Title

A data set of long-term observation of aquatic vertebrates and associate environmental factors in a temperate stream, the Yura River, Kyoto, Japan

Author

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Abstract

The population dynamics of fishes are strongly affected by habitat characteristics, which are constantly changing due to seasonal and interannual variations in climatic, hydrological, and geographical processes. Seasonal and interannual variations in hydrological events directly affect the movement, growth, and mortality of stream fishes, and indirectly affect their population density and standing crop through changes in local-scale habitat structures. Characteristics of local-scale habitats directly affects on availability of foods, shelters, spawning sites, and interspecific interactions of stream fishes. Therefore, long-term data regarding the local-scale dynamics of habitat characteristics and its use by fish species over a few generations or longer would need for understanding the mechanism of the determinant process of fish population dynamics. When investigating the effects of habitat changes due to natural processes on the long-term dynamics of fish populations, removal of artificial influences such as changes in land use, dam constructions and channelization of riverrines is often problematic. Thereby, sampling sites where long-term observation of non-artificial changes in stream fish populations and habitats are very valuable. Here, I report the long-term seasonal and annual changes in stream fish populations and their habitat characteristics based on 75 snorkeling observations of fishes and environmental measurements in the upper reaches of the Yura River at Ashiu Research Forest, which has a 36.5-km^2 catchment area with very little artificial disturbance, from May 2007 to

June 2018. Snorkeling observations were conducted using the line-transect method during the day and at night, and microhabitat characteristics (water depth, current velocity, substratum characteristics, and presence/absence of cover) were determined for all individuals observed. A total of 56,042 individuals were observed, belonging to 17 fish and 7 other aquatic vertebrate species. These data may be used to examine the effects of habitat change on the processes that determine fish populations.

Key words

amphibians, assemblage, line-transect, long-term, microhabitat, snorkeling, stream environment, stream fish, underwater observation

Introduction

The population dynamics of fishes are strongly affected by habitat characteristics, which are constantly changing due to seasonal and interannual variations in climatic, hydrological, and geographical processes. For example, seasonal and interannual variations in hydrological events directly affect the movement (Young et al. 2010), growth (Jensen & Johnsen 1999; Grossman et al. 2017), and mortality (Jensen & Johnsen 1999; Grossman et al. 2017) of stream fishes, and indirectly affect their population density and standing crop through changes in local-scale (i.e., Microhabitats, river-units and reaches) habitat structures (Fausch et al. 1988; Maddock 1999; Febris et al. 2017). In addition, several hydrological and geographical processes, such as storage and remobilization of sediments, may delay the appearance of these effects on stream habitats and fish populations (Hamilton 2012). Therefore, long-term data regarding stream fishes and their habitats over a few generations or longer would be useful for assessing the effects of habitat changes on stream fish communities.

Characteristics of local-scale habitats directly affects on availability of foods, shelters, spawning sites, and interspecific interactions of stream fishes (Zaret & Rand 1971; Fausch et al.

1988; Inoue et al. 1997; Maddock 1999; Febris et al. 2017). Therefore, the information of the local-scale dynamics of habitat characteristics and its use by fish species would need for understanding the mechanism of the determinant process of fish population dynamics.

When investigating the effects of habitat changes due to natural processes on the long-term dynamics of fish populations, removal of artificial influences is often problematic. Artificial modification of habitats is frequently carried out for water utilization, disaster prevention, and hydroelectric power generation in Japanese rivers and their catchments, except for very small rivers and tributaries (Siakeu et al. 2004; Luo et al. 2013; Miyazaki & Terui 2016), and is assumed to affect the population dynamics of stream fishes. Therefore, sampling sites where long-term observation of non-artificial changes in stream fish populations and habitats are very valuable.

Ashiu research forest is located in the catchment area of the headwater and upper reaches of the Yura River in northern Kyoto Prefecture, central Japan. This forest is managed by Kyoto University, and the almost part of the area covered by the forest has very little artificial disturbance, with < 0.02 km^2 in residential or agricultural use and no clear cuts > 0.01 m^2 in the past 30 years (data from the Ashiu Forest Research Station). In this paper, I report the long-term seasonal and interannual changes in stream fish populations and their habitats based on 75 snorkeling observations of fishes and environmental measurements using the line-transect method in the upper reaches of the Yura River, with a catchment area of 36.5 km^2 and very little artificial disturbance, from May 2007 to June 2018.

