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Tubificids (Oligochaeta, Tubificidae) of northern Lake Baikal

(39)*

by L.N. Snimshchikova

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INTRODUCTION

Up to 1975, we knew of only 10 species of tubificids in Lake Baikal, the endemic species discovered by Michaelsen Rhyacodrilus korotneffi, 1905; R. multispinus, 1905; R. coccineus inaequalis, 1905; Isochaetides baicalensis, 1901; I. arenarius, 1926; Peloscolex inflatus, 1901, and P. werestschagini, 1933; the palearctic species P. velutinus (Grube, 1873), R. multispinus multiovatus discovered by V.S. Burov (1936) in northern Lake Baikal, and the very small Peloscolex kozovi described by Hrabě (1969) on the basis of specimens from M.M. Kozhov's collection.

The data on Baikal tubificids have been added to considerably in recent years. In 1975, O.V. Chekanovskaya described seven new species of tubificids from the abyssal zone: Svetlovia maculata, Rhyacodriloides abissalis, Rhyacodrilus isossimovi, Tubifex taediosus, T. minutus, T. bazikalovae and Peloscolex malevici; the first two are members of new genera.

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*The numbers in the right-hand margin are the pages of the Russian text – translator

Holmquist (1978, 1979) established the new genus Baicalodrilus to which P. kozovi and the new species B. digitatus Holmquist, 1979 were assigned.

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V.P. Semernoi (1982) discovered 4 new species and 3 subspecies of tubificids in Lake Baikal: Isochaetides eximius, I. adenodicystis, Tubifex crassiseptus, T. kessleri baicalensis, T. kessleri variabilis, T. pericraspedifer, T. speciosus vetus and the endemic lycodrilid genus Tubipenifer with two species, T. tendens and T. nitens. The new genus is similar to the genus Limnodrilus Claparede (family Tubificidae) in the structure of the reproductive system.

L.N. Snimshchikova (1982) has described a new genus and 7 new species of tubificids: Lymphachaeta pinnigera, Svetlovia majusculata, Tubifex mirandus, Peloscolex exilis, P. cristatus, P. solitarius and P. falcatus, and has also added to the description of P. malevici Czekanovskaja, 1975.

S. Hrabě (1982) has described 2 new species of Isochaetides: I. excavatus and I. acapillatus. Proceeding from the structure of the genital organs of Lycodrilus dybowskii Grube and L. schizochaetus Michaelsen, he came to the conclusion that these species belong to different genera of the family Tubificidae: Lycodrilus Grube, 1873 and Lycodrilides Hrabě, 1982. He moved Lycodrilus parvus Michaelsen from the family Lycodrilidae into the Lumbriculidae, changing the name of the genus to Pseudolycodrilus Hrabě, 1982.

No special study of the oligochaeta fauna of northern Lake Baikal has ever been carried out in the past. We have information

only on individual species encountered in this area, and among them several forms of tubificids are mentioned. For example, Rhyacodrilus korotneffi, Isochaetides baicalensis, I. arenarius, Peloscolex inflatus and Lycodrilus schizochaetus have been noted in abundance in Boguchansky Bay at a depth of 3-20 m; P. inflatus has been noted in the open part of the lake at a depth of up to 500 m (Burov et al., 1934). Somewhat later, V.S. Burov (1936) discovered Rhyacodrilus multispinus multispinus and R. multispinus multiovatus in northern Lake Baikal. Of the tubificids in the N Baikal sor* we know Tubifex tubifex, Isochaetides baicalensis, I. michaelseni, I. sp., Peloscolex ferox and Lycodrilus schizochaetus (Cherepanov et al., 1977).

In connection with the construction of the Baikal-Amur Mainline railway, the Limnological Institute of the Siberian Department of the USSR Academy of Sciences is conducting a detailed study of the northern Baikal area with the purpose of analyzing the natural condition of the lake and surrounding districts before extensive operations begin in the area.

