# Second Report of the Regular Limnological Survey of Lake Biwa (1967) III. Benthos\*

Ву

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As mentioned in the previous articles "First Report of the Regular Limnological Survey of Lake Biwa (Oct. 1965–Dec. 1966) (1) General Remark and (IV) Benthos (Mori et al. 1967 and Suzuki and Mori 1967)", these investigations have been carrying on to detect the quantitative as well as qualitative changes including seasonal variation in benthic communities in lake Biwa extending over a long period of time.

Because sample size seems to be rather small to estimate exactly the values of standing crop in the areas where the samples were collected and the distribution patterns of benthic animals at the given area of lake bottom were not ascertained yet, it seems to be risky to discuss on seasonal changes in number or biomass of benthic animals on the basis of the data obtained during only two years except one or two species which indicates rather clear seasonal changes. The variations in number and biomass of several species among stations are discussed in this paper.

Our collecting stations and their conditions, and the methods for collection were generally mentioned in the previous articles (Mori et al. 1967, and Suzuki and Mori 1967).

The number of individuals and total fresh weight, and the average values of number of individuals/m² and fresh weight/m² calculated from three samples (sometimes from two or one samples available) are shown in the following tables. The number of individuals of Oligochaeta could not always be counted, because they were often cut into small pieces. As animals below 10 mg body weight were generally too small to weight exactly because of rapid drying during operation, so their body weights are given as 0.00. Furthermore, the next

<sup>\*</sup> Contributions from the Otsu Hydrobiological Station, Kyoto University, No. 197 IBP-JPF Publication No. 21.

marks are used in the tables.

- -: no speciments were collected
- \*: these were adhered to the surface of molluscan shells
- \*\* : dead shell
- ? : these were uncountable

#### A Benthic community at station Ie-1

Station Ie-1 is chosen as a representative of northern part of the lake or main basin, where is oligotrophic. This station is about 74 m in depth and bottom is muddy clay.

Benthic community is chiefly composed of Oligochaeta, Hirudinea and Chironomidae larva. Any Mollusca was not found in the sample collected at this station up to now (Table 1).

Table 1

							Ie-1									
Date		Jai	nuai	ry 13,	196	7				Febr	uar	y 15,	196	7		
Sampling No.		1	·····	2		3	Aver	age		1		2		3	Ave	rage
	No.	g.	No.	g.	No.	g.	Ind./m²	$g/m^2$	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²
Oligochaeta Hirudinea Chironomidae larvae	4	0.01	. ?	0.12	?	0.1	1 ? _	3.6	?	0. 17 0. 00	?	0. 10 0. 00		0.07	30	5. 0 0. 0
Phaenopsectra sp.		_		-					TV N Name below 1991	_	1	0.0	0	_	15	0.0
Date		Ма	rch	13, 19	967					Apı	ril 1	.4, 19	67			
Sampling No.		1		2		3	Avera	ıge		1		2		3	Αve	erage
	No.	g.	No.	g.	No.	g.	Ind./m²	$g/m^2$	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²
Oligochaeta Hirudinea Chironomidae	2	0.01	2	0.07	4	0.0	3 118 1 15	1. 6 0. 1	1	0.02	1	0.06	10	0. 14 -	178	3, 2
larvae <i>Phaenopsectra</i> sp.	1	0.00	1	0.00	-	_	30	0.0	1	0.00		_	I see see a see Asses	_	15	0.0
Date			Ма	ıy 11,	196′	7				J	une	15,	1967	,		
Sampling No.		1		2		3	Avera	ıge		1	ersete bebeset i Pron	2		3	Ave	erage
	No.	g.	No.	g.	No.	g.	Ind./m²	$g/m^2$	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²
Oligochaeta	2	0.17	3	0.18	?	0.30	9 ?	9.6	3	0.06	6	0.12	1	0.07	148	3.7

Date			Ju	ly 17,	196	7				P	lug	ust 16	i, 1	967		
Sampling No.		1		2		3	Aver	age		1		2		3	Ave	erage
	No.	g.	No.	g.	No	. g.	Ind./m	2 g/m²	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²
Oligochaeta	4	0.08	3	0.01	2	0.0	7 133	2. 4	4	0. 23	1	0.12	2	0. 28	104	9. 3
Date		Se	pter	nber 1	19, 1	967				Oct	obe	r 20,	196	7		
Sampling No.		1		2		3	Aver	age		1		2		3	Ave	erage
	No.	g.	No.	g.	No.	g.	Ind./m²	$g/m^2$	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²
Oligochaeta Chironmidae larvae		0. 12	2	0.02	2	0.08	104	3. 2	10	0.07	6	0. 21	4	0.12	296	5. 9
(Unidentified sp. )	α			-		***	-		2	0.00			1	0.00	44	0.0
Date		No	ven	nber 1	5, 1	967				Decer	nbe	r 15,	196	7		
Sampling No.		1		2		3	Aveı	age	ANTHONY REPORTED AND A	1		2	~~~~	3	Ave	erage
	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²
Oligochaeta Crustacea Palaemon paucidens	8 (	0. 29	?	0. 15	?	0. 23	3	9.9	8	0. 17	4	0. 17	5	0. 33	252	9.9
DeHaan		-		-		-	-			-		-	1	0.13	15	1.9

