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Fourth Report of the Regular Limnological Survey of Lake Biwa (1970) II. Benthos[1)2)]

By

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The regular limnological survey on benthos at four stations selected in Lake Biwa has been carrying on as a part of the routine work of the Otsu Hydrobiological Station. The aim of this research is to detect quantitative as well as qualitative changes in benthic communities extending over a long period (Mori et al. 1967; Suzuki and Mori 1967).

The collecting stations and their conditions, the methods for collection and the results during past four years have been mentioned in the previous papers (2, 3, 4, 5).

Some notable trends in change of amount of benthic animals are recognizable at some stations during five years (1966-1970). A gradual increase of Oligochaeta, a snail *Semisulcospira decipiens* (Westerlund) and a clam *Unio biwae* Kobelt, and a gradual decrease of chironomid larvae *Spaniotoma* spp. and a clam *Corbicula sandai* Reinhardt are all worth attention.

The numbers of individuals and total fresh weights of three samples (each 15×15cm) and their average values per m^2 are shown in the following tables (Table 1-Table 4). In these tables the following marks are used.

— : No specimen was collected.
? : Uncountable because of various reasons.
( ) : Average value calculated from one or two samples.

The series of reports were edited by the Director of the Station, Syuiti Mori, and the present part, on the benthos, was arranged especially by Syuiti Mori and Tetsuya Narita. The collection of samples was performed chiefly by M. Nakanishi, T. Narita, T. Ueda, Y. Nakajima and A. Kawabata, and other members of the Otsu Hydrobiological Station have assisted this survey in many ways.

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1) Contribution from the Otsu Hydrobiologcal Station, Kyoto University, No. 215.
2) JIBP-PF Publication No. 121.

A. Benthic community at Station Ie-1

Station Ie-1 has been chosen as a representative of the northern part of the lake or main basin, where the lake is oligotrophic and the depth is about 74 m.

Animals found in the samples in 1970 were Oligochaeta, Hirudinea, Amphipoda and Pelecypoda as shown in Table 1. A pelecypod mollusc *Pisidium lacustre* Woodward, that appeared unusually abundantly through 1968, was only found in January in 1970, which seemed to be recovered to an ordinary state. On the other hand, oligochaete worms increased continuously. As the reason of this change will be considered later.

Table 1. Benthic faunal composition and their abundance at St. Ie-1

Date	January 20, 1970								February 16, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	12	0.19	15	0.53	12	0.25	577	14.2	15	0.18	16	0.24	19	0.42	754	12.4

Date	March 18, 1970								April 13, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	7	0.37	11	0.30	15	0.50	488	17.3	6	0.19	9	0.38	9	0.38	355	14.2
Amphipoda																
Anisogammarus annandalei (Tattersall)	—	—	—	—	—	—	—	—	—	—	2	0.01	1	0.004	44	0.2
Pelecypoda																
Pisidium lacustre Woodward	1	0.01	—	—	—	—	13	0.1	—	—	—	—	—	—	—	—

Date	May 13, 1970								June 17, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	23	0.69	15	0.58	12	0.18	755	22.3	11	0.25	22	0.63	17	0.38	755	18.6
Amphipoda																
Anisogammarus annandalei (Tattersall)	1	0.006	—	—	2	0.02	44	0.4	—	—	—	—	2	0.02	31	0.4

Date	July 16, 1970								August 13, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	9	0.29	17	0.37	22	0.58	710	18.2	28	0.70	18	0.42	22	0.66	1007	26.6
Amphipoda																
Anisogammarus annandalei (Tattersall)	—	—	3	0.05	4	0.06	102	1.7	4	0.08	2	0.04	—	—	89	1.8

Date	September 16, 1970								October 15, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	10	0.25	23	1.10	?	0.34	?	25.4	25	10.9	18	0.15	10	0.18	786	18.2
Hirudinea	—	—	1	0.007	1	0.004	31	0.2	—	—	—	—	—	—	—	—
Amphioda																
Anisogammarus annandalei (Tattersall)	1	0.02	2	0.03	—	—	44	0.7	3	0.06	—	—	—	—	44	0.8