Metadata

1. Title

A data set of long-term observation of aquatic vertebrates and associate environmental factors in a temperate stream, the Yura River, Kyoto, Japan

2. IDENTIFER

Hikaru Nakagawa

3. CONTRIBUTER

A. Dataset owner

Hikaru Nakagawa

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B. Dataset creator

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4. PROGRAM

A. Title

Factors affecting spatio-temporal patterns in temperate stream communities (Doctoral thesis of Hikaru Nakagawa, 2013)

B. Personal

Hikaru Nakagawa

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C. Funding

None

D. Objectives

I collected detailed data (1) to evaluate how the assemblage and populations of fish species respond to local-scale habitat changes, and (2) to determine whether these values exhibit any patterns and what factors drive their patterns. Our data may be useful for future studies modeling the processes driving the dynamics of fish populations.

5. GEOGRAPHIC COVERAGE

A. Geographic description

Upper reaches of Yura River, Ashiu Forest Research Station of the Kyoto University Field Science Education and Research Center, Japan

B. Geographical position

35.30722N, 135.71861E (WGS84)

6. TEMPORAL COVERAGE

A. Begin

May 2007

B. End

June 2018

7. TAXONOMIC COVERAGE

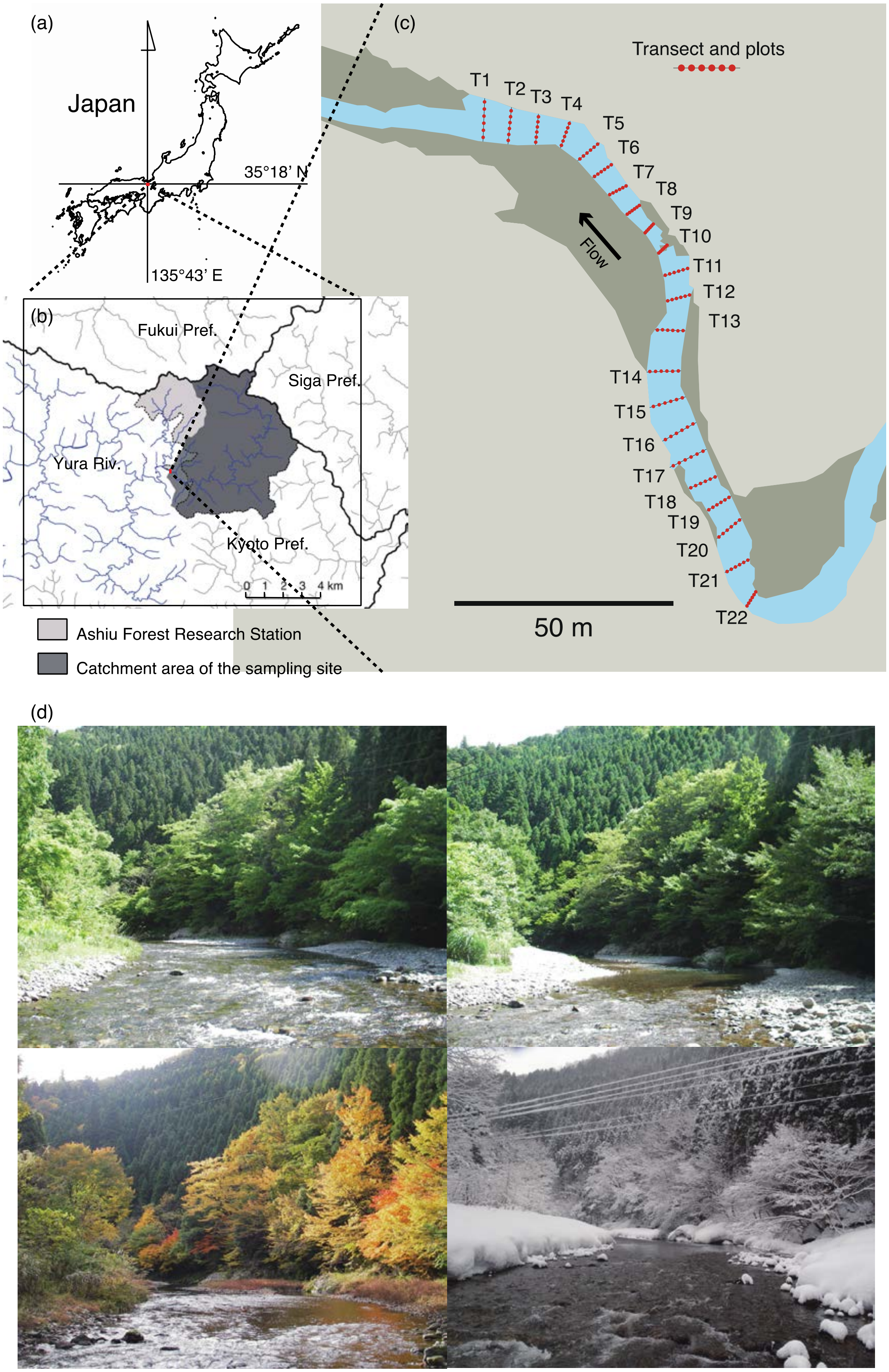
Order	Family	Species
Petromyzontiformes	Petromyzontidae	*Lethenteron reissneri* (Dybowski, 1869)
Osmeriformes	Osmeridae	*Plecoglossus altivelis* (Temminck & Schlegel, 1846)
Salmoniformes	Salmonidae	*Oncorhynchus masou* (Brevoort, 1856)
Cypriniformes	Cyprinidae	*Tribolodon hakonensis* (Günther, 1877)
		Rhyncocypris oxycephalus (Jordan & Snyder, 1901)
		Nipponocypris temminckii (Temminck & Schlegel, 1846)
		Zacco platipus (Temminck & Schlegel, 1846)
		Pangatsungia herzi (Herzenstein, 1892)
		Pseudogobio esocinus (Temminck & Schlegel, 1846)
		Hemibarbus longolostris (Regan, 1908)
		Cyprinus carpio (Linnaeus, 1758)
	Cobitidae	*Cobitis* sp. (Jordan & Snyder, 1901)
		Niwaella delicata (Niwa, 1937)
Siluriformes	Amblycipitidae	*Liobagrus reinii* (Hilgendorf, 1878)
Perciformes	Odontobutidae	*Odontobutis obscura* (Temminck & Schlegel, 1845)
	Gobiidae	*Rhinogobius flumineus* (Mizuno, 1960)
Scorpaeniformes	Cottidae	*Cottus pollux* (Günther, 1873)
Caudata	Cryptobranchidae	*Andrias japonicus* (Temminck, 1836)