#### B Benthic communities at station Nb 2, Nb 5 and Na 3

Stations Nb 2, Nb 5 and Na 3 were chosen as representatives of mesotrophic southern part of lake or accessory basin. Nb 2 and Na 3 are 0.1 km off the east and west coast of the southern part of the lake respectively, and both are about 2 m in depth, while station Nb 5 is middle part of the southern part of the lake and about 4.5 m in depth. The bottom condition of station Nb 2 is sand or sandy mud, while those of stations Nb 5 and Na 3 are muddy.

Benthic communities in those stations are chiefly composed of Oligochaeta, Hirudinea, Chironomidae larvae and Mollusca (Table 2-4).

Table 2 Nb-2

Date	J	anu	ary 14	, 1967				Feb	ruary	7 17	, 19	967		
Sampling No.	1		2	3	Ave	rage		1	2			3	Ave	rage
	No. g.	No.	g.	No. g.	Ind./m²	g/m²	No.	g.	No.	g.	No,	g.	Ind./m²	g/m²
Oligochaeta	_	1	0.02	-	15	0.3	1	0.04			1	0.02	30	0.9

Mollusca					Nb-	2								
Gastropoda Semisulcospira decipiens (Westerlund) Pelecypoda Corbicula sandai	-	1	0. 67	-	15	9. 9				-				-
Reinhardt	1 1.5				15	22. 2	1	1. 45	1	2.64	1	1. 20	44	78. 3
Date		Mai	rch 14,	1967				Ар	ril :	17, 19	67			
Sampling No.	1	***********	2	3	Aver	age		1		2		3	Ave	erage
	No. g.	No.	g.	No. g.		$n^2 g/m^2$	No.		No.	g.	No.			2 g/m <sup>2</sup>
Oligochaeta Chironomidae		1	0.02	me.	15	0.3	1	0.01		-		-	15	0.1
larvae (Unidentified sp.) Amphipoda Anisogammaru. annandalei	- s	,	-	-	-	-	4	0. 01	2	0.00	1	0.00	59	0.0
(Tattersall) Mollusca Gastropoda Semisulcospira decipiens	~		www	-		·		-	1	0.05	1	0.3	30	5. 2
(Westerlund) Pelecypoda Corbicula sandai	~-		-	~	-		1	0.5			1	0.36	30	12.7
Reinhardt Pupae of Sim	- uliidae	*						1. 53 0. 01	1	0.07	1	0. 96 -	59 59	37. 9 0. 1
				The second secon										
Date		May	16, 19	967				Ju	ne I	16, 19	67			
Sampling No.	1		2	3	Aver	age		1		2	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	3	Ave	erage
	No. g.	No.	g.	No. g.	Ind./m	n² g/m²	No.	g.	No.	g.	No.	g.		2 g/m <sup>2</sup>
Oligochaeta Hirudinea Chironomidae larvae	erine.			1 0.04 1 0.02	15 15	0. 6 0. 3	1	0.01		_	3	- 0.03	15 44	0. 1 0. 4
(Unidentified sp. ) Mollusca Gastropoda	1 0.0	0 1	0.00	-	30	0.0		<u></u>		-		-		-

							Nb-	2								
Semisulcospira decipiens																
(Westerlund) Pelecypoda Corbicula sandai	1	0.74		-	2	1. 10	44	27.2		-						-
Reinhardt Unio biwae		-		-	1	0.03	15	0.4	3	5. 37	2	0. 17	9	10.67	207	239. 9
Kobelt Pisidium		-		-		-			2	3.9		een.	1	0.09	44	59. 1
<i>kawamurai</i> Mori			2	0.02			30	0.3		_		_		-		_
Pupae of Simuliidae*				-		-	_			-		-	3	0.01	44	0. 1
Date			July	15,	196	7				Augu	st 1	15, 19	67			
Sampling No.		1		2		3	Aver	age		1		2		3	Av	erage
	N	o. g.	No.	g.	N	o. g.	Ind./m	2 g/m <sup>2</sup>	No.	g.	No	. g.	No	. g.	Ind./m	2 g/m <sup>2</sup>
Chironomidae larvae Phaenopsectra sp. Mollusca Gastropoda Semisulcospira deci piens		-	2	0.00		-	30	0.0		-		-		-		-
(Westerlund) Valvata (Cincinna) japonica	2	0. 17	7 1	0.03	1	0. 23	59	6. 3		-		_				-
v. Martens Pelecypoda Corbicula sandai	1	0.00	)**				_					war <b>a</b>		~		ead.
Reinhardt <i>Unio biwae</i>	3	1, 22	2 1	0. 95	2	0.37	89	37. (	6			~		-		-
Kobelt	1	0. 23	3 2	1.09	l		44	19. 5	5	_		-				***