Date	November 13 1970								December 16, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	14	0.25	19	0.20	18	0.42	754	12.9	15	0.77	23	0.58	27	0.48	963	27.1
Amphipoda																
Anisogammarus annandalei (Tattersall)	—	—	2	0.06	2	0.03	58	1.3	—	—	8	0.19	1	0.02	133	3.2

B. Benthic communities at Stations Nb-2, Nb-5 and Na-3

Stations Nb-2, Nb-5 and Na-3 have been chosen as the representatives of the mesotrophic southern part of the lake or sub-basin. Nb-2 (sand or sandy mud substratum) and Na-3 (muddy substratum) are the stations located 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 (muddy substratum) is in the central part of the southern lake and about 4.5m in depth.

Results are shown in Tables 2, 3 and 4. Animals found were Pisces (1 sp.) Oligochaeta, Hirudinea, Chironomidae larvae (more than 4 spp.), Gastropoda molluscs (5 spp.), Pelecypoda molluscs (4 spp.) and Decapoda crustaceans (3 spp.). It is noticeable that Oligochaeta, the snail *Semisulcospira decipiens* (Westerlund) and the clam *Unio biwae* Kobelt increased steadily, but chironomid larvae *Spaniotoma* spp. and the clam *Corbicula sandai* Reinhardt decreased continuously through past five years. As the cause of these changes is discussed in the later paragraph.

Table 2. Benthic faunal composition and their abundance at St Nb-2

Date	January 14, 1970								February 17. 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	9	0.13	1	0.001	1	0.001	164	1.9	11	0.08	9	0.04	3	0.02	342	2.1
Chironomidae larvae																
Tendipes halophilus (Kieffer)	—	—	—	—	1	0.002	13	0.02	—	—	—	—	—	—	—	—
Pelecypoda																
Corbicula sandai Reinhardt	1	2.1	—	—	—	—	13	31.1	—	—	1	0.7	—	—	13	10.2

Date	March 16, 1970								April 15, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	W;.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	13	0.01	31	0.13	28	0.34	1066	6.9	11	0.08	5	0.01	6	0.02	324	1.6
Chironomidae larvae																
Tendipes plumosus (Meigen)	—	—	1	0.04	—	—	13	0.6	—	—	—	—	—	—	—	—
Tendipes halophilus (Kieffer)	—	—	—	—	6	0.01	89	0.1	1	0.004	—	—	—	—	13	0.1
Unidentified	—	—	—	—	2	0.004	31	0.1	—	—	—	—	—	—	—	—
Gastropoda																
Semisulcospira decipiens (Westerlund)	—	—	1	0.9	—	—	13	13.3	2	0.70	—	—	1	0.59	44	19.1
Pelecypoda																
Corbicua sandai Reinhardt	—	—	—	—	1	1.61	13	24.0	—	—	—	—	—	—	—	—

Date	May 14, 1970								June 17, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	34	0.01	30	0.01	55	0.01	1764	0.4?	—	—	—	—	—	—	—	—
Chironomidae larvae																
Tendipes plumosus (Meigen)	1	0.002	—	—	—	—	13	0.03	—	—	—	—	—	—	—	—
Tendipes halophilus (Kieffer)	1	0.002	1	0.002	1	0.005	44	0.1	—	—	—	—	—	—	—	—
Spaniotoma sp.	—	—	1	0.001	—	—	13	0.01	—	—	—	—	—	—	—	—
Pentaneura sp.	4	0.01	2	0.003	—	—	89	0.1	—	—	—	—	—	—	—	—
Cryptochironomus sp.	—	—	—	—	—	—	—	—	—	—	—	—	1	0.002	13	0.04
Unidentified sp.	—	—	—	—	—	—	—	—	—	—	—	—	1	0.01	13	0.1
Gastropoda																
Semisulcospira decipiens (Westerlund)	—	—	1	0.03	—	—	13	0.4	1	0.02	—	—	—	—	13	0.3
Pelecypoda																
Unio biwae Kobelt	—	—	—	—	1	1.41	13	20.9	—	—	—	—	—	—	—	—
Corbicula sandai Reinhardt	—	—	—	—	1	0.001	13	0.01	—	—	—	—	1	1.40	13	20.9

