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PLANKTON OF THE LAKES OF THE ISLAND OF ETOROFU (ITURUP)*

BY

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(With six text-figures)

The present paper deals with the plankton collected during the two limnological expeditions in the lakes of the Island of Etorofu, one of the South Kuriles. The materials were obtained in the first expedition of July-August, 1932, by Dr. D. MIYADI in twenty lakes, and in the second of July-September, 1933, by Viscount A. TANAKA and Mr. R. HOSINO in six lakes, three of which left unexplored in the preceding year. On the Cladocera of the first collection a short report was already published by the present writer (UÉNO 1933). I am much obliged to Dr. D. MIYADI and Viscount A. TANAKA, who allowed me to undertake this work. My thanks are also due to Prof. K. AKATSUKA for the identification of some species of algae.

1. Remarks on the Localities

It is not necessary to describe the lakes in detail, as a full account of them was already given by MIYADI (1933). Except the four volcanic lakes: Shibetoro-ko, Urumobetsu-ko Kimonma-numa and Kimonma-pontô, all lakes seem to be a marine relic (sand-dammed type), their water surface lying usually not higher than 10 m above sea level.

Owing to low atmospheric temperature, weak sunshine and also to very heavy winds, the water temperatures of the lakes were low, forming only incomplete stratifications. The stagnation period of the water in these lakes seems to be markedly shortened. The lakes of volcanic origin have the neutral or weakly acid water, while the surface water of the coast-lakes show rather pronounced alkaline reaction, their pH-values being mostly higher than 8.0. The large amounts of total residues were obtained in the coast-lakes, but in the water of volcanic lakes the relatively small amounts of inorganic substances were estimated. N and P were read mostly oligo- or mesotype. Some shallow lakes

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Table I. Lakes of Etorofu¹⁾ (After A. TANAKA and R. Hosino)

Mame of lake	Altitude (m)	Area (sq. m)	Maxi- mum depth (m)	Date*	Temp. °C (surface)	pH**
Shibetoro-ko	173	2,691,000	4.0	3. VIII .33	21.3	7.5 (7.3)
Tôro-numa	c. 3	1,358,000	21.0	17. VII .32	12.1	6.8 (6.9)
Seseki-numa	10	365,750	5.8	20. VII .32	14.8	6.7 (6.5)
Shana-numa	10	993,000	3.0	23. VII .32	17.2	8.1 (7.1)
Rausu-numa	c. 5	2,081,000	12.5	26. VII .32	15.4	8.2 (8.2)
Rubetsu-numa... ..	c. 4	280,000	3.5	27. VII .32	14.6	8.4 (7.2)
Kimonma-numa	9	1,907,500	2.0	9. VIII .32	14.0	6.4 (6.3)
"				29. VIII .33	23.6	6.8 (6.8)
Kimonma-pontô	c. 9	12,750	1.1	30. VIII .33	22.5	6.0 (6.0)
Kamoikotan-numa	c. 4	26,500	50 cm	30. VIII .33	22.5	9.0 (9.0)
Naibo-numa	6	2,636,500	1.2	10. VIII .32	18.4	8.4 (8.4)
Toshimoé-ko	c. 4	4,065,000	15.7	30. VII .32	14.4	7.0 (6.7)
Kimon-numa	c. 8	570,000	5.0	1. VIII .32	14.4	8.2 (8.2)
Yanké-numa	c. 2	200,000	1.8	31. VII .32	14.2	6.5 (6.5)
"				25. VIII .33	20.1	6.5 (6.4)
Rébun-numa	c. 2	610,000	2.0	31. VII .32	13.7	7.3 (7.3)
"				25. VIII .33	19.0	7.2 (6.9)
Urumobetsu-ko	83	5,818,000	48.0	5. VIII .32	11.5	7.0 (6.3)

* Dates indicate the days on which the samples were collected.

** Figures in parenthesis are the values obtained from the bottom-water.

such as Tôro-numa and Seseki-numa, however, preserve a good content of phosphorus. The chemical analyses show that the water of most lakes consumed rather large amounts of KMnO_4 , but there are found no dystrophic lakes in true sense (MIYADI 1933). It is clear that such large quantities of oxygen consumed are not correlated with the humic substances or vegetable extractives in the water. Most of the lakes are the harmonic type and some shallow ones are often in a pronounced eutrophic condition.