	Salamandridae	*Cynops pyrrhogaster* (Boie, 1826)
Anura	Rhacophoridae	*Buergeria buergeri* (Temminck & Schlegel, 1839) *Rhacophorus arboreus* (Okada & Kawano, 1924)
	Ranidae	*Rana rugosa* (Temminck & Schlegel, 1838)
		Rana sakuraii (Matsui & Matsui, 1990)
Testudines	Geoemydidae	*Mauremys japonica* (Temminck & Schlegel, 1835)

8. METHODS

A. Study site

Sampling was conducted from May 2007 to June 2018 in the upper reaches of the Yura River at the Ashiu Forest Research Station of the Kyoto University Field Science Education and Research Center, located in northern Kyoto Prefecture in western Japan (35.30722 N, 135.71861 E, 356 m a.s.l.; Fig. 1). At this site, the stream exhibits a distinct pool-riffle sequence, characteristic of the upper reaches of temperate streams. The regional climate is warm-temperate with monsoonal influences. The annual precipitation is 2,257 mm, and snow depth in winter averages ~1 m. Most flooding events are attributable to snowmelt in spring, heavy precipitation in early summer, and typhoons in late summer. The channel has a mean wet width of 11.3 m (range, 4–15 m) and a slope of 1%–2%. The distribution and ecology of fishes at the study site have been reported in part previously (Nakagawa et al. 2012; Nakagawa 2014; Nakagawa 2018ab).



(a)
Japan
35°18' N
135°43' E
(b)
Fukui Pref.
Siga Pref.
Yura Riv.
Kyoto Pref.
0 1 2 3 4 km
(c)
Transect and plots
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16
T17
T18
T19
T20
T21
T22
Flow
50 m
Ashiu Forest Research Station
Catchment area of the sampling site
(d)

129

Fig. 1 (a) Location and (b) catchment area of the sampling site, (c) the arrangement of transects (T1–T22) and plots for fish observation and habitat measurements, and (d) typical view of the sampling site at May 2009 (upper left), August 2010 (upper right), November 2008 (lower left), and February 2011 (lower right).