Date	July 17, 1970								August 12, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	—	—	—	—	11	0.002	13	0.03	1	0.0000	2	0.002	2	0.002	120	0.05
Chironomidae larvae																
Cryptochironomus sp.	—	—	3	0.005	1	0.0003	58	0.07	—	—	—	—	—	—	—	—
Pentaneura sp.	—	—	1	0.002	—	—	13	0.03	—	—	—	—	—	—	—	—
Tendipes halophilus (Kieffer)	—	—	—	—	—	—	—	—	—	—	1	0.001	—	—	13	0.01
Spaniotoma spp.	—	—	—	—	—	—	—	—	—	—	2	0.002	—	—	31	0.03

Gastropoda																
Semisulcospira decipiens (Meigen)	—	—	—	—	—	—	—	—	1	0.94	—	—	1	0.46	31	20.9
Pelecypoda																
Corbicula sandai Reinhard	—	—	1	0.09	—	—	13	1.3	—	—	—	—	—	—	—	—

Date	September 17, 1970								October 16, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	—	—	—	—	—	—	—	—	1	0.001	—	—	1	0.001	31	0.03
Chironomidae larvae																
Pentaneura sp.	—	—	—	—	—	—	—	—	1	0.002	—	—	—	—	13	0.03
Calopsectra sp.	—	—	—	—	—	—	—	—	—	—	1	0.0001	—	—	13	0.01
Pelecypoda																
Corbicula sandai Reinhardt	—	—	—	—	—	—	—	—	—	—	1	0.71	—	—	13	10.5
Unio biwae Kobelt	—	—	—	—	—	—	—	—	—	—	1	2.36	1	0.02	31	35.1

Date	November 14. 1970								December 15. 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	13	0.02	12	0.02	2	0.003	400	0.5	1	0.01	1	0.002	6	0.04	120	0.7
Hirudinea	—	—	—	—	2	0.002	31	0.02	—	—	—	—	1	0.002	13	0.03
Chironomidae larvae																
Tendipes halophilus (Kieffer)	1	0.0004	—	—	1	0.0004	31	0.01	—	—	—	—	—	—	—	—
Gastropoda																
Semisulcospira decipiens (Meigen)	1	1.14	—	—	—	—	13	16.9	—	—	—	—	—	—	—	—

Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt. (g)	No.	Wt. (g)	No.	Wt. (g)	No. /m²	g/m²	No.	Wt. (g)	No.	Wt. (g)	No.	Wt. (g)	No. /m²	g/m²
Pelecypoda																
Corbicula sandai Reinhardt	1	1.92	3	1.23	3	12.47	102	231.3	—	—	—	—	—	—	—	—
Unio biwae Kobelt	3	20.56	—	—	1	4.02	58	363.6	—	—	—	—	2	0.41	31	6.1
Pisidium kawamurai Mori	—	—	—	—	—	—	—	—	—	—	—	—	1	0.0001	13	0.001

Table 3. Benthic faunal composition and their abundance at St Nb-5

Date	January 14, 1970								February 17, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	19	0.28	54	0.73	27	0.24	1479	18.3	19	0.18	18	0.44	34	0.29	1052	13.6
H-rudinea	—	—	2	0.005	—	—	31	0.07	—	—	—	—	—	—	—	—
Chironomidae larvae																
Tendipes plumosus (Meigen)	2	0.006	—	—	4	0.03	89	0.5	—	—	—	—	—	—	—	—
Tendipes halophilus (Kileffer)	1	0.001	—	—	—	—	13	0.01	—	—	—	—	—	—	—	—
Spaniotoma spp.	—	—	—	—	—	—	—	—	—	—	1	0.005	1	0.002	31	0.1
Pentaneura sp.	—	—	—	—	—	—	—	—	—	—	1	0.002	2	0.003	44	0.08
Gastropoda																
Semisulcospira decipiens (Meigen)	—	—	1	1.90	—	—	13	28.1	—	—	—	—	—	—	—	—