1) In the subsequent tables the following abbreviations are used to indicate the lakes.

Si. Shibetoro-ko.	Tr. Tôro-numa.	Se. Seseki-numa.
Sa. Shana-numa.	Ru. Rubetsu-numa.	Ra. Rausu-numa.
Kk. Kamoikotan-numa.	Ka. Kimonma-numa.	Kp. Kimonma-pontô.
Na. Naibo-numa.	Ts. Toshimoé-ko.	Km. Kimon-numa.
Va. Yanké-numa.	Ré. Rébun-numa.	Ur. Urumobetsu-ko.

2. Short Account of the Plankton

1. Shibetoro-ko. Although the plankton-production of this caldera lake was poor, there were found many littoral forms of rotifers and cladocerans, among which was *Notholca striata acuminata* recorded for the first time from the Kuriles. A water-bloom consisting of *Melosira*, *Anabaena* and *Dinobryon* was very slightly developed.

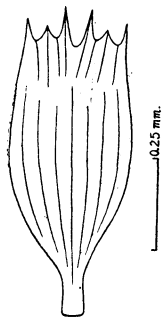


Fig. 1. *Notholca striata acuminata* EHRENBURG.
Dorsal view. Shibetoro-ko (Aug. 3, 1933).

2. Tôro-numa. The plankton is scarcely produced; the collection contained a small number of a calanoid *Eurytemora affinis*, a young form of *Cyclops* and three species of rotifers, but a massive water-bloom of *Anabaena circinalis*.

3. Seseki-numa. A special feature of the plankton in this lake is the occurrence of a large number of *Conochilus unicornis* und *Eurytemora affinis*. Cladocera is represented by a dwarf race of *Bosmina coregoni*. The chief element of the phytoplankton is the floating diatoms of several species, though they are not so abundant as to form a distinct water-bloom.

4. Shana-numa. The plankton-production of this shallow lake is very small, young forms of *Cyclops* and a rotifer *Anuraea cochlearis* being the main components. Two species of Cladocera, *Alona guttata* and *A. costata* were also common. No phytoplankton was found at all in the samples.

5. Rubetsu-numa. The samples contained a large amount of a blue-green alga *Oscillatoria lacustris*. As the zooplankton was secured a young form of *Diaptomus* only.

6. Rausu-numa. The samples were whitish-blue in colour, owing to the floating contorted filaments of *Anabaena circinalis* which was so abundant as to cause a massive water-bloom. Another feature of the plankton is seen in the enormous quantity of *Vorticella campanulata*. This lake is also rich in rotifers and entomostrans.

7. Kimonma-numa. The plankton of this maar obtained in 1932 was represented by only three species of Entomostraca, namely: *Acanthodiaptomus pacificus yamanacensis*, *Bosmina coregoni* and *Daphnia*

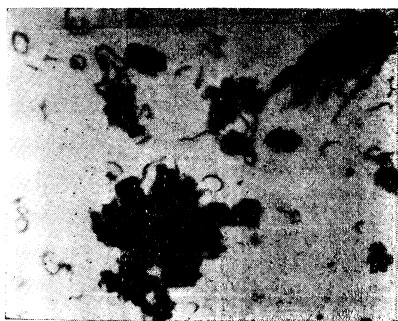


Fig. 2. Plankton of Rausu-numa.
(July 26, 1932)

Water-bloom of *Anabaena circinalis*; *Eurytemora affinis*.

longispina, the first of which was in a large number. The other components were *Anuraea cochlearis* and *Ceratium hirundinella* both in a small quantity. The former rotifer was met with abundantly in the samples of 1933 too, among which a cladoceran *Monospilus dispar* was found for the first time from the Kuriles.

8. Kimonma-pontô. This small lake lies close to the west of Kimonma-numa with a maximum depth of 1.1 m. The plankton-production is rather large, consisting of chiefly a calanoid copepod and a rotifer *Anuraea*, the latter of which is very large in individual numbers (85 % of composition).

9. Kamoikotan-numa. This is a small and very shallow lake (50 cm in maximum depth) fed by cold springs. The plankton is scarcely produced. *Anuraea cochlearis* is the dominant zooplankter. Nevertheless the samples contained a good amount of some benthic species of a diatom genus *Fragilaria*.