Date			ember							ber 2					
Sampling No.	1		2		3	Avera			1		2		3	Ave	rage
	No. g.	No.	g.	No.	g.	Ind./m²	$g/m^2$	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²
Oligochaeta	-	1	0.01		-	15	0.1		-		-				-
Hirudinea Mollusca			-		-					-	-	1	0.01	15	0.1

Kobelt

- 1 0.29

							Nb-	-2								
Gastropoda Semisulcospira decipiens (Westerlund) Pelecypoda Corbicula sandai				_	2	1.01	30	15. 0		_	1	0.46	1	0.68	30	16. 9
Reinhardt <i>Unio biwae</i>	2	3. 1	1	4. 91	6	0. 22	133	121.8	2	0. 13	2	0. 67	4	11. 79	118	186. 3
Kobelt <i>Anodonta</i>		-		-	3	1. 10	44	16. 3		-	2	2. 36		-	30	34. 9
cali pygos Kobelt		_			1	0.05	**			_	****	-		_		_
Date		N	love	mber	16,	1967				Dec	emt	oer 16	, 19	967		
Sampling No.		1		2		3	Avera	ge		1		2		3	Ave	rage
	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²	N	√o. g.	No	. g.	No.	g. I	nd./m²	g/m²
Mollusca Gastropoda Semisulcospira decipiens (Westerlund) Pelecypoda Corbicula sandai	:	-	3	1. 1	1	0. 21	. 59	19. 4		-		_		-		-
Reinhardt Unio biwae		-	1	0. 18		-	15	2.7				-		-		-

Table 3

15

4.3

				Nb-5				
Date	Ja	nuary 14	4, 1967		Feb	ruary 17	, 1967	
Sampling No.	1	2	3	Average	1	2	3	Average
	No. g.	No. g.	No. g.	Ind./ $m^2$ g/ $m^2$	No. g.	No. g.	No. g.	Ind./m² g/m
Oligochaeta Chironomidae larvae Tendipes plumosus	? 0.19	? 0.21	? 0.30	) ? 10.3	? 0.08	? 0.12	? 0.15	5 ? 5.2
(Meigen) (Unidentified	2 0.02	-	3 0.10	74 1.8	1 0.03	2 0.02		44 0.8
sp.)	-	-	-	-	-	1 0.00	1 00.0	30 00.0

				N	b-5				
Mollusca Gastropoda Semisulcospira decipiens									
(Westerlund)  Valvata (Cinc japonica	inna)	1 2.37		15	35. 1	-	enui.		-
v. Martens Pisces Rhinogobius brunneus	1 0.02	-	-	15	0.3	-	-	1 0.02 1	5 0.3
(Temminck et Schlegel)		1 0.45	_	15	6. 7	_	-		-

Date			Ma	rch 14	l, 19	967				A	pril	17,	1967	7		
Sampling No.	***************************************	1		2	3	3	Ave	rage	1			2	***************************************	3	Avei	age
	No.	g.	No.	g.	No.	g.	Ind./m	$^{2}$ g/m $^{2}$	No.	g.	No.	g.	No.	g.	Ind./m²	g/m²
Oligochaeta	?	0, 24	3	0.12	?	0. 18	?	8.0	12 0	. 05	3	0.03	?	0.09	222	2.5
Chironomidae																
larvae																
Pentaneura																
sp.				-			-				3	0.01	1	0.01	59	0.2
Spaniotoma				0.01			1.5	0.1			0	0.04			00	0.0
sp.		_	1	0.01	L	-	15	0. 1	_		2	0.04		***	30	0.6
Tendi pes																
plumosus		0.00		0.05				1.0						0.00	00	0.0
(Meigen)		0.06	) I	0.07		_	44	1.9	Ι (	0. 03		-	1	0.02	30	0.8
(Unidentified sp. )		0.01	. 4	0.03	1	0.01	L 89	0.7	1	0.00			1	0.00	30	0.0
Amphipoda																
Anisogammarı annandalei	ıs															
(Tattersall)	1	0.01				-	15	0.1	-			-		-	-	
Mollusca					*											
Gastropoda																
Semisulcospira	ı															
deci piens																
(Westerlund)		_		-		-	-	-	-			-	1	2. 22	15	32.9
Pelecypoda																
Unio biwae																
Kobelt				-		-			1 2	2. 15		_			15	31.8
Eggs of some animals*				_		-		_	? (	0. 02		_		_	î	0.3
Pupae of simuliidae*		_		_		-		_	5 (	0. 03		_	4	6 0.0	9 754	1.8