Date	March 16, 1970								April 15, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	3	0.02	22	0.04	19	?	555	1.3	12	0.15	27	0.15	61	0.36	1479	9.6
Chironomidae larvae																
Tendipes plumosus (Meigen)	2	0.06	—	—	1	0.02	44	1.2	—	—	—	—	—	—	—	—
Tendipes halophilus (Kieffer)	—	—	—	—	—	—	—	—	1	0.002	—	—	—	—	13	0.03
Spaniotoma spp.	3	0.05	—	—	1	0.008	58	0.8	2	0.02	3	0.03	3	0.04	120	1.2
Pentaneura sp.	—	—	—	—	1	0.001	13	0.01	1	0.001	—	—	2	0.01	44	0.1
Chironomidae pupae	1	0.02	1	0.01	—	—	31	0.5	—	—	—	—	—	—	—	—
Pelecypoda																
Pisidium kawamurai Mori	—	—	—	—	—	—	—	—	2	0.002	—	—	1	0.001	44	0.04

Date	May 14, 1970								June 15, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	4	0.03	9	0.02	7	0.30	297	5.2	30	0.11	40	0.05	4	0.03	1097	2.7
Chironomidae larvae																
Tendipes plumosus (Meigen)	—	—	—	—	—	—	—	—	2	0.02	—	—	2	0.02	58	0.7
Pentaneura sp.	1	0.01	1	0.001	1	0.002	44	0.1	—	—	3	0.02	—	—	44	0.3
Spaniotoma spp.	—	—	—	—	—	—	—	—	3	0.01	—	—	—	—	44	0.1
Gastropoda																
Semisulcospira decipiens (Meigen)	—	—	1	0.08	—	—	13	1.2	—	—	—	—	—	—	—	—

Date	July 17, 1970								August 12, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaete	4	0.11	4	0.06	5	0.10	191	4.1	3	?	7	0.09	10	0.18	377	(6.0)
Chironomidae larvae																
Pentaneura sp.	—	—	1	0.01	1	0.01	31	2.0	—	—	2	0.002	—	—	31	0.03
Gastropoda																
Semisulcospira decipiens (Meigen)	—	—	—	—	1	1.61	13	23.8	—	—	—	—	—	—	—	—
Pelecypoda																
Unio biwae Kobelt	—	—	—	—	—	—	—	—	—	—	—	—	1	7.65	13	113.2

Date	September 17, 1970								October 16, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	8	0.09	4	0.05	5	0.02	253	2.3	9	0.17	3	0.02	4	0.04	235	3.5
Hirudinea	—	—	—	—	—	—	—	—	—	—	1	0.01	—	—	13	0.2
Chironomidae larvae																
Tendipes halophilus (Kieffer)	—	—	—	—	1	0.002	13	0.03	—	—	—	—	—	—	—	—
Gastropoda																
Semisulcospira decipiens (Meigen)	—	—	—	—	1	1.37	13	20.3	—	—	—	—	—	—	—	—
Pelecypoda																
Unio biwae Kobelt	—	—	—	—	1	0.41	13	6.1	—	—	—	—	—	—	—	—

Date	November 14, 1970								December 15, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	11	0.14	19	0.09	15	0.10	666	4.6	6	0.03	6	0.05	16	0.19	413	4.0

Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt. (g)	No.	Wt. (g)	No.	Wt. (g)	No. /m²	g/m²	No.	Wt. (g)	No.	Wt. (g)	No.	Wt. (g)	No. /m²	g/m²
Chironomidae larvae																
Spaniotoma sp.	—	—	—	—	—	—	—	—	—	—	2	0.02	1	0.02	44	0.6
Pentaneura sp.	—	—	—	—	—	—	—	—	1	0.004	1	0.001	—	—	31	0.07

Table. 4. Benthic faunal composition and their abundance at St Na-3

Date	January 14, 1970								February 17, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	14	0.02	1	0.001	17	0.14	475	2.3	48	0.49	83	1.01	49	0.97	2664	36.4
Hirudinea	—	—	—	—	—	—	—	—	2	0.02	1	0.01	—	—	44	0.5
Decapoda																
Paratya compressa (De Haan)	1	0.06	—	—	—	—	13	0.9	—	—	—	—	—	—	—	—
Palaemon paucidens De Haan	—	—	—	—	1	0.59	13	8.4	—	—	1	0.17	—	—	13	2.5
Macrobrachium nipponensis (De Haan)	1	0.15	1	0.09	—	—	31	3.5	—	—	—	—	—	—	—	—
Isopoda																
Tachea chinensis Thielemann	—	—	—	—	—	—	—	—	—	—	1	0.01	—	—	13	0.2
Chironomidae larvae																
Tendipes plumosus (Meigen)	—	—	—	—	—	—	—	—	1	0.04	—	—	—	—	13	0.2
Spaniotoma spp.	—	—	—	—	—	—	—	—	—	—	2	0.003	—	—	31	0.05
Pentaneura sp.	—	—	—	—	—	—	—	—	—	—	1	0.005	—	—	31	0.09
Gastropoda																
Semisulcospira decipiens (Westerlund)	1	0.54	1	0.26	1	0.90	44	25.3	5	3.75	5	2.81	2	1.61	178	120.8
Pelecypoda																
Unio biwae Kobelt	—	—	—	—	—	—	—	—	—	—	—	—	1	14.55	13	215.3

Date	March 16, 1970								April 15, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Pisces																
Rhinogobius similis (Gill)	—	—	—	—	—	—	—	—	2	0.26	—	—	—	—	31	3.8
Oligochaeta	61	0.32	28	0.13	64	0.28	2264	10.9	27	0.07	12	0.05	54	0.17	1376	4.2
Hirudinea	—	—	—	—	1	0.01	13	0.1	—	—	—	—	—	—	—	—
Chironomidae larvae																
Tendipes plumosus (Meigen)	4	0.14	—	—	2	0.06	89	3.1	—	—	—	—	—	—	—	—
Spaniotoma spp.	5	0.01	—	—	1	0.002	89	0.2	5	0.04	—	—	—	—	75	0.6
Pentaneura sp.	—	—	—	—	—	—	—	—	—	—	1	0.001	—	—	13	0.02
Pupae of Chironomidae	1	0.01	—	—	—	—	13	0.2	—	—	—	—	—	—	—	—
Gastropoda																
Semisulcospira decipiens (Westerlund)	11	7.06	—	—	6	2.62	253	38.6	—	—	2	0.50	9	5.55	164	89.7
Semisulcospira libertina (Gould)	—	—	—	—	1	2.20	13	31.1	—	—	—	—	—	—	—	—
Pelecypoda																
Unio biwae Kobelt	—	—	2	26.29	—	—	31	388.9	—	—	—	—	1	3.24	13	48.0
Sphaerium japonicum biwaense Mori	—	—	—	—	—	—	—	—	1	0.01	—	—	—	—	13	0.1

Date	May 14, 1970								June 15, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	W.t(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	21	0.05	15	0.16	11	0.03	697	3.6	5	0.01	15	0.01	15	0.06	519	1.3
Hirudinea	—	—	—	—	—	—	—	—	1	0.01	—	—	—	—	13	0.1