10. Naibo-numa. The samples contained rather small quantities of organisms which consisted of six species, among which *Bosmina coregoni* and *Euchlanis dilatata* were the commonest. Of the phytoplankters, a blue-green alga *Coelosphaerium Kützingianum*, a diatom *Fragilaria crotonensis* and many other green algae were common.

11. Toshimoé-ko. In spite of that this lake receives water of Kimon-numa at the southern corner, it differs markedly in the property of the plankton from the latter. The samples were yellowish green, owing to the fertility of plankton-diatoms consisting of chiefly *Melosira granulata*, with profusions of *Asterionella* and *Cyclotella*. The occurrence of some species of Isokontae was also noticed. Of the zooplankters, *Conochilus*, *Asplanchna* and *Anuraea* were present in rather large quantities; a small number of *Polyarthra* and *Ploesoma* were also met with. The Entomostraca, consisted of merely a small number of *Bosmina* and *Cyclops*.

12. Kimon-numa. Kimon-numa is the most interesting among the lakes, as far as the feature of the plankton is concerned. The principal constituents of the zooplankton were *Bosmina coregoni*, *Sinocalanus tenellus*, *Eurytemora affinis* and *Euchlanis dilatata*. This lake is also characterized by the appearance of a race of *Daphnia longispina* with a pointed helmet (UENO 1933). The phytoplankton scarcely yielded, only a small quantity of *Anabaena* having been detected.

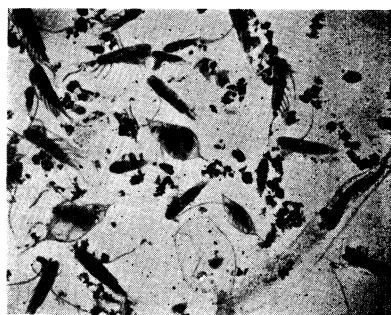


Fig. 3. Plankton of Kimon-numa (Aug. 1, 1932).

Daphnia longispina (galeata), *Leptodora kindtii*, *Bosmina coregoni*, *Sinocalanus tenellus*, *Eurytemora affinis*, *Conochilus unicornis*.

13-14. Yanke-numa and Rebun-numa. Yanke-numa is separated from Rebun-numa by a narrow sandy bar of the River Opépon. The total quantity of the plankton of Yanke-numa is considerably small, containing only five species of organisms in the catches of both years. There occurred two rotifers, *Anuraea cochlearis* and *Ploesoma truncatum*, and a calanoid copepod *Eurytemora affinis*, among which the first two species were relatively common. The plankton of Rebun-numa has a somewhat different appearance from that of Yanke-numa collected on the same day. There were found only a few numbers of *Sinocalanus tenellus* and *Eurytemora affinis* mingling with a large amount of vegetable debris and decayed crustacean shells. A large discoidal marine diatom *Arachnoidiscus Ehrenbergi* was also found in the samples.



Fig. 4. Plankton of Urumobetsu-ko
(Aug. 5, 1932).

Daphnia longispina (primitiva),
Acanthodiaptomus pacificus yamanacensis, Copepodid of *Cyclops* sp.

15. Urumobetsu-ko. As the phytoplankton of this large and deep caldera lake, *Ceratium hirundinella* was only found. The constituents of the zooplankton were principally Crustacea, among which *Daphnia longispina* with a short head and very short spine (UENO 1933) was the most abundant; *Acanthodiaptomus*, *Cyclops* and *Bosmina* were also common. It is of a great ecological interest that the first-named calanoid is deep carrot-red owing to the carotinoid pigments in the body, as was the case with the same species living in Kimonma-numa. This is a common phenomenon to this species living in Japanese volcanic lakes of weakly acid water.

3. General Considerations

1. The Composition of the Plankton. The plankton-organisms found in the collections are listed in Tables IV and V. (Appendix).

Of the 30 species of zooplankters (excepting copepodid), the rotifers are the richest in species (c. 43 %), the Cladocera coming to the next (c. 37 %). None of the eulimnetic forms of Protozoa, especially Rhizopoda were found in the samples. Among the phytoplankton, diatoms are the richest, occurring more than 20 species. Isokontae are also represented by many species, while Myxophyceae have only four eulimnetic representatives. It is also remembered that no species of *Dinobryon* occurred in the lakes examined, excepting Shibetoro-ko,

and that there were seen very few desmids. The percentage composition of the zooplankton of the lakes is given in Table II.