The shoals of northern Lake Baikal are the result of the river drifts of the two large tributaries of the lake, the Upper Angara and Kichera rivers. As they fall into Lake Baikal, they form a vast delta which is separated from the lake by the N Baikal sor. The sor covers an area of approximately 2300 ha, has a depth of up to 3.5 m, and the predominant substrate is brown mud with a large amount of detritus. During the summer, almost the entire

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*Russ. sor (1. A salina in Kazakhstan and Central Asis; 2. In the Ob river basin the underwater portion of a partly submerged valley), solonchak playa.

area of the sor overgrows with pond weed. The natural boundary between the sor and the lake is a narrow sand bar (Yarki Is.) which is broken through where the rivers fall into the lake. Beginning from the bar, the clean sands (depth 0-20 m) in Lake (41
Baikal are replaced by silted sands (20-50 m) as the depth gradually increases, and these are followed by large- and fine-grained silts (50 m and deepter). At the breaks in the sand bar, the bottom is covered with a substantial layer of detritus, carried out into Lake Baikal by the river current. Rocky bottoms are found only in the littoral zone (depth 0-5 m) along the western and eastern shores where the mountains of the Baikal and Barguzin ranges come right up to the lakeshore. Consequently, the shoals of northern Lake Baikal are affected by the river drainage and the waters of the adjacent areas of the open lake. This area has a complex hydrologic and hydrochemical regime. The conditions in the shoal waters affect the composition of the benthos there. The determination of the faunistic composition and ecology of the organisms populating the bottom (particularly oligochaetes) in this unique area is of unquestionable interest to us, especially as these questions have hardly been touched upon in previous investigations.

Up to now, we have always believed that the Lumbriculidae occupy first place among the Oligochaeta in the diversity of species and abundance. As our investigations have shown, the major role in the shallows of northern Lake Baikal belongs to the Tubificidae. Our great lack of knowledge of Baikal tubificids and the numerous finds of tubificids at the very beginning

of our investigations prompted us to devote special attention to the study of oligochaetes of the family Tubificidae. In the study area, we discovered 53 taxa of tubificids, 17 of them new to science (including 14 species, 3 subspecies, 2 genera and one subgenus). The descriptions of some of them have already been published (Snimshchikova, 1982). The descriptions of four species and one genus are in press. Two species, Rhyacodrilus sibiricus Semernoj, 1971 and Tubifex hubsugulensis Semernoj, have been noted in Lake Baikal for the first time.

MATERIAL AND METHOD

The material for the present study consisted of oligochaete specimens collected from the benthos (M.Yu. Bekman et al.) around the northern extremity of Lake Baikal. The material was collected during the open-water periods (June—October) of 1975-1979. Depths from 0 to 500 m were studied, and several samples were also taken from the N Baikal sor. The material was collected with Petersen dredges with a working area of 1/10 m^2 and 1/40 m^2, a drag net and a trawl, and with a lift net by a diver. Approximately 300 samples were processed. The use of a large number of quality specimens enabled us to cover the populations of the species more extensively, and to find scarce and rare forms. The material was collected during different seasons in order to record the different stages of sexual maturation in the oligochaetes. The latter were fixed with a solution of 4% Formalin and 70% alcohol.

Whole-mount preparations of oligochaetes and their genital organs in glycerin and balsam were prepared for species determination. Series of paraffin sections 4-6 μm thick and stained

by Mallory's method were also prepared to study the internal morphology.

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ECOLOGICAL-SYSTEMATIC REVIEW OF THE TUBIFICIDAE OF NORTHERN LAKE BAIKAL

Genus Rhyacodrilus Bretscher, 1901

1. Rhyacodrilus isossimovi Czekanovskaja, 1975

Occurrence. A widely distributed species in the study area, in our collections found at depths of 2-500 m. Commonly found at considerable depths (over 20 m), prefers soft muddy bottoms, much scarcer on clean or slightly silted sand with rocks. Forms populations of average density (200-500 specimens/m^2), rarely encountered singly. Mature specimens noted in July—October.