Decapoda																
Palaemon paucidens De Haan	—	—	—	—	—	—	—	—	—	—	—	—	1	0.26	13	3.8
Chironomidae larvae																
Spaniotoma spp.	—	—	1	0.01	—	—	13	0.1	—	—	—	—	—	—	—	—
Pentaneura sp.	—	—	—	—	—	—	—	—	—	—	1	0.01	—	—	13	0.9
Odonata																
Gomphus larva	—	—	1	0.04	—	—	13	0.5	—	—	—	—	—	—	—	—
Gastropoda																
Semisulcospira decipiens (Westerlund)	2	1.42	1	0.91	—	—	44	34.5	16	2.22	10	3.94	6	1.37	457	111.4
Radix japonica (Jay)	—	—	—	—	—	—	—	—	1	0.01	—	—	—	—	13	0.1

Date	July 17, 1970								August 12, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	8	0.05	24	0.08	11	0.08	636	3.1	5	0.08	17	0.21	10	0.13	457	6.2
Chironomidae larvae																
Spaniotoma spp.	1	0.01	—	—	—	—	13	0.1	—	—	—	—	—	—	—	—
Pentaneura sp.	—	—	—	—	—	—	—	—	—	—	—	—	1	0.01	13	0.1
Gastropoda																
Semisulcospira decipiens (Westerlund)	7	5.94	6	3.71	—	—	191	142.8	1	0.28	7	5.35	8	5.76	235	168.6
Heterogen longispira (Smith)	—	—	—	—	1	5.51	13	81.7	—	—	—	—	1	1.27	13	18.6

Date	September 17, 1970								October 16, 1970							
Sampling No.	1		2		3		Average		1		2		3		Average	
	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²	No.	Wt.(g)	No.	Wt.(g)	No.	Wt.(g)	No./m²	g/m²
Oligochaeta	14	0.08	12	0.05	10	0.05	444	2.3	9	0.08	4	0.01	6	0.02	280	1.4
Hirudinea	—	—	—	—	—	—	—	—	—	—	—	—	1	0.004	13	0.05

Sampling No.	1 No.	1 Wt. (g)	2 No.	2 Wt. (g)	3 No.	3 Wt. (g)	Average No. /m²	Average g/m²	1 No.	1 Wt. (g)	2 No.	2 Wt. (g)	3 No.	3 Wt. (g)	Average No. /m²	Average g/m²
Decapoda																
Macrobrachium nipponensis (De Haan)	—	—	—	—	—	—	—	—	—	—	1	0.63	—	—	13	9.4
Chironomidae larvae																
Pentaneura sp.	1	0.001	1	0.001	—	—	31	0.02	—	—	—	—	—	—	—	—
Gastropoda																
Semisulcospira decipiens (Westerlund)	4	3.98	6	2.62	1	0.06	164	98.6	—	—	14	10.04	8	1.75	325	159.7
Sinotaia histrica (Gould)	—	—	3	4.41	—	—	44	65.3	—	—	—	—	—	—	—	—
Heterogen longispira (Smith)	—	—	—	—	—	—	—	—	—	—	—	—	1	2.02	13	29.9
Pelecypoda																
Unio biwae Kobelt	—	—	—	—	—	—	—	—	—	—	—	—	2	29.77	31	440.4

Date	November 14, 1970								December 15, 1970							
Sampling No.	1 No.	1 Wt.(g)	2 No.	2 Wt.(g)	3 No.	3 Wt.(g)	Average No./m²	Average g/m²	1 No.	1 Wt.(g)	2 No.	2 Wt.(2)	3 No.	3 Wt.(g)	Average No./m²	Average g/m²
Oligochaeta	25	0.08	13	0.02	35	0.09	1079	2.9	32	0.63	10	0.13	10	0.04	768	11.8
Decapoda																
Macrobrachium nipponeneis (De Haan)	1	0.23	—	—	—	—	13	3.4	—	—	—	—	—	—	—	—
Chironomidae larvae																
Spaniotoma sp.	—	—	—	—	—	—	—	—	—	—	—	—	1	0.01	13	0.2
Gastropoda																
Semisulcospira decipiens (Westerlund)	24	7.83	1	0.55	—	—	369	123.9	3	0.83	—	—	1	0.001	58	12.3
Sinotaia histrica (Gould)	1	0.01	1	0.02	—	—	31	0.4	—	—	—	—	—	—	—	—

C. Remarkable trends in biomass changes of benthic animals during past five years (1966-1970)

There are some remarkable trends in biomass changes of several benthic animals since 1966. We wish to point out general features of those changes and to consider on their causes.