Nb-5

							7	10 0					
Date		M	lay	16,	1967				Ju	ne 16, 19	167		
Sampling No.		1		2		3	Ave	erage	1	2	3	Aver	age
	No	. g.	No.	. g.	No.	g. In	nd./m²	$g/m^2$	No. g.	No. g.	No. g.	Ind./m²	$g/m^2$
Oligochaeta Chironomidae larvae	15	0.11	2	0.0	3 3	0.05	296	2.8	2 0.02	2 0.02	7 0.06	163	1.5
Pentaneura sp. Spaniotoma	3	0.02		_	2	0. 01	74	0. 4		-	-	-	
sp. Tendi pes		-		-		-		-	-		1 0.02	15	0.3
plumosus (Meigen)		_		***		_			-	1 0.02	-	15	0.3
(Unidentified sp.)		0.00			2	0.00	44	0.0		-	1 0.01		0. 1
Amphipoda Anisogammaru annandalei	ıs												
(Tattersall) Mollusca Gastrodopa Semisulcospira		0.02		-		-	15	0.3	-	-		-	
decipiens (Westerlund) Valvata (Cinc	inr	- 1a)	1	0.0	4	-	15	0.6	-	-	_	-	
japonica v. Martens Pelecypoda Corbicula sandai		-	1	0.0	4	_	15	0.6	-	-	-	-	
Reinhardt <i>Pisidium</i>		-			1	3. 46	15	51. 2	-		-	-	
kawamuai Mori Sphaerium japonicum biwaense	2	0.02		-		-	30	0.3	-	-	-	-	
Mori	2	0. 07			1	0.03	44	1.5	-	_	_	_	
Pupae of Simuliidae*			4	0.0	1	-	59	0. 1		_	work	_	
Date			July	, 15,	196	7			Au	gust 15,	1967		
Sampling No.	**********	1		2		3	Ave	erage	1	2	3	Aver	age
	No	. g.	No	o. g.	No	. g. 1	Ind./m	2 g/m²	No. g.	No. g.	No. g.	Ind./m²	g/m²
Oligochaeta Nematoda		0.02 0.00		0.0		0. 04 0. 00		1. 9 0. 0	1 0.04	2 0.02	1 0.03	59 -	1. 3

				Nb-5				
Chironomidae larvae <i>Pentaneura</i>								
sp. Tendi pes	-		-	***	2 0.03		_	30 0.04
plumosus (Meigen) Mollusca Gastropoda Semisulcospira	<b>-</b>	3 0.05	2 0.02	74 1.0	-	-		-
deci piens								
(Westerlund)		-	**		_	1 0.11	***	15 1.6
Date		Septembe	er 20, 19	967	Octo	ber 21,	1967	
Sampling No.	1	2	3	Average	1	2	3	Average
	No. g.	No. g.	No. g.	Ind./m² g/m²	No. g.	No. g.	No. g.	Ind./m² g/m²
Oligochaeta	1 0.02	2 0.05	1 0.04	59 1.6	1 0.01	? 0.15	2 0.13	67 4.3
Nematoda Chironomidae		1 0.00	1 0.00	30 0.1	-	1 0.01	_	15 0.1
larvae <i>Tendi pes</i>								
plumosus (Meigen)		-		-	1 0.02	-	-	15 0.3
Mollusca Gastropoda Semisulcospira deci piens								
(Westerlund) Pelecypoda Corbicula	gunt	1 0.00	***	15 0.0	-		****	
sandai						(1 0.09*	*	
Reinhardt	-	-	-	****	-	$\begin{cases} 1 & 4.11 \end{cases}$	-	15 60.8
							· · · · · · · · · · · · · · · · · · ·	And the second s
Date	N	ovember	16, 1967		Dece	ember 16	, 1967	
Sampling No.	1	2	3	Average	1	2	3	Average
	No. g.			nd./m² g/m²	No. g.	No. g.	No. g.	Ind./m <sup>2</sup> g/m <sup>2</sup>
Oligochaeta Nematoda Chironomidae larvae	1 0.03 2 0.00	2 0.07 1 0.00	? 0.02	44 1. 8 44 0. 0	? 0.24	? 0.08	? 0.17	? 7. 2 15 0. 0
Spaniotoma sp.	-	_	1 0.03	15 0.4	8 0.09	1 0.01	4 0.03	192 1.9
(Unidentified sp. ) Mollusca	-	-	1 0.00	15 0.0		1 0.00		15 0.0

