

**Seventh Report of the Regular Limnological
Survey of Lake Biwa (1973)
III. Benthos¹⁾**

By

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The regular limnological survey on benthos at four stations in Lake Biwa has been carrying on since 1965. The aim of the research is to detect quantitatively as well as qualitatively the changes of benthic communities extending over a long period.

The sampling stations and the methods for collection together with the results obtained during past 8 years have been described in the previous papers (Mori et al. 1967; Mori 1970, 1971, 1972, 1976; Suzuki and Mori 1967, 1968).

The number of individuals and fresh weight of them per 15×15 cm with three samples and their average values per m² are shown in Tables 1, 2, 3 and 4. In these tables the mark “-” means no specimen was collected.

It has to be noted in this report that there were some misidentification for *Corbicula* species in the former reports, that is, *Corbicula (Corbiculina) leana* Prime was sometimes misidentified as *Cor. sandai* Reinhardt in recent years. In this report it is corrected and the right illustration of the change in density is given in Fig. 5.

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

A. Benthic community at Station Ie-1 (northern basin)

The result obtained at Station Ie-1 in the northern main basin, where the depth is about 74 m and the bottom is muddy, is shown in Table 1. Oligochaeta was most abundant and *Anisogammarus* and some chironomid larvae were collected sometimes.

1) Contribution from the Otsu Hydrobiological Station, Kyoto University, No. 267.

Table 1. Composition and abundance of benthic animal community at St. Ie-1

Date	January 17, 1973				February 14, 1973			
	1	2	3	Average	1	2	3	Average
Sampling No.	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²
Oligochaeta	12 344.5	11 357	18+1 816.4	621.6 22.464	16 574	15 400.5	17 460	710.4 21.232
Amphipoda <i>Anisogammarus annandalei</i> (Tattersall)	1 14.5	--	--	14.8 0.213	--	--	--	--
Date	March 17, 1973				April 17, 1973			
Sampling No.	1	2	3	Average	1	2	3	Average
No. mg	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²
Turbellaria <i>Bdellocephala annandalei</i> Ijima et Kaburaki	--	--	--	--	--	1 13.2	--	14.8 0.195
Oligochaeta	10 510.2	21 814.4	20+1 858.8	768.12 32.314	8 255.7	9 244.3	11 190.5	412.92 10.221
Amphipoda <i>Anisogammarus annandalei</i> (Tattersall)	--	--	--	--	1 5.2	1 2.9	--	31.08 0.120
Chironomidae larvae <i>Spantotoma sp. B</i>	--	--	--	--	1 0.4	3 3.3	--	57.72 0.053
Date	May 14, 1973				June 14, 1973			
Sampling No.	1	2	3	Average	1	2	3	Average
No. mg	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²
Oligochaeta	12 394.3	8 267.5	14 352.5	501.72 15.012	32 956.3	21 379.3	17+3 390.3	1078.92 25.543

*B. Benthic communities at Stations Nb-2, Nb-5 and Na-3
(southern basin)*

The results obtained at Stations Nb-2, Nb-5 and Na-3 in the southern sub-basin are shown in Tables 2, 3 and 4. Nb-2 (sand or sandy substratum) and Na-3 (mud substratum) are the stations of 0.1 km off the east and west coast of the lake respectively and both are about 2 m in depth, while Nb-5 (mud substratum) is in the central part about 4.5 m in depth.

Results are shown in Tables 2, 3 and 4. Animals found were Oligochaeta, Hirudinea, Chironomidae larvae (more than 6 spp.), Odonata (1 sp.), Crustacea (2 spp.), Gastropoda (7 spp.), Pelecypoda (6 spp.) and Pisces (1 sp.).

