Creepers	Crawlers	Crawlers
1223	9	2013/12/01	U-BW-22	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	5	76	6	36	76	-	Creepers	Crawlers	Crawlers
1224	9	2013/12/01	U-BW-22	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	1	76	6	36	76	-	Creepers	Crawlers	Crawlers
1225	9	2013/12/01	U-BW-22	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	10	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1226	9	2013/12/01	U-BW-22	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	1	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1227	9	2013/12/01	U-BW-22	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1228	9	2013/12/01	U-BW-22	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	4	76	6	36	76	-	Creepers	Crawlers	Crawlers
1229	9	2013/12/01	U-BW-22	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	2	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1230	9	2013/12/01	U-BW-22	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	2	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1231	9	2013/12/01	U-SP-21	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	198	76	6	36	76	-	Creepers	Crawlers	Crawlers
1232	9	2013/12/01	U-SP-21	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	98	76	6	36	76	-	Creepers	Crawlers	Gliders
1233	9	2013/12/01	U-SP-21	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	34	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1234	9	2013/12/01	U-SP-21	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	22	76	6	36	76	-	Burrowers	Burrowers	Gliding burrowers
1235	9	2013/12/01	U-SP-21	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	16	76	6	36	76	-	Creepers	Crawlers	Crawlers
1236	9	2013/12/01	U-SP-21	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	16	76	6	36	76	-	Creepers	Crawlers	Crawlers
1237	9	2013/12/01	U-SP-21	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	19	76	6	36	76	-	Swimmers	Swimmers	Swimmers
1238	9	2013/12/01	U-SP-21	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	66	76	6	36	76	-	Creepers	Crawlers	Crawlers
1239	9	2013/12/01	U-SP-21	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	1	76	6	36	76	-	Creepers	Crawlers	Crawlers
1240	9	2013/12/01	U-SP-21	36	284	Insecta	Coleoptera	Elmidae	*Zaitzeviaria* sp.	16	76	6	36	76	-	Creepers	Crawlers	Crawlers
1241	9	2013/12/01	U-SP-21	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1242	9	2013/12/01	U-SP-21	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	2	76	6	36	76	-	Creepers	Crawlers	Crawlers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1243	9	2013/12/01	U-SP-21	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	52	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1244	9	2013/12/01	U-SP-21	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	1	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1245	9	2013/12/01	U-SP-21	49	260	Insecta	Diptera	Dolichopodidae	Dolichopodidae	19	76	6	36	76	-	Burrowers	Burrowers	Free burrowers
1246	9	2013/12/15	D-SP-22	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	29	543	49	50	90	-	Creepers	Crawlers	Crawlers
1247	9	2013/12/15	D-SP-22	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	16	543	49	50	90	-	Creepers	Crawlers	Gliders
1248	9	2013/12/15	D-SP-22	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	2	543	49	50	90	-	Burrowers	Burrowers	Free burrowers
1249	9	2013/12/15	D-SP-22	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	6	543	49	50	90	-	Burrowers	Burrowers	Gliding burrowers
1250	9	2013/12/15	D-SP-22	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1	543	49	50	90	-	Creepers	Crawlers	Crawlers
1251	9	2013/12/15	D-SP-22	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	23	543	49	50	90	-	Creepers	Crawlers	Crawlers
1252	9	2013/12/15	D-SP-22	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	1	543	49	50	90	-	Creepers	Crawlers	Crawlers