Table II. Percentage Composition of Zooplankton*

	Si.	Tr.	Se.	Sa.	Ru.	Ra.	Kk.	Ka.	Kp.	Na.	Ts.	Km.	Ya.	Ré.	Ur.
Protozoa	o	o	o	o	o	75.0	o	o	o	o	3.8	o	o	o	o
Rotatoria	(28.1)	18.9	64.8	5.7	o	15.9	(99.6)	0.4	(78.4)	72.7	65.5	35.5	68.5	o	17.3
								(73.5)					(97.0)	(100)	
Cladocera	(1.6)	o	4.1	2.5	o	4.1	o	13.9	(2.7)	6.0	19.8	38.0	o	o	69.3
								(0.7)					(1.3)		
Copepoda	(41.7)	81.0	31.2	92.7	100	4.8	o	85.4	(19.0)	19.6	11.0	26.5	32.8	100	12.6
								(3.7)					(1.9)		
<i>Ceratium</i>	(25.8)						(0.6)	0.4							0.8
								(22.1)							

* Including *Ceratium hirundinella*. Bracketed figures show the frequency in 1933.

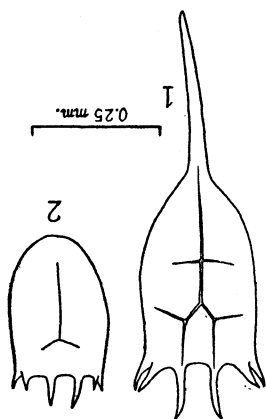


Fig. 5. *Anuraea cochlearis* GOSSE.
Dorsal view.

1. Kimonma-numa; Aug. 29, 1933.
2. Shana-numa; July 23, 1933.

The typical form of this species with a long hind spine is most widely distributed in the lakes of Etorofu.

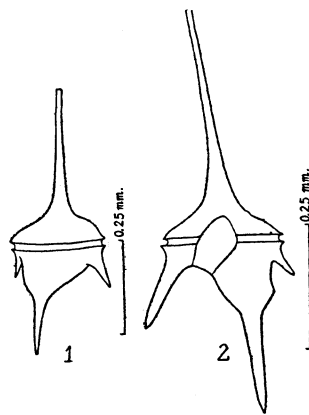


Fig. 6. *Ceratium hirundinella* O. F. MÜLLER.

1. Urumobetsu-ko (Aug. 1932).
2. Shibetoro-ko (Aug. 1933).

Ceratium hirundinella occurring in the lakes of Etorofu belongs to this form (*Austriacum*-form).

2. Biogeography. The plankton fauna and flora of the Island of Etorofu are much more allied to those in Hokkaido than in the North Kuriles, as the writer has already pointed out in the Cladocera-fauna (UÉNO 1933; cf. also UÉNO 1934). With regard to the copepodan fauna this is also true. Three species of Calanoida recorded from Etorofu are common in Hokkaido and Honshu (KIKUCHI 1927 and 1933, KOKUBO 1932), but three species: *Heterocope borealis*, *Diaptomus occidentalis* and *D. angustilobus* found in the North Kuriles were not collected in the lakes of Etorofu. *Acanthodiaptomus pacificus yamanacensis* is the only exception, being distributed throughout Japan, from Kyushu to Paramushir as far north as Kamchatka (KIKUCHI 1927, SMIRNOV 1929).

All rotifers are cosmopolitan species which are distributed in the waters of the Japanese Islands south of Etorofu. There is to be found no biogeographical peculiarity in the phytoplankton; it is represented by wide-spread species in the Northern Hemisphere.

It is noteworthy that a marine relic copepod *Sinocalanus tenellus* (KIKUCHI) inhabits in three lakes of relic nature, such as Tôro-numa, Rausu-numa and Kimon-numa, the waters of which contain similarly richer amounts of chloride than in the other lakes. None of such peculiar boreal elements as discussed by MIYADI (1933) in the macroscopic fauna were not detected in the planktic animals and plants of the lakes of Etorofu.