The species was first described by O.V. Chekanovskaya (1975) from the abyssal zone of Lake Baikal, from depths of 512-1610 m, but it has also been encountered by her at smaller depths (100-330 m). O.V. Chekanovskaya believes that Rh. isossimovi, which is similar to Rh. stephensoni Cernosvitov from Tibet, may eventually be found beyond Lake Baikal, in Asian water bodies, but so far we are inclined to regard this species as an endemic one.

2. Rhyacodrilus korotneffi (Michaelsen, 1905)

Occurrence. Constantly encountered in northern Lake Baikal at depths of 2-205 m on clean and silted sand, on mud with detritus and on silt. Prefers soft muddy bottoms with a substantial admixture of detritus. Attains an abundance of 190 specimens/m^2, mostly 50-80 specimens/m^2. Mature specimens were encountered in July-October.

An endemic described by Michaelsen (1905) from the material of A.A. Korotnev's Baikal expedition (1900-1902). Noted by

A.A. Noskova (1967) in the Selenga area, by T.V. Akinshina and I.F. Lezinskaya (1978, 1980) in southern Lake Baikal in the vicinity of Utulik-Murino, and by T.Ye. Shidlovskaya (1981) in the Maloye More channel. It is also known from the Yenisei Basin (Chekanovskaya, 1956) and the Bratsk Reservoir (Akinshina, Tomilov, 1976).

3. Rhyacodrilus multispinus multispinus (Michaelsen, 1905)

Occurrence. Opposite Yarki Is., at a depth of 3 m, in fine sand (4 specimens, 2 mature ones); in Dagarskaya Bay, at a depth of 2.5 m, in sand (one specimen); Dagarskaya Bay, at a depth of 10 m, in sand and rocks (11 specimens, 4 mature ones).

An endemic, known from northern Lake Baikal (Michaelsen, 1905; Burov, 1936), from the Selenga area (Noskova, 1967), Maloye More (Semernoi, Shidlovskaya, 1981) and the Bratsk Reservoir (Akinshina, Tomilov, 1976). (43

4. Rhyacodrilus multispinus multiovatus Burov, 1936

Occurrence. Discovered at various points of northern Lake Baikal (near the Chuka R., at Nizhneangarsk, near Yarki Is., in the Kichera estuary, near Cape Irexocon and in Dagarskaya Bay) at depths of 2-30 m on clean sand amidst rocks, on sand with detritus, slightly silted sand, and on mud with detritus.

An endemic, for the first time described by V.S. Burov (1936) from northern Lake Baikal from sandy bottoms at depths of up to 11 m. Later noted in the Selenga area (Noskova, 1967), in southern Lake Baikal (Akinshina, Lezinskaya, 1978, 1980) and in the Angara (Tomilov et al., 1977).

5. Rhyacodrilus sibiricus Semernoj, 1971

Occurrence. Mouth of the Upper Angara, between sand bars, depth 1 m, large-grained sand, plants (1 specimen); Dagarskaya Bay, depth 134 m, clay (1 specimen, mature); Cape Irexocon, depth 196 m, gray mud (3 specimens, mature).

Species described by V.P. Semernoi (1971) from water bodies of Transbaikal area. Found in the Istoksky sor in Lake Baikal (Snimshchikova, 1977).

6. Rhyacodrilus coccineus (Vejdovsky, 1875)

Occurrence. Yarki Is., depth 50 m, mud with detritus (one specimen); Cape Irexocon , depth 60 m, large-grained clean sand, fragments of yellow clay (12 specimens, 4 mature ones).

Palearctic species, earlier known from the shallow zone and adjacent areas of Lake Baikal (Michaelsen, 1905, 1930; Noskova, 1967; Snimshchikova, 1977).

Genus Pararhyacodrilus Snimstschikova, gen. n.

7. Pararhyacodrilus aspersus Snimstschikova, sp. n.

Occurrence. Northern Lake Baikal, near Cape Kurla (north of the port), depth 2 m, stones and pebbles covered with sponge (12 specimens, 8 mature ones).

The description of the new genus and new species is in the press.