1253	9	2013/12/15	D-SP-22	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1	543	49	50	90	-	Swimmers	Swimmers	Swimmers
1254	9	2013/12/15	D-SP-22	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	137	543	49	50	90	-	Case-bearers	Crawlers	Case-bearers
1255	9	2013/12/15	D-SP-22	34	274	Insecta	Coleoptera	Hydrophilidae	*Laccobius* sp.	20	543	49	50	90	-	Creepers	Crawlers	Crawlers
1256	9	2013/12/15	D-SP-22	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	9	543	49	50	90	-	Creepers	Crawlers	Crawlers
1257	9	2013/12/15	D-SP-22	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3	543	49	50	90	-	Burrowers	Burrowers	Free burrowers
1258	9	2013/12/15	D-SP-22	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	19	543	49	50	90	-	Creepers	Crawlers	Crawlers
1259	9	2013/12/15	D-SP-22	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	20	543	49	50	90	-	Burrowers	Burrowers	Free burrowers
1260	9	2013/12/15	D-SP-22	46	238	Insecta	Diptera	Chironomidae	*Dicrotendipes* sp.	8	543	49	50	90	-	Burrowers	Burrowers	Free burrowers
1261	10	2014/02/13	U-BW-11	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	1	500	109	110	150	-	Burrowers	Burrowers	Free burrowers
1262	10	2014/02/13	U-BW-11	7	32	Arachnida	Acarina	Lebertiidae	*Lebertia* sp.	46	500	109	110	150	-	Creepers	Crawlers	Crawlers
1263	10	2014/02/13	U-BW-11	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	70	500	109	110	150	-	Creepers	Crawlers	Crawlers
1264	10	2014/02/13	U-BW-11	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	76	500	109	110	150	-	Creepers	Crawlers	Gliders
1265	10	2014/02/13	U-BW-11	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	11	500	109	110	150	-	Burrowers	Burrowers	Free burrowers
1266	10	2014/02/13	U-BW-11	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	7	500	109	110	150	-	Burrowers	Burrowers	Gliding burrowers
1267	10	2014/02/13	U-BW-11	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	1	500	109	110	150	-	Creepers	Crawlers	Crawlers
1268	10	2014/02/13	U-BW-11	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1	500	109	110	150	-	Creepers	Crawlers	Crawlers
1269	10	2014/02/13	U-BW-11	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	108	500	109	110	150	-	Creepers	Crawlers	Crawlers
1270	10	2014/02/13	U-BW-11	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	4	500	109	110	150	-	Creepers	Crawlers	Crawlers
1271	10	2014/02/13	U-BW-11	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	82	500	109	110	150	-	Swimmers	Swimmers	Swimmers
1272	10	2014/02/13	U-BW-11	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	32	500	109	110	150	-	Case-bearers	Crawlers	Case-bearers
1273	10	2014/02/13	U-BW-11	33	180	Insecta	Trichoptera	Leptoceridae	*Mystacides* sp.	33	500	109	110	150	-	Case-bearers	Crawlers	Case-bearers
1274	10	2014/02/13	U-BW-11	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3	500	109	110	150	-	Creepers	Crawlers	Crawlers
1275	10	2014/02/13	U-BW-11	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	3	500	109	110	150	-	Burrowers	Burrowers	Free burrowers
1276	10	2014/02/13	U-BW-11	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	1	500	109	110	150	-	Attachers	Attachers	Net-spinners
1277	10	2014/02/13	U-BW-11	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	2	500	109	110	150	-	Burrowers	Burrowers	Free burrowers
1278	10	2014/02/13	U-BW-11	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	3	500	109	110	150	-	Creepers	Crawlers	Crawlers
1279	10	2014/02/13	U-BW-11	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	436	500	109	110	150	-	Burrowers	Burrowers	Free burrowers
1280	10	2014/02/13	U-BW-11	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	2	500	109	110	150	-	Burrowers	Burrowers	Free burrowers