1. Oligochaetes

Average amounts of oligochaete from 1966 through 1970 at Stations Ie-1, Nb-2, Nb-5 and Na-3 are illustrated in Fig. 1. It is clear that a gradual increase of population is seen at all stations. We are afraid that this phenomenon might be induced, at least partly, by increasing eutrophication, and if it is true, it must be noticed that eutrophication is proceeding even at the deep bottom more than 70 meters in the central part of Lake Biwa.

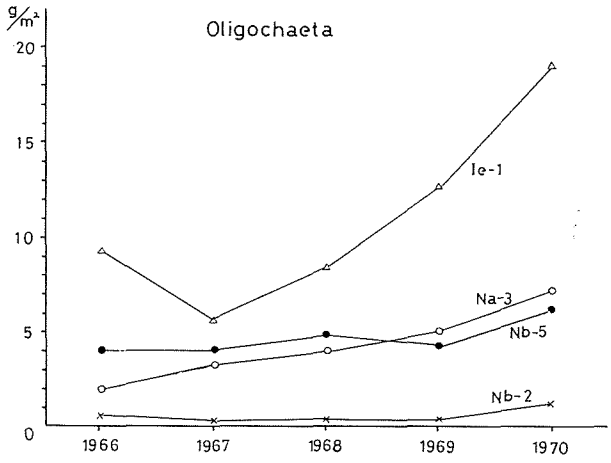

Fig. 1. Change of Average annual biomass of oligochaete worms from 1966 through 1970.

2. Chironomid larvae

Fig. 2 shows changes of biomass of *Spaniotoma* spp. and *Tendipes plumosus* (Meigen). The population of the latter is not changed, but that of the former is clearly decreased, especially at Station Na-3. The gradual decrease of biomass seems also to be an indication of the progress of eutrophication.

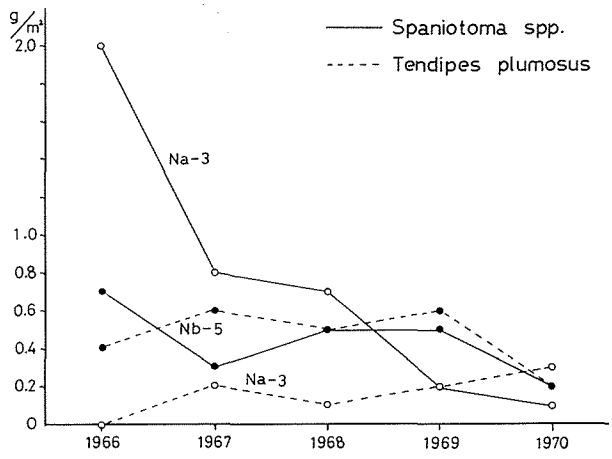

Fig. 2. Biomass change of some chironomid larvae.

3. Pelecypod molluscs

a) *Corbicula sandai* Reinhardt (Seta-sijimi)

The annual change of a clam, *Corbicula sandai* Reinhardt, which is one of abundant molluscs in this lake, is shown in Fig. 3. It is clear that the amount is decreasing both at Nb-2 and Nb-5. They have been rarely found at Na-3 and have never been found at Ie-1 during past five years.