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Genus Rhyacodriloides Czekanovskaja, 1975

8. Rhyacodriloides abissalis abissalis Czekanovskaja, 1975

Occurrence. One of the characteristic inhabitants of the open parts of Lake Baikal. We have encountered it in the most diverse biotopes at depths from 10 to 360 m (Sosnovaya Bank,

depth 270-360 m; Capa Frolov, depth 50 m; Cape Kurla , depth 50-205 m; Cape Birakan, depth 200-300 m; Dagarskaya Bay, depth 60-200 m; Toshka ravine, depth 18-33 m; Yarki Is., depth 10-20 m). Prefers sandy substrates, silted to various degrees. Maximum abundance 350 specimens/m^2. Mature specimens noted in July-September.

Endemic of Lake Baikal, described by O.V. Chekanovskaya (1975) from the abyssal zone from depths of 552-1610 m. Known from southern Lake Baikal from depths of 5-130 m (Akinshina, Lezinskaya, 1978, 1980).

9. Rhyacodriloides abissalis irexoconi[1] subsp. n.

Occurrence. Near Cape Irexocon, depth 20 m, large-grained, slightly silted sand, rocks, 16 August 1976 (4 specimens, including one mature specimen); near Chuka R., depth 10 m, rocks, stones, 8 August 1976 (3 mature specimens).

Distinguished from the nominative subspecies by the following characters: anterior four segments biannulate, setae of dorsal and ventral bundles similar, forked, with short teeth, distal tooth shorter than proximal one. Single-toothed setae are not encountered.

Genus Svetlovia Czekanovskaja, 1975

10. Svetlovia maculata Czekanovskaja, 1975

Occurrence. Distributed throughout the northern Baikal area at depths of 15-430 m, confined mainly to muddy substrates with detritus. Only in three cases did we encounter this species on

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[1]Subspecies named after its place of occurrence near Cape Irexocon.

large-grained sand, pebbles and gravel (Depth 20-50 m). Maximum abundance 520 specimens/m^2, usually 10-100 specimens/m^2. Mature specimens noted in July-August.

An endemic of Lake Baikal, inhabits the abyssal zone. Genus and species described by O.V. Chekanovskaya (1975) from a single specimen (anterior region of body) found on a muddy substrate at a depth of 680 m. T.V. Akinshina and I.F. Lezinskaya (1978, 1980) have noted this species in southern Lake Baikal (Utulik-Murino area) at a depth of 50-100 m.

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11. Svetlovia majusculata Snimstschikova, 1982

Snimshchikova, 1982: 88-90, fig. 2.

Occurrence. Northern Lake Baikal, mouth of the Kichera R., depth 32 m, mud with detritus, 7 July 1975 (2 mature specimens).

12. Svetlovia sp. n.

Occurrence. Northern Lake Baikal, near Yarki Is., depth 53 m, mud with detritus (7 specimens, 2 of them mature).

Description of new species in press.

Genus Lymphachaeta Snimstschikova, 1982

13. Lymphachaeta pinnigera Snimstschikova, 1982

Snimshchikova, 1982: 86-88, fig. 1.

Occurrence. Northern Lake Baikal, near Cape Kurla, depth 50-70 m, mud, large-grained sand (25 specimens, 10 of them mature).

Genus Isochaetides Hrabě, 1975

14. Isochaetides arenarius Michaelsen, 1926

Occurrence. In northern Lake Baikal encountered at depths of 5-260 m on mud with detritus, on silted sand, clean sand and on rocks. Most common near river estuaries at depths of 5-20 m

on mud with detritus. Rarely encountered singly, usually in numbers of 100-500 specimens/m^2. Sometimes form concentrations of up to 2700 specimens/m^2. Mature specimens noted in July-October.

An endemic, many times noted in Lake Baikal (Michaelsen, 1926; Michaelsen, Verestschagin, 1930; Kozhov, 1947; Akinshina, Lezinskaya, 1978, 1980). Noted in the Posol'sky sor (Noskova, 1967), in the Bratsk Reservoir (Akinshina, Tomilov, 1976).