1281	10	2014/02/13	U-BW-11	48	247	Insecta	Diptera	Chironomidae	*Tanytarsus* sp.	32	500	109	110	150	-	Burrowers	Burrowers	Tube burrowers
1282	10	2014/02/13	U-BW-11	50	261	Insecta	Diptera	Empididae	Empididae	268	500	109	110	150	-	Burrowers	Burrowers	Free burrowers
1283	10	2014/02/13	U-BW-22	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	32	150	80	110	150	-	Creepers	Crawlers	Creepers
1284	10	2014/02/13	U-BW-22	5	16	Oligochaeta	Tubificida	Naididae	*Nais bretscheri*	691	150	80	110	150	-	Burrowers	Burrowers	Free burrowers
1285	10	2014/02/13	U-BW-22	6	22	Oligochaeta	Tubificida	Naididae	*Slavina appendiculata*	169	150	80	110	150	-	Burrowers	Burrowers	Free burrowers
1286	10	2014/02/13	U-BW-22	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	73	150	80	110	150	-	Creepers	Crawlers	Crawlers
1287	10	2014/02/13	U-BW-22	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	35	150	80	110	150	-	Creepers	Crawlers	Gliders
1288	10	2014/02/13	U-BW-22	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	6	150	80	110	150	-	Burrowers	Burrowers	Free burrowers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since bitrh	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1289	10	2014/02/13	U-BW-22	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	44	150	80	110	150	-	Burrowers	Burrowers	Gliding burrowers
1290	10	2014/02/13	U-BW-22	23	97	Insecta	Ephemeroptera	Caenidae	*Caenis* sp.	96	150	80	110	150	-	Creepers	Crawlers	Crawlers
1291	10	2014/02/13	U-BW-22	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2	150	80	110	150	-	Creepers	Crawlers	Crawlers
1292	10	2014/02/13	U-BW-22	26	151	Insecta	Hemiptera	Corixidae	*Micronecta* sp.	1	150	80	110	150	-	Swimmers	Swimmers	Swimmers
1293	10	2014/02/13	U-BW-22	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	2	150	80	110	150	-	Burrowers	Burrowers	Free burrowers
1294	10	2014/02/13	U-BW-22	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	39	150	80	110	150	-	Creepers	Crawlers	Crawlers
1295	10	2014/02/13	U-BW-22	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	5	150	80	110	150	-	Burrowers	Burrowers	Free burrowers
1296	10	2014/02/13	U-BW-22	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	136	150	80	110	150	-	Burrowers	Burrowers	Free burrowers
1297	10	2014/02/13	U-BW-22	47	246	Insecta	Diptera	Chironomidae	*Stictochironomus* sp.	2	150	80	110	150	-	Burrowers	Burrowers	Free burrowers
1298	10	2014/02/13	U-BW-22	50	261	Insecta	Diptera	Empididae	Empididae	134	150	80	110	150	-	Burrowers	Burrowers	Free burrowers
1299	10	2014/02/13	U-Rf-1	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	3	876	0	110	150	876	Creepers	Crawlers	Creepers
1300	10	2014/02/13	U-Rf-1	2	3	Enopla	Hoplonemertea	Tetrastemmatidae	*Prostoma* sp.	52	876	0	110	150	876	Creepers	Crawlers	Creepers
1301	10	2014/02/13	U-Rf-1	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	208	876	0	110	150	876	Creepers	Crawlers	Crawlers
1302	10	2014/02/13	U-Rf-1	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	20	876	0	110	150	876	Swimmers	Attachers	Exposed attachers
1303	10	2014/02/13	U-Rf-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	50	876	0	110	150	876	Creepers	Crawlers	Gliders
1304	10	2014/02/13	U-Rf-1	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	4	876	0	110	150	876	Creepers	Crawlers	Gliders
1305	10	2014/02/13	U-Rf-1	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	99	876	0	110	150	876	Creepers	Crawlers	Crawlers
1306	10	2014/02/13	U-Rf-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	185	876	0	110	150	876	Creepers	Crawlers	Crawlers
1307	10	2014/02/13	U-Rf-1	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	54	876	0	110	150	876	Net-spinners	Attachers	Net-spinners
1308	10	2014/02/13	U-Rf-1	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	49	876	0	110	150	876	Net-spinners	Attachers	Net-spinners