B. Research methods

a. Line transects

Twenty-two line transects were set perpendicular to water flow along the channel at 10-m intervals along the sampling area on the main stream of the Yura River (Fig. 1b). Six plots were established along each transect at regular intervals (Fig. 1b).

b. Fish observation

Fish observations were conducted from May 2007 to June 2018. Fish observations were not completely periodic, occurring once or twice a month from May 2007 to December 2010 except from January to March, then once a month or every two months from February 2011 to February 2013 and from April 2017 to February 2018, and irregularly (one to three times a year) in April, September, and December 2014, August 2015, and August and October 2016. Observations were conducted over 5 days or a shorter period under conditions without extremely high discharge or turbid water. When a course of observations (i.e., fish observation and environment measurement) was suspended due to unsuitable conditions, such as sudden heavy rain for 4 days, the observations were either started again from the beginning or terminated. Observations were conducted through snorkeling during the day (9:00–15:00) and at night (21:00–3:00), as some fish species are active at night. Night observations were not finished due to sudden heavy rain in early August 2010. Snorkeling observations were conducted using the line-transect method with the following procedure: First, I dove in from the right or left side of the stream channel and moved 1 m downstream of the transect. Five minutes later, fish exhibited normal behavior, and I quietly moved along the transect, observing the fish. Whenever a fish was observed, I recorded its species, standard length (<5, 5–10, 11–20, ≥20 cm), age (larva, yearling, 1 year or older), vertical position (stays on streambed, cruises along the bottom, middle, or surface layer of the water column), and the nearest plot. All observations were conducted by the author. A waterproof hand light and headlight were used for night observations.

Note that, the line-transect observation method by snorkeling have several advantages to the methods with the capture of fishes. For example, the former method is not threat fish individuals and make a smaller disturbance to the behavior of fish individuals comparing with the later methods, and then, suitable for investigating a fine-scale (e.g., river-unit and microhabitat scale) description of fish distribution. Contrastingly, the snorkeling method has disadvantage to capture methods such as uncertainty caused by double counts, different finding efficiency among species, and miss-identification especially for small-individuals. In the previous study, I roughly estimated finding rate of the line transect observation by comparing the abundance estimated from the removal method for numerically abundant species (Nakagawa 2018b). The finding rates were generally high in swimming species (*Tribolodon hakonensis*, *Rhynchocypris oxycephalus*, and *Nipponocypris temminckii*) than benthic species (*Niwaella delicata*, *Liobagrus reinii*, *Rhinogobius flumineus*, and *Cottus pollux*) and were changed seasonally. Therefore, to use the data of this study, the consideration of such biases is needed. In addition, I recorded small-larva (standard length <1 cm) of *Tribolodon hakonensis*, *Rhynchocypris oxycephalus*, *Zacco platypus*, and *Nipponocypris temminckii* to ‘Cyprinidae Gen. sp.’, because they were difficult to identify during underwater observations.

c. Measurement of environmental characteristics

Water temperature was measured at a riffle with ≥ 30 cm/s surface current velocity near the river bank at the start of each daytime or nighttime fish observation using the digital thermometer (Extech 39240: Waterproof Stem Thermometer, Extech Instruments, USA). Water depth, current velocity, and substrate characteristics were measured at each observation plot after fish observation. These are major factors to describe the abiotic environmental characteristics of microhabitats and reaches in a stream (Frissell et al. 1986; Roth et al. 1996) and are often used for examining habitat niche use of stream fishes (e.g., Zaret & Rand 1971; Inoue et al. 1997; Nakagawa et al. 2012; Nakagawa 2014). Measurement of environmental factors was not completed due to equipment trouble or sudden heavy rain on 20 June, 2007, 7 July, 2008, 24 September, 2008, 9 August, 2010, 22 May, 2011, and 29 April and 9 December, 2014. Water depth was measured with 1-cm precision using a meter stick. Current velocity was measured at the surface, 60% of the depth, and the bottom of a water column from May 2007 to February 2012, and only at 60% of the water column depth from April 2012 to June 2018 using a portable tachometer (Model 3651 Pocket Tachometer; Cosmo-Riken, Osaka, Japan). To measure substrate characteristics, a 50 × 50 cm quadrat with 10 × 10 cm cells (total 25 cells) was placed on the center of a plot. The most major substrate type was recorded, as characterized by sediment particle size, in each cell based on the Udden–Wentworth particle scale (<2 mm, sand; 2–4 mm, granules; 5–64 mm, pebbles; 65–256 mm, cobbles; >256 mm, boulders; bedrock; Wentworth 1922). I calculated the relative frequency of each substrate type as the number of cells occupied by each substrate divided by the total number of cells (25 cells) for each plot.