15. Isochaetides baicalensis Michaelsen, 1901

Occurrence. N Baikal sor, depth 1.4 m, mud, detritus, vegetation (15 specimens, 7 mature); Kichera estuary, depth 22 m, mud, detritus (45 specimens, 10 mature); near Yarki Is. (closer to Nizhneangarsk), depth 20 m, mud, some detritus (6 specimens, 2 mature).

An endemic, known from southern Lake Baikal from depths of 4-13 m (Michaelsen, 1901; Michaelsen, 1905), from northern Lake Baikal from depths up to 250 m (Noskova, 1967), from the N Baikal sor (Cherepanov et al., 1977), noted in the Bratsk Reservoir (Akinshina, Tomilov, 1976). (46)

16. Isochaetides eximius Semernoj, 1982

Occurrence. Common for northern Lake Baikal, encountered everywhere at depths from 2 to 205 m, prefers mud with detritus. Abundant, up to 330 specimens/m^2.

Endemic of Lake Baikal, described by V.P. Semernoi (1982) from Barguzin Bay from a depth of 24 m.

17. Isochaetides adenodicystis Semernoj, 1982

Occurrence. The most widely distributed species among the tubificids in the study area. Inhabits the most diverse biotopes at depths from 2 to 360 m, but obviously prefers muddy substrates

with detritus. Abundant, forms concentrations up to 5040 specimens/m^2.

Endemic of Lake Baikal, described by V.P. Semernoi (1982) as an abundant species from Barguzin Bay from depths of 20-102 m.

18. Isochaetides sp_1.

Occurrence. Encountered in the Tyya, Kichera and Upper Angara estuaries, near Yărki Is. and in Dagarskaya Bay at depths from 2 to 108 m, mainly on muddy substrates; in two cases encountered on sand and pebbles. Attains an abundance of 1640 specimens/m^2.

19. Isochaetides sp_2.

Occurrence. Found near the Toshka ravine, near Nizhneangarsk, at capes Kurla and Irexocon and in Dagarskaya Bay at depths of 5-100 m. Confined mainly to rocky and sandy substrates silted to various degrees, less commonly encountered on mud with detritus. Maximum abundance 440 specimens/m^2.

20. Isochaetides sp_3.

Occurrence. Kichera estuary, depth 200 m, mud with detritus (12 specimens, 4 mature).

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21. Isochaetides sp_4.

Occurrence. Toshka ravine, Kichera estuary, Yarki Is., Upper Angara estuary, Dagarskaya Bay, Cape Irexocon at depths of 2.5-198 m. Encountered on mud with detritus, silted and clean sand, clay. Maximum abundance 1120 specimens/m^2.

Some taxa of this genus, which we have denoted as "species", were previously unknown in Lake Baikal. All of them are apparently closely related sympatric species and subspecies. Further detailed investigations will enable us to establish the degree of their

relationship and the direction in which speciation progressed in this group.

Genus Tubifex Lamarck, 1816

22. Tubifex kessleri variabilis Semernoj, 1982

Occurrence. One of the dominant species of tubificids in northern Lake Baikal. Encountered at depths of 2-260 m, prefers sandy substrates at depths from 2 to 20 m where it displays a clearly defined patchy distribution and abundance from 50 to 9480 specimens/m^2.

A Baikal subspecies similar to T. kessleri Hrabě (1962) from Lake Onega, described by V.P. Semernoi (1982). According to this author, it is found throughout Lake Baikal, it goes into the Angara R., and it is encountered in abundance in the Bratsk Reservoir.

23. Tubifex kessleri baicalensis Semernoj, 1982

Occurrence. In northern Lake Baikal, a widely distributed form encountered at depths from 5 to 360 m. Confined mainly to muddy substrates with detritus, less common on silted and clean sand. Maximum abundance 2630 specimens/m^2.

This subspecies also belongs to the group T. kessleri Hrabě described by V.P. Semernoi (1982) as an abundant species from southern and central Lake Baikal from depths of 15-30 m.