1309	10	2014/02/13	U-Rf-1	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	10	876	0	110	150	876	Net-spinners	Attachers	Net-spinners
1310	10	2014/02/13	U-Rf-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	32	876	0	110	150	876	Case-bearers	Crawlers	Case-bearers
1311	10	2014/02/13	U-Rf-1	35	282	Insecta	Coleoptera	Elmidae	*Zaitzevia* sp.	3	876	0	110	150	876	Creepers	Crawlers	Crawlers
1312	10	2014/02/13	U-Rf-1	38	184	Insecta	Diptera	Tipulidae	*Antocha* sp.	24	876	0	110	150	876	Attachers	Attachers	Net-spinners
1313	10	2014/02/13	U-Rf-1	**39**	187	Insecta	Diptera	Tipulidae	*Hexatoma* sp.	6	876	0	110	150	876	Burrowers	Burrowers	Free burrowers
1314	10	2014/02/13	U-Rf-1	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	6	876	0	110	150	876	Burrowers	Burrowers	Free burrowers
1315	10	2014/02/13	U-Rf-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	147	876	0	110	150	876	Burrowers	Burrowers	Free burrowers
1316	10	2014/02/13	U-Rf-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	1352	876	0	110	150	876	Burrowers	Burrowers	Free burrowers
1317	10	2014/02/13	U-Rf-1	50	261	Insecta	Diptera	Empididae	Empididae	69	876	0	110	150	876	Burrowers	Burrowers	Free burrowers
1318	10	2014/02/13	U-Rf-21	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	26	150	0	110	150	-	Creepers	Crawlers	Crawlers
1319	10	2014/02/13	U-Rf-21	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	2	150	0	110	150	-	Creepers	Crawlers	Crawlers
1320	10	2014/02/13	U-Rf-21	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	34	150	0	110	150	-	Creepers	Crawlers	Gliders
1321	10	2014/02/13	U-Rf-21	21	95	Insecta	Ephemeroptera	Ephemerellidae	*Torleya japonica*	32	150	0	110	150	-	Creepers	Crawlers	Crawlers
1322	10	2014/02/13	U-Rf-21	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	114	150	0	110	150	-	Creepers	Crawlers	Crawlers
1323	10	2014/02/13	U-Rf-21	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	18	150	0	110	150	-	Net-spinners	Attachers	Net-spinners
1324	10	2014/02/13	U-Rf-21	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	1	150	0	110	150	-	Net-spinners	Attachers	Net-spinners
1325	10	2014/02/13	U-Rf-21	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	1	150	0	110	150	-	Net-spinners	Attachers	Net-spinners
1326	10	2014/02/13	U-Rf-21	37	183	Insecta	Diptera	Tipulidae	*Tipula* sp.	1	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1327	10	2014/02/13	U-Rf-21	40	192	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	1	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1328	10	2014/02/13	U-Rf-21	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	1	150	0	110	150	-	Creepers	Crawlers	Crawlers
1329	10	2014/02/13	U-Rf-21	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	2	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1330	10	2014/02/13	U-Rf-21	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	262	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1331	10	2014/02/13	U-Rf-21	50	261	Insecta	Diptera	Empididae	Empididae	37	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1332	10	2014/02/13	U-Rf-23	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	3	150	0	110	150	-	Creepers	Crawlers	Creepers
1333	10	2014/02/13	U-Rf-23	8	33	Arachnida	Acarina	Spercontidae	*Sperchon* sp.	7	150	0	110	150	-	Creepers	Crawlers	Crawlers
1334	10	2014/02/13	U-Rf-23	13	55	Insecta	Ephemeroptera	Baetidae	*Baetiella japonica*	16	150	0	110	150	-	Swimmers	Attachers	Exposed attachers

Table 2 Survey data on selected 50 macro-invertebrates for the analysis. (continued)

Note: Y, M, and D refer to Year, Month, and Day respectively. D and U in habitat full name refer to Downstream and upstream of the camera site.

Rf, BW, and SP refer to riffle, back water, and side pool respectively.