F. Data verification procedures

The data were manually digitized and checked for typographical errors by the investigators.

9. DATA STATUS

A. Latest update

20 June 2018

B. Metadata status

The metadata are complete for this period and stored with the data.

10. ACCESSIBILITY

A, License and usage rights

B. Contact

Hikaru Nakagawa

Name	Definition	Reference
transectID	No. of transect settled on the sampling site.	Yura_Riv_Ashiu_mea.txt, Yura_Riv_Ashiu_occ.txt
plotID	No. of plot at each transect.	Yura_Riv_Ashiu_mea.txt, Yura_Riv_Ashiu_occ.txt
measurementID	An identifier for the MeasurementOrFact (information pertaining to measurements, facts, characteristics, or assertions).	Yura_Riv_Ashiu_mea.txt
measurementType	The nature of the measurement, fact, characteristic, or assertion.	Yura_Riv_Ashiu_mea.txt
measurementValue	The value of the measurement, fact, characteristic, or assertion.	Yura_Riv_Ashiu_mea.txt
measurementAccuracy	The description of the potential error associated with the measurementValue.	Yura_Riv_Ashiu_mea.txt
measurementUnit	The units associated with the measurementValue.	Yura_Riv_Ashiu_mea.txt
measurementDeterminedDate	The date on which the MeasurementOrFact was made.	Yura_Riv_Ashiu_mea.txt
measurementMethod	A description of or reference to (publication, URI) the method or protocol used to determine the measurement, fact, characteristic, or assertion.	Yura_Riv_Ashiu_mea.txt
occurrenceID	An identifier for the Occurrence (as opposed to a particular digital record of the occurrence). In the absence of a persistent global unique identifier, construct one from a combination of identifiers in the record that will most closely make the occurrenceID globally unique.	Yura_Riv_Ashiu_occ.txt
catalogNumber	An identifier (preferably unique) for the record within the data set or collection.	Yura_Riv_Ashiu_occ.txt
scientificName	The full scientific name, with authorship and date information if known.	Yura_Riv_Ashiu_occ.txt
lifeStage	The life stage of an individual. The codes indicate 1, larva; 2, yearling; and 3, 1 year or older.	Yura_Riv_Ashiu_occ.txt
standardLength	Standard length of observed individual. The codes indicate 1, <5 cm; 2, 5–10 cm; 3, 11–20 cm; 4, and >20 cm.	Yura_Riv_Ashiu_occ.txt
verticalPosition	Vertical position of observed individual along water column. The codes indicate 1, stays on the streambed; 2, cruises in the bottom layer of the water column; 3, cruises in the middle layer of the water column; and 4, cruises in the surface layer of the water column.	Yura_Riv_Ashiu_occ.txt

occurrenceRemarks	Other descriptions	Yura_Riv_Ashiu_occ.txt
eventDate	The date-time or interval during which an Event occurred.	Yura_Riv_Ashiu_occ.txt
eventTime	The time or interval during which an Event occurred.	Yura_Riv_Ashiu_occ.txt
basisOfRecord	The specific nature of the data record.	Yura_Riv_Ashiu_occ.txt

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C. Storage location

JaLTER Database

Raw data sheets and digital data are stored with H. Nakagawa on multiple hard drives in two physical locations.

11. DATA STATUS

A. Data tables

Data file names	Inside files	Description
Yura_Riv_Ashiu_mea.txt		Environmental characters of the observation plots.
dwca-yura_riv_ashiu_occ.zip	eml.xml	Simplified ecological metadata language files according to TDWG role.
	meta.xml	Metafile that defines the contents of Darwin Core.
	Yura_Riv_Ashiu_occ.txt	Taxa, positions, size, and behavioral descriptions of aquatic vertebrates occurred in observations by the line-transect method.

B. Format type

The data files are in ASCII text, tab delimited. The occurrence data was formatted according to the Darwin Core Archives (GBIF 2010).

C. Header information

Headers corresponding to variable names (see section 10.D) are included as the first row in the data file. The format of data follows Darwin Core Archive format (GBIF 2010).

D. Variable definitions

12. ACKNOWLEDGEMENTS

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13. REFFERENCES

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