Gastropoda Semisulcospira deci piens (Westerlund) Pisces Rhinogobius brunneus	2 1.82	1 0.46	-	44 33.7	-	-		-
(Temminck et Schlegel)	-	-	-	-	2 0.24	_	-	30 3.6

## Table 4

## Na-3

Date		Ja	nu	ary 1	4,	1967				Feb	rua	ry 17	, 19	967		
Sampling No.		1		2		3	Ave	erage		1		2		3	Ave	erage
	No	. g.	No.	g.	No.	g.	Ind./m²	g/m <sup>2</sup>	No.	g.	No.	g.	No.	g.	Ind./m	2 g/m <sup>2</sup>
Oligochaeta	?	0.13	?	0.26	?	0.39	?	11.5	? (	0.08	?	0.02	?	0.34	?	6.5
Hirudinea		-		-	1	0.00	15	0.0	-		2	0.01		~	30	0.1
Nematoda		-	3	0.00			44	0.0	-		2	0.00			30	0.0
Chironomidae																
larvae																
Pentaneura																
sp.		-		-		-		-	-		2	0.01			3	00.1
Spaniotoma																
sp.	2	0.03	4	0.07	3	0.05	133	2.2	-		4	0.09	3	0.07	104	2.4
Tendipes																
plumosus	1	0.01			1	0. 02	20	0.4								
(Meigen) (Unidentified		0.01		_	1	0.02	30	0.4	-			_			-	
sp.)		_		_	1	0.00	15	0.0	2 (	0.00	2	0.01	1	0.01	71	0.4
Mollusca					-	0.00	10	0.0	_	OO	-	0.01		0.01	1-2	0.4
Gastropoda																
Semisulcos pira																
deci piens																
(Westerlund)		_	2	4.5		_	44	66, 6					9	1.7	44	05 0
Pupae of			J	4. 0			44	00.0					Э	1. 7	44	25. 2
Simuliidae*				-					 -				7	0.00	104	0.0

Date				rch 1	,					-		7, 19				
Sampling No.		1		2		3	Avei			1	the the section of the section of	2		3	Ave	
	No.	g.	No.	g.	No.	g.	Ind./ $m^2$	$g/m^2 \\$	No.	g.	No.	g.	No.	g.	Ind./m²	$g/m^2$
Oligochaeta Chironomidae larvae		0. 16	?	0. 22	?	0.0	7 ?	6.7	2	0, 03	?	0.10	5	0.07	155	3. 0

							1	Na-3								
Pentaneura sp.						_		garan.		,	1	0.01	1	0.00	30	0.2
Spanitoma sp. Tendipes	1	0.02	6	0.11		-	104	1.9		***	1	0.02		-	15	0.3
<i>plumosus</i> (Meigen)		_	1	0.02		-	15	0.3		_		_		_		-
(Unidentified sp. )		0.08	15	0.09	6	0.04	518	3.0	4	0.03	2	0.01	6	0.04	178	1.2
Mollusca Gastropoda Semisulcospira decipiens																
(Westerlund) Pelecypoda Sphaerium		-	3	3.6	1	1.61	59	77.1	1	1.01		-		-	15	15.0
japonicum biwaense Mori		_		-		_		_		_	1	0.04		_	15	0.6
Pisces Cobiiis taenia striata																
Okada et Ikeda		_				-		-		-	1	2.0		-	15	29.6
Pupae of									90	0.03		_			006	0.4
Simuliidae*									24	0.03					326	0.4
Simuliidae*  Date			Ма	y 16,	196	- 67	-	AM.			ne 1	6, 196	67		320	0.4
		1	Ма	y 16,	196	- 67 3	Av	erage	44		ne 1	6, 196	67	3		erage
Date	No		Ma No.	2	196 No.	3	Av Ind./m	0	No.	Jur	ne 1		67 No.			erage
Date Sampling No. Oligochaeta Chironomidae larvae Tendipes			No.	2	No.	3	Ind./m	0	No.	Jur 1	No.	2	No.		Av	erage
Date Sampling No. Oligochaeta Chironomidae larvae Tendi pes plumosus (Meigen)	6	g.	No.	2 g.	No.	3 g.	Ind./m 163	1 <sup>2</sup> g/m <sup>2</sup>	No. 1	Jur 1	No.	2 g.	No.	g.	Av Ind./m ?	erage ² g/m²
Date Sampling No.  Oligochaeta Chironomidae larvae Tendipes plumosus (Meigen) (Unidentified sp.) Mollusca Gastropoda Semisulcospira	6	g.	No. 3	2 g.	No. 2	3 g. 0.02	Ind./m 163 89	1. 3	No. 1	Jur 1 g. 0, 03	No. ?	2 g.	No. 1	g. 0.03	Av. Ind./m ?	erage 2 g/m <sup>2</sup> 1.0
Date Sampling No.  Oligochaeta Chironomidae larvae Tendipes plumosus (Meigen) (Unidentified sp.) Mollusca Gastropoda	6	g.	No. 3	2 g. 0.04	No. 2	3 g. 0.02	Ind./m 163 89 104	1. 3	No. 1	Jur 1 g. 0, 03	No. ?	2 g. 0.01	No. 1	g. 0.03	Av. Ind./m ?	erage <sup>2</sup> g/m <sup>2</sup> 1.0