Reference	Survey date information			Species reference number							Habitat age information (days)						Life type information		
Selected data reference number	Y/M reference number	Survey date (Y/M/D)	Habitat full name	Selected reference number	All species reference number	Class	Order	Family	Name	Abundance	Habitat age since birth	Habitat age at level 2 (lotic)	Habitat age at level 3 (q2000)	Habitat age at level 4 (q3500)	Habitat age at level 5 (q7000)	Categorization by Merrit & Cummins (1996)	Categorization by Takemon (2005)	
1335	10	2014/02/13	U-Rf-23	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	48	150	0	110	150	-	Creepers	Crawlers	Gliders
1336	10	2014/02/13	U-Rf-23	17	76	Insecta	Ephemeroptera	Heptageniidae	*Rhithrogena* sp.	33	150	0	110	150	-	Creepers	Crawlers	Gliders
1337	10	2014/02/13	U-Rf-23	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	50	150	0	110	150	-	Creepers	Crawlers	Crawlers
1338	10	2014/02/13	U-Rf-23	28	156	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche infascia*	6	150	0	110	150	-	Net-spinners	Attachers	Net-spinners
1339	10	2014/02/13	U-Rf-23	29	159	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche orientalis*	17	150	0	110	150	-	Net-spinners	Attachers	Net-spinners
1340	10	2014/02/13	U-Rf-23	30	165	Insecta	Trichoptera	Stenopsychidae	*Stenopsyche marmorata*	9	150	0	110	150	-	Net-spinners	Attachers	Net-spinners
1341	10	2014/02/13	U-Rf-23	42	210	Insecta	Diptera	Chironomidae	*Cardiocladius* sp.	33	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1342	10	2014/02/13	U-Rf-23	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	72	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1343	10	2014/02/13	U-Rf-23	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	207	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1344	10	2014/02/13	U-Rf-23	50	261	Insecta	Diptera	Empididae	Empididae	16	150	0	110	150	-	Burrowers	Burrowers	Free burrowers
1345	10	2014/02/13	U-SP-1	1	2	Turbellaria	Tricladida	Dugesiidae	*Dugesia japonica*	2	603	109	110	150	-	Creepers	Crawlers	Creepers
1346	10	2014/02/13	U-SP-1	10	39	Arachnida	Acarina	Hygrobatidae	*Hygrobates* sp.	1	603	109	110	150	-	Creepers	Crawlers	Crawlers
1347	10	2014/02/13	U-SP-1	12	46	Malacostraca	Decapoda	Atyidae	*Paratya improvisa*	3	603	109	110	150	-	Swimmers	Swimmers	Swimmers
1348	10	2014/02/13	U-SP-1	16	70	Insecta	Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.	2	603	109	110	150	-	Creepers	Crawlers	Gliders
1349	10	2014/02/13	U-SP-1	19	82	Insecta	Ephemeroptera	Ephemeridae	*Ephemera orientalis*	1	603	109	110	150	-	Burrowers	Burrowers	Free burrowers
1350	10	2014/02/13	U-SP-1	20	85	Insecta	Ephemeroptera	Potamanthidae	*Potamanthus formosus*	1	603	109	110	150	-	Burrowers	Burrowers	Gliding burrowers
1351	10	2014/02/13	U-SP-1	22	96	Insecta	Ephemeroptera	Ephemerellidae	*Uracanthella punctisetae*	1	603	109	110	150	-	Creepers	Crawlers	Crawlers
1352	10	2014/02/13	U-SP-1	24	109	Insecta	Odonata	Gomphidae	*Sinogomphus flavolimbatus*	1	603	109	110	150	-	Burrowers	Burrowers	Free burrowers
1353	10	2014/02/13	U-SP-1	25	131	Insecta	Plecoptera	Perlidae	*Neoperla* sp.	2	603	109	110	150	-	Creepers	Crawlers	Crawlers
1354	10	2014/02/13	U-SP-1	31	169	Insecta	Trichoptera	Hydroptilidae	*Hydroptila* sp.	34	603	109	110	150	-	Case-bearers	Crawlers	Case-bearers
1355	10	2014/02/13	U-SP-1	41	200	Insecta	Diptera	Chironomidae	Tanypodinae	35	603	109	110	150	-	Creepers	Crawlers	Crawlers
1356	10	2014/02/13	U-SP-1	43	212	Insecta	Diptera	Chironomidae	*Cricotopus* sp.	221	603	109	110	150	-	Burrowers	Burrowers	Free burrowers
1357	10	2014/02/13	U-SP-1	44	218	Insecta	Diptera	Chironomidae	*Orthocladius* sp.	32	603	109	110	150	-	Burrowers	Burrowers	Free burrowers
1358	10	2014/02/13	U-SP-1	50	261	Insecta	Diptera	Empididae	Empididae	276	603	109	110	150	-	Burrowers	Burrowers	Free burrowers