Table 2. Composition and abundance of benthic animal community at St. Nb-2

Date	January 17, 1973				February 14, 1973				Average No./m ² g/m ²								
	1	2	3	Average	1	2	3	Average									
Sampling No.	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²					
Oligochaeta	6	20.6	17	47.1	10	21.7	488	1.3	24	83.4	3	9.4	35	88.2	919	2.7	
Chironomidae larvae <i>Spantotoma akamusi</i> Tokunaga	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0.5	15	0.009
<i>Spantotoma</i> sp. c	—	—	—	—	—	—	—	—	1	2.4	—	—	—	1	1.0	31	0.05
<i>Chironomus plumosus</i> (Meigen)	—	—	—	—	—	—	—	—	—	—	1	26.2	—	—	—	15	0.4
<i>Einfeldia</i> sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1.1	15	0.02
Gastropoda <i>Semisulcospira decipiens</i> (Westerlund)	—	—	—	—	—	—	—	—	—	—	—	—	—	1	20	15	0.3
Pelecypoda <i>Corbicula (Corbiculina) leana</i> Prime	—	—	1	1630	—	—	15	24.1	—	—	—	—	—	—	—	—	—
<i>Sphaerium japonicum</i> <i>biwaense</i> Mori	—	—	—	—	1	1	15	0.01	2	11	—	—	—	10	150	178	2.4
Date	March 17, 1973				April 17, 1973												
Sampling No.	1	2	3	Average	1	2	3	Average	1	2	3	Average					
No. mg	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²					
Oligochaeta	34	135.8	25	138.6	39	99.6	1452	5.5	4	4.2	3	3.2	4	6.2	164	0.2	
Amphipoda <i>Anisogammarus amandaei</i> (Tattersall)	—	—	—	—	—	—	—	—	—	—	1	10.3	—	—	14.8	0.15	
Chironomidae larvae <i>Spantotoma</i> sp. C	—	—	1	1.2	1	1.0	31	0.03	—	—	—	—	—	—	—	—	
<i>Einfeldia</i> sp.	2	2.0	—	—	1	1.0	44	0.04	—	—	—	—	—	—	—	—	
Chironomid pupae	—	—	—	—	—	—	—	—	—	—	1	1.0	—	—	15	0.01	
Gastropoda <i>Sinotata hisbrica</i> (Gould)	1	1120	—	—	—	—	15	16.6	—	—	—	—	—	—	—	—	
<i>Semisulcospira decipiens</i> (Westerlund)	1	180	—	—	1	200	30	5.6	—	—	2	1460	—	—	30	21.6	

Date	May 14, 1973				June 14, 1973				Average No./m ² g/m ²
	1	2	3	Average	1	2	3	Average	
Sampling No.	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No. mg	No./m ² g/m ²
Pelecyopoda									
<i>Unio biwae</i> Kobelt	—	1 370	—	15 5.5	—	—	2 880	—	30 13
<i>Corbicula (Corbiculina)</i>	—	1 1080	—	15 16.0	—	—	—	—	—
<i>leana</i> prime	—	—	—	—	—	—	1 5000	—	15 74
<i>Corbicula sandai</i> Reinhardt	—	—	—	—	—	—	—	—	—
<i>Sphaerium japonicum</i> <i>biwaense</i> Mori	1 10	—	—	15 0.1	4 230	10 375	1+1 10	235 9.1	—
Date	May 14, 1973				June 14, 1973				
Sampling No.	1	2	3	Average	1	2	3	Average	
Oligochaeta	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²	
<i>Procladius</i> sp.	—	—	4+1	75 0.2	7 13.8	12+8	5.0 11	564 0.45	
<i>Chironomus plumosus</i> (Meigen)	1 4.3	1 4.2	4	33.3 0.62	—	—	1	0.7 0.01	
Gastropoda									
<i>Sinotata historica</i> (Gould)	1 4600	—	1	20 30	2 320	1 30	2 460	75 12	
<i>Semisulcospira</i> <i>deceptans</i> (Westertlund)	—	—	1	1 15	—	2 1200	—	30 18	
Pelecyopoda									
<i>Unio biwae</i> Kobelt	—	—	—	—	—	1 30	—	15 0.44	
<i>Corbicula (Corbiculina)</i>	—	—	—	—	—	—	—	—	
<i>leana</i> prime	—	4+5 4	1+2 1	178 0.08	3+3 80	12 600	14 530	475 18	
<i>Sphaerium japonicum</i> <i>biwaense</i> Mori	—	(1)	—	—	—	1 80	1 50	29.6 2.9	
Date	July 16, 1973				August 9, 1973				
Sampling	1	2	3	Average	1	2	3	Average	
Oligochaeta	No. mg	No. mg	No. mg	No./m ² g/m ²	No. mg	No. mg	No. mg	No./m ² g/m ²	
<i>Chironomidae</i> larvae	2 2.4	3 3.8	2 1.0	102 0.11	2 9.9	3 6.2	1 0.5	89 0.24	
<i>Shaniotoma</i> sp. c	1 0.2	—	—	—	—	—	—	—	
<i>Chironomus plumosus</i> (Meigen)	—	1 0.6	1 0.7	31 0.02	—	—	1 0.7	15 1.3	
Gastropoda									
<i>Sinotata historica</i> (Gould)	2 370	—	3 800	75 17.3	—	1 820	—	15 12.1	