							Na	ı-3								
Mori Sphaerium japonicum		-	2	0.02	-		30	0.3		_		-			-	
biwaense Mori			1	0.06	-		15	0.9		-		-		_	-	
Pupae of Simuliidae*	211076 0000			-			-		7	0.03		-	·	-	104	0. 4
Date			Jul	y 15,	1967					Aug	gust	15,	1967	7		
Sampling No.		1		2	3		Aver	age		1		2		3	Ave	rage
	No.	g.	No.	g.	No. g	. I	nd./m²	$\rm g/m^2$	No.	g.	No.	g.	No.	g.	Ind./m <sup>2</sup>	g/m²
Oligochaeta Hirudinea	1	0. 01 -	1	0.03	1 0.	02	44 -	0.9	2	0.01 -	1	0. 03 -	1 1	0.05 0.03		1.3 0.4
Nematoda Chironomidae larvae Tendipes plumosus		_		and a	3 0.	00	44	0.0		_		-		wet		
(Meigen) Mollusca Gastropoda Semisulcospira decipiens		0.01	1	0.00	-		44	0. 1		-		-		_		
(Westerlund)		-			-		-			-		-	2	2.09	30	31
Date		S	Sept	embe	r 20,	196′	7			0	ctob	er 21	, 19	967		
Sampling No.		1		2	3		Ave	age		1		2		3	Ave	erage
	No.	g.	No.	g.	No.	g. I	nd./m²	$g/m^2$	No.	g.	No.	g.	No.	g.	Ind./Im	2 g/m <sup>2</sup>
Oligochaeta Mollusca Gastropoda Semisulcospira		0.06	1	0.02	1 0.	01	44	1.3	1	0.01	3	0.01		-	59	0.3
deci piens (Westerlund) Pelecypoda Unio biwae	,	-	1	0. 61 <sup>3</sup> 0. 24	1 0.	22	30	6.8		una.	2	1.04	2	0. 73	59	26. 2
Kobelt		-		-	1 0.	75	15	11.1	1	1.48			1	4.2	30	84.0
111100 ACTIVITY																
Date		N	ove	mber	16, 19	967				De	cem	ber 1	6,	1967		
Sampling No.		1		2	3		Ave	rage		1		2		3	Ave	erage
								/ 0					No.	g.	T 1/	2 a/m2
Oligochaeta	No.	. g. 0.05	No.	g. 0, 10	No. g	. Ir .01	nd./m² ?	$g/m^2$ 2. 4	No. ?	g. 0, 12	No	g. 0.02			Ind./m <sup>2</sup>	2.7

								Na-3									
larvae																	
Spaniotoma																	
sp.	1	0.02		-	1	0.01	30	0.	4	13	0.15	2	0.01	2	0.02	252	2.7
(Unidentified																	
sp.)	1	0.01		_		-	15	0.	1		-		-		-	-	-
Crustacea																	
Macrobrachiun	ı																
ni p ponense																	
(DeHaan)		-		_				-		2	0.8	1	0.04		-	44	12.4
Mollusca																	
Gastropoda																	
Semisulcospira																	
deci piens																	
(Westerlund)		-	2	2.67	1	0.13	44	41.	4	3	0.81		-	1	0.13	59	13.9

# C Variation in number and biomass of benthic animals among stations

Data obtained over two years (1966 and 1967) were available for this purpose. As several miscalculations and misprints were found in the published data of 1966, recalculations were made from original data.

In the begining of 1966 the survey were carried out twice or thrice a month so that mean values were obtained from two or three values and they were regarded as representative values of the month.

The comparisons of numbers and biomasses of benthos among stations were performed only on Oligochaeta including several species, two species of Chironomidae larva (*Spaniotoma* sp. and *Tendipes plumosus*) and two species of Mollusca (*Semisulcospira decipiens* and *Corbicula sandai*), since they were rather abundant in these areas and made it possible to compare.