We can suppose several causes for this phenomenon. First, the progress of eutrophication may be responsible for, because this clam is an inhabitant of clear water area. The other reason, especially at Station Nb-2, may be a direct human

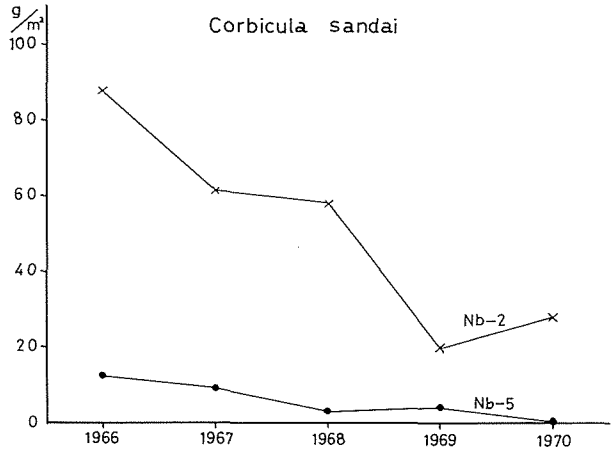

Fig. 3. Change of annual average biomass of *Corbicula sandai* from 1966 through 1970

effect due to an increasing fishing pressure and a mechanical bottom digging for getting sand for construction. Around Station Nb-2 has been a good fishing place for the clam, but now the resource is subjected to a serious damage.

b) *Unio biwae* Kobelt (Tatebosi)

Contrary to the case of *Corbicula* this mussel is increasing, especially remarkable at Na-3 (Fig. 4). This mussel is a little more fond of muddy bottom than *Corbicula* does, and is conjectured to be more resistant to eutrophication than *Corbicula* is. However, the real cause of this increase is not clear.

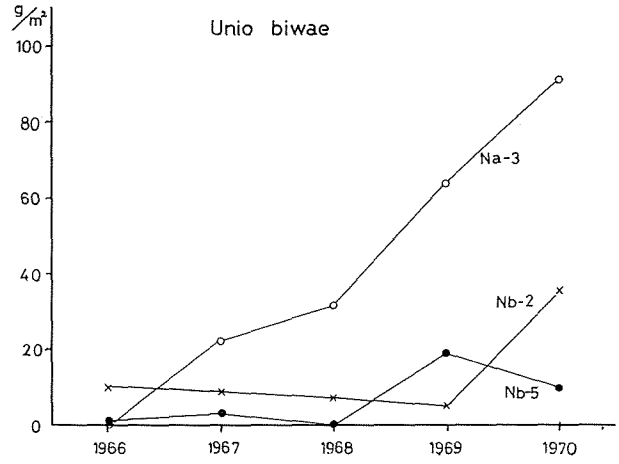

Fig. 4. Biomass change of *Unio biwae*.

4. Gastropod mollusc

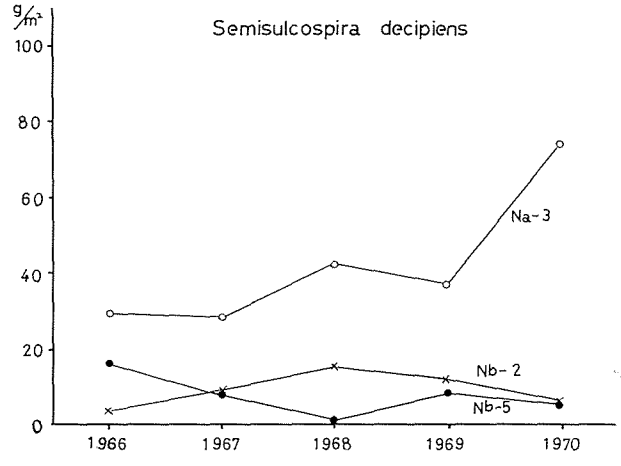

Fig. 5. Change of annual average biomass of *Semisulcospira decipiens* from 1966 through 1970.

Fig. 5 shows the annual change of *Semisulcospira decipiens* (Westerlund) (Ibo-kawanina). The trend of change of this gastropod at Stations Nb-2 and Nb-5 is not clear, but that at Na-3 is very clear - increasing. The cause of this phenomenon is not known yet.

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