Date	May 14, 1973					June 14, 1973											
	1	2	3	Average	1	2	3	Average									
Sampling No.	No. mg	No. mg	No. mg	No./m ² g/m ²	No.	No. mg	No. mg	No./m ² g/m ²	No.	No. mg	No. mg	No./m ² g/m ²					
Pelecypoda																	
<i>Sphaerium japonicum</i>	—	—	1	20	—	—	15	0.3	1	20	—	15	0.3				
<i>bitwaense</i> Mori																	
Date	May 14, 1973					June 14, 1973											
Sampling No.	1	2	3	Average	1	2	3	Average	1	2	3	Average					
Oligochaeta	14	175.4	7	29.0	10	231.0	457	6.4	6	67.2	13	139.9	7	92.5	386	4.44	
Oligochaeta cocoon	—	—	—	—	—	—	—	—	—	—	1	6.4	1	5.4	31	0.17	
Chironomidae larvae																	
<i>Procladius</i> sp.	2	3.8	—	—	2	5.7	58	0.14	—	—	—	—	—	—	—	—	
<i>Cirratulus</i> sp.	—	—	—	—	—	—	—	—	1	5.2	1	6.2	1	8.9	44	0.30	
<i>Spaniotona akamusi</i> (Tokunaga)	1	7.0	—	—	—	—	15	0.10	—	—	—	—	—	—	—	—	
<i>Spaniotoma</i> sp. A	1	0.2	1	0.2	3	0.7	75	0.02	—	—	—	—	—	—	—	—	
<i>Chironomus plumosus</i> (Meigen)	23	93.3	16	63.7	25	118.7	946	4.08	8	156.5	16	218.5	19	348.5	635	10.71	
<i>Einfeldia</i> sp. Unidentified	1	4.3	1	4.8	1	3.2	44	0.18	2	1.7	—	—	—	—	30	0.03	
Gastropoda																	
<i>Semisulcospira decipiens</i> (Westerlund)	—	—	1	1020	—	—	15	15.1	—	—	—	—	—	—	—	—	
Pelecypoda																	
<i>Corbicula</i> (<i>Corbiculina</i>) <i>leana</i> prime	—	—	—	—	—	—	—	—	—	—	—	—	—	1	20	15	0.3
<i>Pisidium japonicum</i> Pilsbry et Hirase	—	—	—	—	1	40	15	0.59	—	—	—	—	—	—	—	—	—
<i>Sphaerium japonicum</i> <i>bitwaense</i> Mori	—	—	1	80	1	120	30	2.96	—	—	—	—	—	—	—	—	—
Teleostomi																	
<i>Rhinogobius similis</i> (Gill)	—	—	—	—	—	—	—	—	—	—	1	2.3	—	—	15	0.04	
Date	July 16, 1973					August 9, 1973											
Sampling No.	1	2	3	Average	1	2	3	Average	1	2	3	Average					
Oligochaeta	6+1	109.0	14	126.2	12	136.0	488	5.49	6	47.0	7	190.2	4	97.9	253	5	
Hirudinea	4	22.0	1	1.7	2	4.4	102	0.42	—	—	—	—	—	—	—	—	
Chironomidae larvae																	
<i>Procladius</i> sp.	1	1.0	—	—	—	—	15	0.01	—	—	—	—	—	—	—	—	
<i>Chironomus plumosus</i> (Meigen)	2	34.3	10	218.6	21	404.9	488	9.74	7	175.0	6	112.3	1	0.4	209	4.26	