3. The Stratification ('Biozone'). In the lakes of Etorofu the zooplankters appear to live chiefly in the upper layers, not merely in deeper lakes but in shallower ones also, the richest species in the largest individual numbers being always found in the surface catches. In the deepest lake, Urumobetsu-ko, judging by a series of samples obtained by vertical hauls of a closing-net, the number of plankters is the greatest in the surface layer. The individual numbers of each species at the layer of 10-20 m is about half as many as those at the layer of 0-10 m, and none of them are found at all in the stratum below 17 m. The occurrence of *Bosmina* and *Acanthodiaptomus* is limited to the surface layer only. The latter calanoid is, in Honshu and Hokkaido, always found in either deep lakes with hypolimnion in summer or cold alpine lakes and ponds, while in Etorofu it lives in a shallow lakes Kimon-numa and in the surface layer of a deep lake Urumobetsu-ko. In Paramushir of the North Kuriles, it was obtained even in small bog-pools situated in the sea-coast (UÉNO 1934).

4. Associations and Productivity. The composition of the plankton is highly variable in the different lakes. Of the fifteen lakes, the three of volcanic origin are characterized by the rich production of crustacean plankton

consisting of chiefly *Daphnia*, *Acanthodiptomus* and *Anuraea*. In such lakes the phytoplankton is quite scarce, *Ceratium hirundinella* only occurring in a very small quantity. Among the volcanic lakes, Shibetoro-ko is only exceptional, having many littoral animals and a visible amount of phytoplankton. This must be due chiefly to the shallowness of its basin compared with its large area. On the contrary, most of the lakes situated near the sea coast, the phytoplankton was often observed in immense numbers. Such lakes may conveniently be divided into the following three types:

	Zooplankton	Lake
1. Myxophyceae-Type	Rotifers abundant; <i>Sinocalanus tenellus</i> dominant (exp. Ru.)	{ Tôro, Rubetsu, Rausu, Kimon
2. <i>Melosira-Pediastrum</i> -Type...	Rotifers abundant	Toshimoe
3. <i>Melosira-Coelastrum</i> -Type...	Rotifers abundant	Seseki

While *Anabaena* appeared sufficiently to cause a massive water-bloom in both Rausu-numa and Tôro-numa, in the other two lakes the same blue-green alga was restricted to such an extent that either gives only 'vegetable colouration' to the water or only scarcely grows in water-bloom (Kimon-numa). Seseki-numa and Toshimoe-ko are also in contrast. The water of the former lake was only coloured with the phytoplankton, but in the latter lake *Melosira granulata* multiplied to a vast quantity as to cause a water-bloom. Such various grades of quantities of phytoplankton in these lakes are, I think, due to the individual characters of the basins and some meteorological factors (low temperature, weak insolation, heavy winds) rather than to the amounts of nutritive substances (N, P, Ca, & c) dissolved in lake-water. The eutrophic condition in such shallow lakes is often in pronounced progress, as MIYADI (1933) suggests (cf. also NATHANSSON 1906 and MÜNSTER-STRÖM 1933), owing to some organic matter in solution derived from the bottom-mud, which would be stirred up by heavy winds. On the other hand, however, in some of these lakes the turbulence by winds seems to be too heavy to yield sufficient quantities of plankton, especially phytoplankton.

In Table III are given a series of figures obtained by Mr. HOSINO from surface water of the lakes, together with a rough indication of the nature of the plankton.

Table III. Chemical Analyses of Lake Waters* and Characteristic Plankton

Lake	N	P	SiO ₂	Ca	Cl	Cons. of KMnO ₄	Phytoplankton	Zooplankton
Tr.	0.05	0.19	110.8	0.95	16.7	56.0	<i>Anabaena</i> , ccc.	<i>Sinocalanus</i>
Se.	0.04	0.44	38.4	1.00	13.1	54.4	<i>Coelosphaerium</i> , cc.	
Sa.	0.06	0.07	53.4	0.2	13.1	34.4	nil.	
Ru.	0.06	0.04	52.4	1.3	16.0	48.0	<i>Oscillatoria</i> , c.	
Ra.	0.09	0.09	54.3	2.3	26.9	184.0	<i>Anabaena</i> , ccc.	<i>Sinocalanus</i>
Ka.	0.07	0.04	28.3	2.1	—	72.0	<i>Ceratium</i>	<i>Daphnia</i>
Na.	0.08	0.06	39.1	1.0	13.1	80.0		
Ts.	0.07	0.095	22.0	0.2	13.1	12.0	Diatoms, ccc.	
Km.	0.05	0.02	51.6	1.8	24.8	64.0	<i>Anabaena</i> , c.	<i>Sinocalanus</i> & <i>Daphnia</i>
Ya.	0.05	0.02	3.1	2.1	11.4	72.0	nil.	
Ré.	0.05	0.05	37.9	1.0	8.9	12.0		
Ur.	0.10	0.005	56.3	0.6	—	32.0	<i>Ceratium</i>	<i>Daphnia</i>

* mg per litre.