In our collections, these two subspecies are rarely encountered together in the same sample. We have observed their inter-replacement many times. They are often abundant in neighbouring biotopes. At the same time, T. kessleri baicalensis is usually found deeper than T. kessleri variabilis.

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24. Tubifex mirandus Snimstschikova, 1982

Snimshchikova, 1982: 90-92, fig. 3.

Occurrence. At the northern extremity of Lake Baikal, 1 km from the shore, depth 11 m, rocks, slightly silted large-grained sand (20 specimens, 5 mature).

25. Tubifex minutus Czekanovskaja, 1975

Occurrence. Encountered quite frequently in northern Lake Baikal. Discovered at depths from 2 to 360 m on mud with detritus, on silted sand and on sand with gravel. Encountered mostly in small numbers, 10-30 specimens/m^2. Maximum abundance 310 specimens/m^2.

An endemic species, extends into the abyssal zone, described by O.V. Chekanovskaya (1975) from depths of 512-1350 m.

26. Tubifex necopinatus sp. n.

Occurrence. Opposite the Toshka ravine, 1.5 km from the shore, depth 15 m, slightly silted large-grained sand (4 specimens, 3 mature); Cape Kurla, depth 50 m, gray slurry with small-grained sand (2 specimens, 1 mature).

T. necopinatus is similar to T. minutus in appearance. It is distinguished from it by a much smaller size; the sperm in the spermathecae is not formed into spermatozeugmata. This is apparently one of the transitional forms from the "lower" tubificids to the "higher" ones.

27. Tubifex hubsugulensis Semernoj, 1980

Occurrence. Discovered at depths from 11 to 220 m on silted sand, on sand with gravel and on mud with detritus in many parts of northern Lake Baikal (opposite the Toshka ravine, near Nizhneangarsk, off Yarki Is., in Dagarskaya Bay, near capes Birakan,

Irexocon and Kurla, in the Tyya estuary). Abundance 10-200 specimens/m^2.

The species was described by V.P. Semernoi (1980) from Lake Hubsugul in Mongolia. It has been noted in Lake Baikal for the first time.

28. Tubifex bazikalovae bazikalovae Czekanovskaja, 1975

Occurrence. In northern Lake Baikal, a widely distributed species at depths from 10 to 360 m. Confined to muddy substrates with detritus, but is also encountered on silted sand, gravel. Maximum abundance 320 specimens/m^2. (49

An endemic, described by O.V. Chekanovskaya (1975) from depths of 328-1300 m.

29. Tubifex bazikalovae aliguantulus subsp. n.

Occurrence. Found at depths from 10 to 200 m on fine-grained muds with small detritus in the Tyya estuary, near Cape Kurla, the Toshka creek valley, Yarki Is. and Cape Irexocon. Abundance up to 160 specimens/m^2.

Distinguished from the nominative subspecies by a smaller size; hairlike setae in dorsal bundles begin from segments III-V, or even from segments II-III (in T. bazikalovae bazikalovae from segment VII). Reproductive system has the same structure.

30. Tubifex bazikalovae grandis subsp. n.

Occurrence. Found near Yarki Is. during different periods at a depth of 20-50 m on silted sand and on mud with detritus.

The distinguishing feature of this subspecies is the presence of hairlike setae only in the dorsal bundles of the postlarval segments. The structure of the reproductive system is the same as in the nominative subspecies.

31. Tubifex bazikalovae crassiseptus (Semernoj, 1982)

Occurrence. Frequently encountered in different parts of northern Lake Baikal at depths of 5-198 m on silted and on clean sand, on sand with gravel, and on mud with detritus. Attains a density of 1300 specimens/m^2.

Described by V.P. Semernoi (1982) as the species Tubifex crassiseptus from Lake Baikal. It is similar to T. bazikalovae Czek. in a number of characters, but is distinguished from it by the absence of hairlike and flabellate setae, a longer vas deferens, and by the form of the penial sheath. Semernoi notes that T. crassiseptus will be regarded as a subspecies of T. bazikalovae if intermediate forms of these two species are found. The two subspecies described above are those transitional forms. (50
Consequently, we now have another example of divergence in the Baikal oligochaetes (tubificids), which is observed here at the level of subspecies.