Sampling No.	November 14, 1973				December 12, 1973				Average No./m ² g/m							
	No. mg	No. mg	No. mg	Average No./m ² g/m ²	No. mg	No. mg	No. mg	No. mg								
Oligochaeta	3	5.5	11+1	25.3	2+1	2.8	266	0.5	27	56.7	29+1	206.0	10+4	41.8	1039	4.5
Decapoda																
<i>Macrobrachium nipponensis</i> (De Haan)									1	158.2					15	2.3
<i>Paratya compressa</i> (De Haan)	1	86.7					15	1.3	1	48.3					15	0.7
Odonata																
<i>Cercion hieroglyphicum</i> Brauer													1	6.1	15	0.1
Chironomidae larvae																
<i>Spaniotoma akamusi</i> (Tokunaga)			1	27.3			15	0.4	1	13.0					15	0.2
<i>Spaniotoma akamusi</i> Pupae					1	9.8	15	0.1								
<i>Chironomus plumosus</i> (Meigen)	2	26.6	8	78.9	6	50.0	235	2.3	2	11.6	4	45.5	2	14.0	120	1.1
<i>Einfeldia</i> sp.									1	1.8					15	0.03
Zygotela larvae									1	1.2					15	0.02
Gastropoda																
<i>Parafossarulus manchuricus japonicus</i> (Filsbry)			1	70			15	1.0			1	50			15	0.74
<i>Semisulcospira decipiens</i> (Westerlund)			1	310			15	4.6	3	550	4	2620			104	46.9
<i>Radix (Btwaikoa) onychia</i> (Westerlund)	4	4					58	0.06	1	10			2	80	44	1.3
<i>Cyranulus bivaensis</i> (Preston)									2	2			7	43	133	0.67
Teleostomi																
<i>Rhinogobius similis</i> (Gil)											1	195.0			15	2.9

C. On some remarkable points in the changes of biomasses of benthic animals

1. Oligochaeta

Biomass change of Oligochaeta from 1966 through 1975 at each station is illustrated in Fig. 1. There is a noticeable feature that an increasing trend, which had been lasted during past several years, stopped or even a decreasing tendency appeared in this year. It is clearly shown at Ie-1 and Na-3, and at Nb-5 the same level is maintained during these three years. The cause of this phenomenon should be carefully examined, whether it is a sign of suspension of eutrophication or it is in-

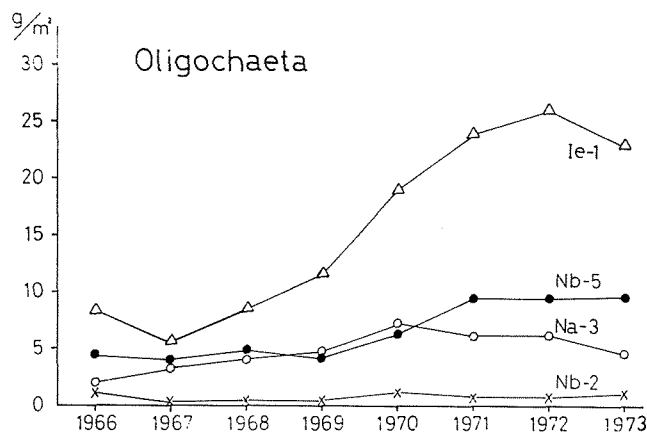


Fig. 1. Change of average biomass of oligochaete worms from 1966 through 1973.

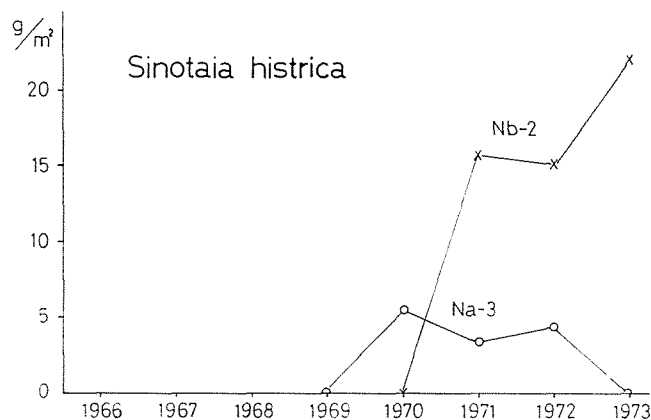


Fig. 2. Change of average biomass of *Sinotaia histrica* from 1966 through 1973.

duced by some other reasons.