#### 1. Oligochaeta

Table 5

		-1		2	Nb	-	Na	
Month	1966 g/m²	1967 g/m²	1966 g/m²	1967 g/m²	1966 g/m²	1967 g/m²	1966 g/m²	1967 g/m²
January	10.0	3.6	0.9	0.3	7.2	10.3	4.3	11.5
February	13. 2	5.0	3.6	0.9	7.0	5. 2	1.6	6.5
March	13.5	1.6	1.2	0.3	5.5	8.0	4.1	6.7
April	12.0	3.2	0.1	0.1	3.6	2.5	0.8	3.0
May	24.3	9.6	0.1	0.6	1.4	2.8	1.5	1.3

Tuno	0.6	2.7	0.4	0.1	0.5	1 5	1.2	1.0
June	0.6	3. 7	0.4	0.1	2.5	1.5	1. 4	1.0
July	7.8	2.4	0.3	0.0	2.1	1.9	0.6	0.9
August	5. 3	9.3	0.0	0.0	0.0	1.3	1.0	1.3
September	3.6	3.2	0.4	0.1	1.8	1.6	1.8	1.3
October	9.0	5.9	0.0	0.0	3.0	4.3	1.5	0.3
November	5. 9	9.9	0.0	0.0	3.2	1.8	3.0	2.4
December	7.7	9.9	0.1	0.0	10.7	7.2	2.8	2.7
Average	9.4	5. 6	0.6	0.2	4.0	4.0	2.0	3. 2

General trend of variations among stations in biomass of Oligochaeta in 1967 was very similar with that of 1966, showing the greatest value at station Ie-1 and the least at station Nb 2. High organic content of the bottom mud at station Ie-1 seems to be responsible for the greatest abundance there. Besides, the least biomass of Oligochaeta at station Nb 2 seems to be caused by the sandy bottom prevailing there around. These phenomena ought to be investigated in details in future.

#### 2. Chironomidae larva

Table 6

Spaniotoma	sp.	
Nh 5		

Na	3

		111	, 0			1161	J		
Month	196	6	196		196	6	1967		
MOHEH	No./m²	$g/m^2$	No. / m <sup>2</sup>	$g/m^2$	No./m²	$g/m^2$	No./m²	g/m²	
January	70	1.6	0	0	677	10.5	133	2.2	
February	45	1.4	0	0	170	3.6	104	2.4	
March	5	0.1	15	0.1	197	3.9	104	1.9	
April	11	4.2	30	0.6	37	0.4	15	0.3	
May	0	0	0	0	8	0.2	0	0	
June	0	0	15	0, 3	0	0	0	0	
July	0	0	0	0	0	0	0	0	
August	0	0	0	0	0	0	0	0	
September	0	0	0	0	0	0	0	0	
October	0	0	0	0	0	0	0	0	
November	74	1.5	15	0.4	237	3.7	30	0.4	
December	0	0	192	1.9	133	1.8	252	2.7	
Average	17	0.7	22	0.3	122	2.0	53	0.8	

Tendi pes plumosus Nb 5 Na 3											
Month	196		196	7	196	7					
	No. /m <sup>2</sup>		No. /m <sup>2</sup>	$g/m^2$	No. / m <sup>2</sup>		No. / m <sup>2</sup>	g/m²			
January	0	0	74	1.8	0	0	30	0.4			
February	8	0.3	44	0.8	0	0	0	0			
March	40	1.6	44	1.9	5	0.1	15	0.3			
April	0 🔮 0		30 0.8	0	0	0	0				
May	0	0	0	0	15	0.2	89	0.3			
June	0	0	15	0.3	0	0	44	1.2			
July	15	0.3	74	1.0	0	0	44	0.1			
August	15	0.3	0	0	0	0	0	0			
September	0	0	0	0	0	0	0	0			
October	30	0.6	15	0.3	0	0	0	0			
November	44	0.9	0	0	0	0	0	0			
December	30	0.6	0	0	15	0.1	0	0			
Average	15	0.4	25	0.6	2. 9	0.0	19	0.2			

Tendipes plumosus (Meigen), Spaniotoma sp., Pentaneura., Phaenopsectra sp. and few unidentified species were found in samples. Spaniotoma and Tendipes appeared abundantly at stations Nb 5 and Na 3, other species were rather scarce in amount.

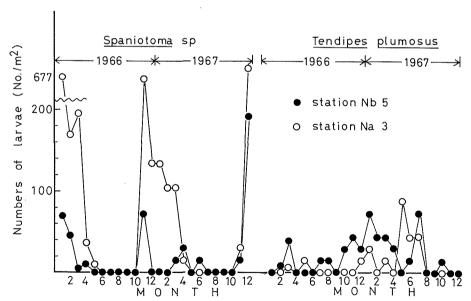


Fig. 1. Seasonal variations in Sponiotoma sp. and Tendipes plumosus

Table 6 shows that *Spaniotoma* was found much more at station Na 3, whereas larger number of *Tendipes plumosus* was found at station Nb 5. These two species were not found from Ie-1 and Nb 2. This shows that these two species prefer shallow and muddy bottom as their habitat.