There is seen an interesting correlation between the two partial productions, the planktic (especially phytoplanktic) and benthic. In ten coast-lakes, in which the larva of *Chironomus plumosus* was a characteristic bottom inhabitant (Miyadi 1933), the phytoplankton usually appeared and was often observed as a vigorous water-bloom. Shana-numa and Naibo-numa are exceptional, though they are of the *plumosus*-type. None of the eulimnetic phytoplankters were found in these lakes, the water of the latter lake being quite clear. This is chiefly due to the effect of heavy winds, since their basins are considerably shallow in most parts compared with their large area. Shallowness as well as the sandyness of the bottom give the similar result to Yanke-numa and Rebun-numa, both of which are the poorest in productions among the lakes of Etorofu, not only plankton but in bottom inhabitants.

(March 10, 1934)

(Ôtsu Hydrobiological Station)

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18. <i>A. quadrangularis affinis</i> (LEYDIG)	...	...	...	...	...	...	...	(+)	...	...	...	(+)	...	...	...	2
19. <i>A. rectangula</i> G. O. SARS	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
20. <i>Chydorus sphaericus</i> (O. F. MÜLLER)	(+)	...	...	...	...	...	...	(+)	...	...	...	...	...	...	...	2
21. <i>Ch. gibbus</i> LILLJEBORG	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
22. <i>Monospilus dispar</i> G. O. SARS	...	...	...	...	...	...	...	(+)	...	...	...	...	...	...	...	1
23. <i>Polyphemus pediculus</i> (LINNÉ)	...	...	...	...	...	...	...	...	(+)	...	...	...	...	...	...	1
24. <i>Leptodora kindtii</i> (FÖCKE)	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	2
COPEPODA																
25. <i>Sinocalanus tenellus</i> (KIKUCHI)	...	+	...	...	...	+	...	...	...	...	...	+	...	...	...	3
26. <i>Eurytemora affinis</i> (POPPE)	...	+	+	...	...	+	...	...	...	...	...	+	+	+	...	6
27. <i>Acanthodiaptomus pacificus yamanacensis</i> BREHM	...	...	...	...	...	...	(+)	+	(+)	...	...	...	...	...	+	4
28. <i>Diaptomus</i> sp. (Copepodid)	(+)	...	...	...	+	...	...	...	...	...	...	...	...	...	...	2
29. <i>Ergasilus</i> sp. (Copepodid)	...	...	...	...	...	...	...	...	(+)	...	...	...	...	...	...	1
30. <i>Cyclops (Diacyclops) crassicaudis</i> G. O. SARS.	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
31. <i>C. (Diacyclops) languidus</i> G. O. SARS.	...	...	...	...	...	...	...	(+)	...	...	...	...	...	...	...	1
32. <i>Cyclops</i> sp. (Copepodid)	...	+	...	+	...	...	...	+	...	+	+	...	+	...	+	(7)
Total	13	6	7	8	1	11	2	8	6	7	11	12	5	2	6	
								(1)								

N. B. Bracketed letters show the occurrence in the samples of 1933.

Table V. Phytoplankton of the Lakes of Etorofu (Iturup)

	Si.	Tr.	Se.	Sa.	Ru.	Ra.	Kk.	Ka.	Kp.	Na.	Ts.	Km.	Ya.	Ré.	Ur.	
BACILLARIOPHYTA																
*1. <i>Melosira varians</i> A. C. AGARDH	...	...	+	...	...	...	...	...	...	...	...	...	...	+	...	2
*2. <i>M. granulata</i> (EHRB.) RALFS	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*3. <i>Cyclotella comta</i> (EHRB.) KÜTZ.	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*4. <i>C. sp.</i>	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*5. <i>Coscinodiscus lacustris</i> GRUN	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	1
6. <i>Arachnoidiscus Ehrenbergi</i>	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
*7. <i>Atheya Zacchariasi</i> J. BRUN	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
*8. <i>Tabellaria fenestrata</i> (LYNGBYE) KÜTZ.	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	1
9. <i>Diatoma sp.</i>	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
*10. <i>D. elongatum</i> AGARDH	(+)	...	+	...	...	...	...	...	...	...	...	...	...	...	...	2
*11. <i>Fragilaria crotonensis</i> KITTON	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
*12. <i>F. capucina</i> DESMAZIÈRES	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
*13. <i>Asterionella formosa gracillima</i> (HANTSCH) HEIBERG	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
14. <i>Synedra ulna</i> EHRENBERG	...	...	+	...	...	...	...	...	...	+	...	...	...	...	...	2
15. <i>S. acus</i> KÜTZ.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
16. <i>S. sp.</i>	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
17. <i>Navicula sp.</i>	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
18. <i>Cymbella (Coconema) sp.</i>	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1