2. Mollusca

i) Gastropod mollusc, *Sinotaia histrica*

This gastropod has been found predominantly at rather polluted areas, but now it is widely distributed all over the southern basin. There is an inconsistency in changing trend of biomass at Nb-2 and Na-3 (Fig. 2). The reason is unknown at present.

ii) Gastropod mollusc. *Semisulcospira decipiens*

A remarkable trend of decrease through successive years can be pointed out at Na-3 (Fig. 3). The cause of this change is not clear.

iii) Pelecypod mollusc, *Unio biwae*

The low level of biomass is still maintained in this year at every station (Fig. 4)

iv) Pelecypod molluscs, *Corbicula sandai* and *Corbicula leana*

There has been a misidentification among these two kinds of *Corbicula* species. *Corbicula sandai* is an endemic species to this lake and has been one of the most economically important mussel. This species is very fond of clear water area and sandy substratum, and a decreasing trend has been conspicuously observed as is illustrated in Fig 5. On the contrary, *Corbicula leana* is increasing steadily these several years. This mussel is widely distributed in Japan, living at small ponds or streams having muddy substratum, and in Lake Biwa it was used to be found only at the inland, eutrophicated bays. However, with a decrease of *Corbicula sandai*, *leana* species took the places once occupied by the former, and it seems to be a distinct evidence of a progress of eutrophication of this lake.

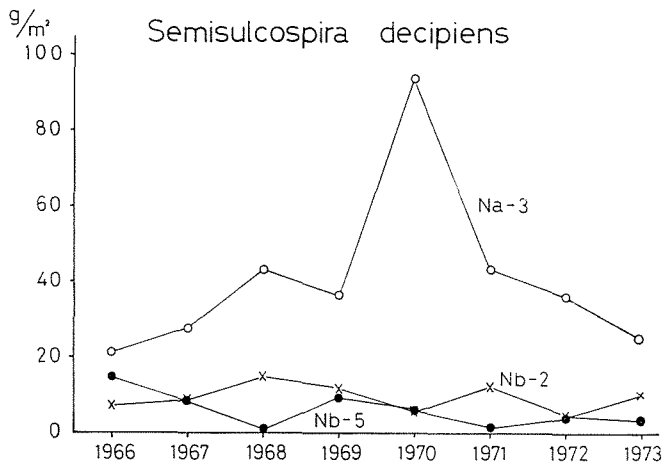


Fig. 3. Change of average biomass of *Semisulcospira decipiens* from 1966 through 1973.

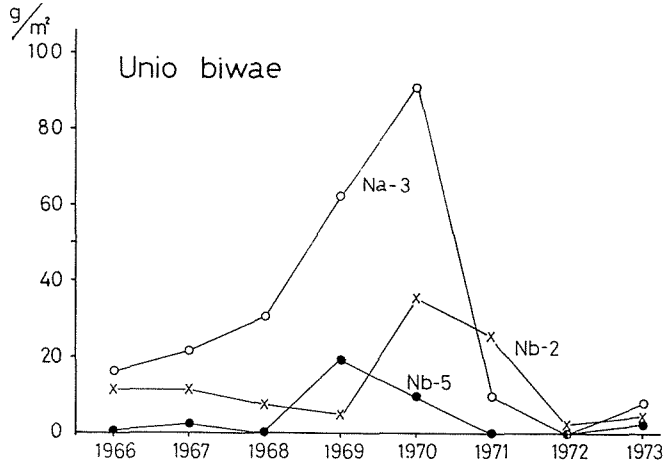


Fig. 4. Change of average biomass of *Unio biwae* from 1966 through 1973.