Both *Spaniotoma* sp. and *Tendipes plumosus* show rather clear seasonal changes (fig. 1). Larvae of *Spaniotoma* appear from November to June, reach the maximum in November or December at both stations Nb 5 and Na 3. Although larvae of *Tendipes plumosus* appear almost every month at both stations, the maximum number can be seen in March at Nb 5 and in May at Na 3 in 1966, and in January at Nb 5 and in May at Na 3 in 1967.

#### 3. Mollusca

Table 7
Semisulcospira decipiens

		Nb 2				Nb 5				Na 3			
Month	1966		19	1967		1966		1967		1966		1967	
	No./m	2 g/m <sup>2</sup>	No./m	$^{2}$ g/m $^{2}$	No./m	2 g/m <sup>2</sup>	No./m	$^{2}$ g/m $^{2}$	No./m	$^{2}$ g/m $^{2}$	No./m	$^2$ g/m $^2$	
January	37	7.9	15	9.9	19	23.5	15	35. 1	33	41.8	44	66.6	
February	30	11.8	0	0	8	15.2	0	0	23	19.9	44	25. 2	
March	5	1.7	0	0	0	0	0	0	34	30.2	59	77.1	
April	0	0	30	12.7	8	41.3	15	32.9	22	20.4	15	15.0	
May	23	12.5	44	27.2	0	0	15	0.6	8	9.1	59	30.8	
June	0	0	0	0	0	0	0	0	30	39.5	0	0	
July	15	0.4	59	6.3	15	31.8	0	0	15	8.1	0	0	
August	0	0	0	0	0	0	15	1.6	30	53.3	30	31.0	
September	15	4.1	30	15.0	0	0	15	0.0	30	32.3	30	6.8	
October	30	14.3	30	16.9	0	0	0	0	15	7.3	59	26.2	
November	0	0	59	19.4	30	76.9	44	33.7	30	41.4	44	41.4	
December	0	0	0	0	0	0	0	0	30	46.2	59	13.9	
Average	13	4.4	22	9.0	7	15. 7	10	8.7	25	29. 1	37	27.8	

#### Corbicula sandai

Month			2		Nb 5			
	1966		1967		1966		1967	
	No./m²	$g/m^2$	No./m²	$g/m^2$	No./m²	$g/m^2$	No./m²	g/m²
January	59	58.8	15	22.2	11	29.7	0	0
February	104	143.6	44	78.3	8	4.6	0	0
March	118	89.5	0	0	0	0	0	0
April	215	255.5	59	37.9	0	0	0	0
May	111	110.3	15	0.4	15	79.5	15	51. 2
June	44	39. 1	207	239.9	0	0	0	0

July	44	29.4	89	37.6	0	0	0	0
August	44	79.9	0	0	0	0	0	0
September	174	152	133	121.8	0	0	0	0
October	89	109	118	186.3	15	30.9	15	60.8
November	15	1.0	15	2.7	0	0	0	0
December	0	0	0	0	0	0	0	0
Average	76	89. 0	58	60.6	4	12.1	2.5	9.3

The following species were found in the samples collected at Nb 2, Nb 5 and Na 3 during two years (1966—1967), whereas nothing was found at Ie-1.

#### Gastropoda

Heterogen longispira (Smith)

Valvata (Cincinna) japonica v. Martens

Parafossarulus manchouricus japonicus (Pilsbry)

Semisulcospira decipiens (Westerlund)

Semisulcospira bensoni reiniana (Brot)

#### Pelecypoda

Lanceolaria oxyrhyncha (v. Martens)

Unio biwae Kobelt

Inversidens bradti (Kobelt)

Inversidens reiniana (Kobelt)

Anodonta calipygos Kobelt

Corbicula sandai Reinhardt

Pisidum kawamurai Mori

Sphaerium japonicum biwaense Mori

Semisulcospira decipiens and Corbicula sandai were the best two in amount which were found in the surveys, so the numbers and biomasses of them are shown in table 7

Semisulcospira decipiens was found in larger amount at station Na 3 than stations Nb 2 and Nb 5, while Corbicula sandai was found considerably more at station Nb 2. It is natural that larger numbers of S. decipiens are living at station Na 3 and those of C. sandai at station Nb 2, because S. decipiens prefers mud substratum to sandy substratum and C. sandai prefers sandy substratum. Although Ie-1 has muddy bottom, it is too deep to inhabit for S. decipiens.

The authors would like to appreciate here Dr. Eiji Harada for the identification of shrimps.

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