19.	<i>Cymbella tumida</i> (BRÉISSON) VAN HEURICK	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
20.	<i>Gomphonema</i> sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	1
21.	<i>Epithemia turgida</i> (EHRB.) KÜTZ.	...	...	...	...	...	...	...	...	...	+	...	...	...	+	...	...	2
22.	<i>Rhopalodia gibba</i> (EHRB.) MÜLLER	...	...	...	...	...	...	...	...	...	+	...	...	...	+	...	...	2
PERIDINEAE																		
*23.	<i>Peridinium</i> sp.	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	1
*24.	<i>Glenodinium</i> sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	1
*25.	<i>Ceratium hirundinella</i> (O. F. M.)	...	...	...	...	...	...	...	+	...	...	...	...	...	...	+	...	2
MYXOPHYCEAE																		
*26.	<i>Oscillatoria lacustris</i> (KLEB.) GEITLER	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	1
*27.	<i>Celosphaerium Kützianum</i> NÄGELI	...	...	+	...	...	...	...	...	...	+	...	...	...	...	...	...	2
*28.	<i>Anabaena circinalis</i> (KÜTZ.) RABENHORST	...	+	...	...	...	+	...	...	...	...	...	+	...	...	...	...	3
*29.	<i>A. flos-aquae</i> (LYNGBYE)	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
30.	<i>Aphanotheca</i> sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
31.	<i>Tolypothrix</i> sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	1
ISOCONTAE																		
*32.	<i>Ankistrodesmus falcatus</i> (CORDA) RALFS	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	1
*33.	<i>Scenedesmus obliquus</i> (TURPIN) KÜTZ.	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	1
*34.	<i>S. abundans</i> (KIRCHNER) CHODAT	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	1

(Table V, continued).

	Si.	Tr.	Se.	Sa.	Ru.	Ra.	Kk.	Ka.	Kp.	Na.	Ts.	Km.	Ya.	Ré.	Ur.
*35. <i>Coelastrum microstorum</i> NÄGELI	...	...	+	...	...	...	...	...	...	...	...	...	...	...	1
*36. <i>Pediastrum Boryanum</i> (TURPIN) MENEGINI	...	...	...	...	...	...	...	...	...	+	+	...	...	...	2
*37. <i>P. duplex</i> MEYEN	...	...	...	...	...	...	...	...	...	+	+	...	...	...	2
*38. <i>P. d. reticulatum</i> LAGERHEIM	...	...	...	...	...	...	...	...	...	...	+	...	...	...	1
39. <i>Mougeotia</i> sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	+	1
40. <i>Spirogyra</i> sp.	...	...	...	...	...	...	...	...	...	+	...	...	...	+	2
*41. <i>Staurastrum paradoxum</i> MEYEN	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
42. <i>Cosmarium reniforme</i> (RALFS) ?	...	...	...	...	+	...	...	...	...	...	...	...	...	...	1
43. <i>C. granatum</i> BRÉB.	...	...	...	...	+	...	...	...	...	...	...	...	...	...	1
44. <i>Closterium Dianae</i> ?	...	...	...	...	+	...	...	...	...	...	...	...	...	...	1
45. <i>Gonatozygon Brébissonii</i> DEBARY	...	...	...	...	...	...	...	...	...	+	...	...	...	...	1
46. <i>Chodatella quadriseta</i> LEMMERMANN	...	...	...	...	...	...	...	...	...	...	+	...	...	...	1
FLAGELLATEAE															
*47. <i>Dinobryon cylindricum</i> IMHOF	(+)	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Total	3	1	7	0	4	1	0	1	0	20	10	1	0	10	1

N. B. Species marked with an asterisk * are the planktic forms. Bracketed letters show the occurrence in the samples of 1933.