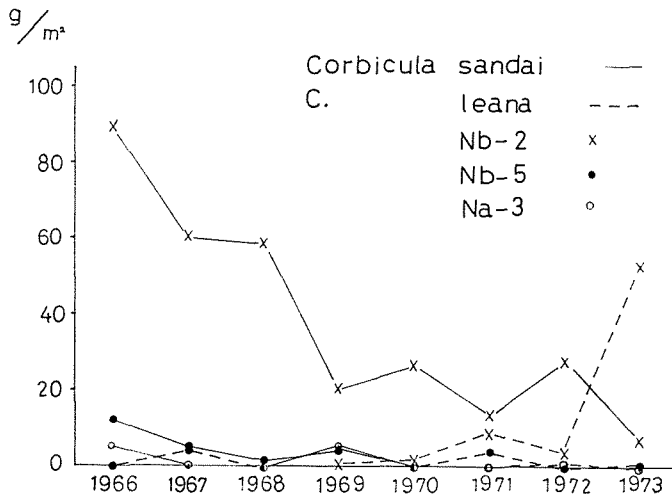


Fig. 5. Changes of average biomasses of *Corbicula sandai* and *C. leana* from 1966 through 1973.

v) Pelecypod mollusc, *Sphaerium japonicum biwaense*

This mussel lives in the muddy substratum, eutrophicated water areas. The tendency of decrease of this small mussel still continued in this year at Nb-2. At Nb-5 the same level of biomass is maintained through these three years (Fig. 6).

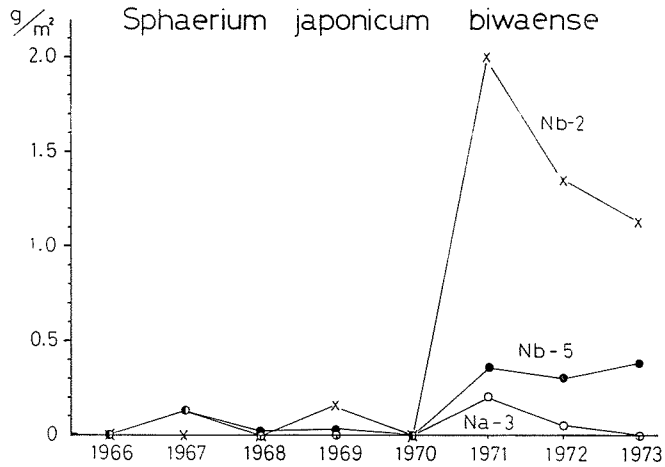


Fig. 6. Change of average biomass of *Sphaerium japonicum* *biwaense* from 1966 through 1973.

3. Chironomid larva, *Chironomus plumosus*

As is seen in Fig. 7 the biomass increased conspicuously at Nb-5.

4. After all, a trend of eutrophication is still seen in some degree, as is shown in the change of corbiculan species, but there is a sign of suspension of eutrophication of lake water, as is seen in decreases of *Oligochaeta* and *Sphaerium*.

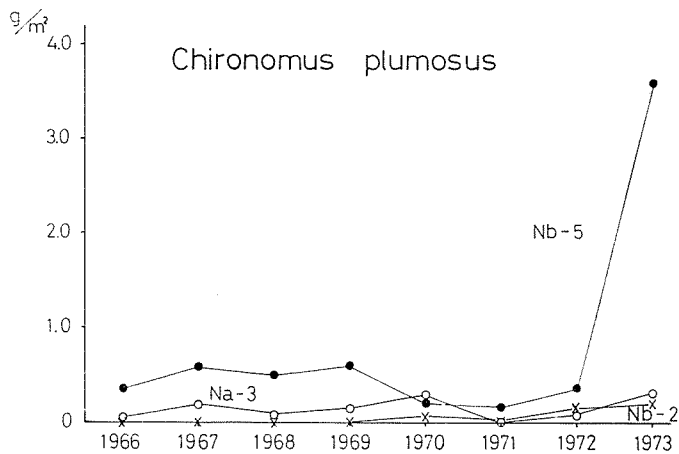


Fig. 7. Change of average biomass of *Chironomus plumosus* from 1966 through 1973.

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