32. Tubifex speciosus vetus Semernoj, 1982

Occurrence. Upper Angara estuary, depth 19 m, sandy mud (3 specimens); Dagarskaya Bay, depth 10 m, sand and rocks (50 specimens); off Cape Kurla, depth 20 m, slightly silted gravel (27 specimens, 7 mature); near the Toshka creek valley, depth 105 m, black-gray mud with detritus (1 mature specimen), Tyya R. estuary, depth 500 m, brown pelogene (3 specimens, 2 mature).

V.P. Semernoi (1982) has assigned the Baikal specimens to the subspecies of T. speciosus Hrabě (1931); they have the same hairlike setae and the same structure of the reproductive system. Semernoi believes that T. speciosus is a relict species which

has been preserved from the preglacial epoch in large bodies of water such as Lake Ochrida (Hrabě, 1931), the Black Sea (Finogenova, 1972) and Lake Baikal.

33. Tubifex tubifex (Müller, 1773)

Occurrence. N Baikal sor, depth 1.4 m, mud, detritus, vegetation (10 mature specimens).

A cosmopolitan species, known from the littoral-sor zone and from the shallow areas of Lake Baikal (Noskova, 1967; Cherepanov et al., 1977). T.V. Akinshina and I.F. Lezinskaya (1978, 1980) have noted this species in southern Lake Baikal, in the vicinity of Utulik-Murino at depths of 5-100 m, in areas affected by anthropogenic factors.

34. Tubifex sp.

Occurrence. In northern Lake Baikal found at depths of 5-220 m on silted gravel, slightly silted sand, and on mud with detritus. Abundance up to 700 specimens/m^2. The given form could not be identified to the species because of the absence of mature specimens.

Genus Psammoryctides Hrabě, 1964

35. Psammoryctides sp.

Occurrence. Dagarskaya Bay, depth 10 m, sand and rocks (1 specimen); near Cape Kurla, depth 20 m, slightly silted gravel (1 specimen); opposite Yarki Is., depth 180 m, mud with detritus (1 mature specimen). Not yet identified to the species.

(51

Genus Peloscolex Leidy, 1852

36. Peloscolex inflatus (Michaelsen, 1901)

Occurrence. Kichera estuary, depth 50 m, dark clayey mud with detritus (9 specimens); Upper Angara estuary, depth 1 m,

sand, vegetation (1 specimen); Dagarskaya Bay, depth 5 m, sand, some large detritus (2 mature specimens).

An endemic, noted in Lake Baikal many times (Michaelsen, 1901; Noskova, 1967; Akinshina, Lezinskaya, 1978, 1980). Also known from the Bratsk Reservoir (Akinshina, Tomilov, 1976).

37. Peloscolex malevici Czekanovskaja, 1975

Chekanovskaya, 1975: 128-129, fig. 7; Snimshchikova, 1982: 92-93, fig. 4.

Occurrence. Northwestern and western parts of shallow areas in the Tyya estuary, off Cape Kurla, near the Chuka R., near the Toshka ravine , near Nizhneangarsk, in the Kichera estuary, off Yarki Is. and in the Upper Angara estuary. Found at depths from 2 to 500 m, confined mainly to muds with detritus, much scarcer on rocks and on small-grained silted sand with detritus. Only one specimen found off the eastern shore at Cape Irexocon, at a depth of 20 m.

An endemic, described by O.V. Chekanovskaya (1975) from the abyssal zone with muddy substrates from a depth of 470-1450 m. The species was described by Chekanovskaya strictly on the basis of external characteristics due to the absence of sufficient material which was later provided by L.N. Snimshchikova (1982).

38. Peloscolex exilis Snimstschikova, 1982

Snimshchikova, 1982: 93-95, fig. 5.

Occurrence. Distributed along the western and eastern shores of northern Lake Baikal at depths of 10-500 m, predominantly on muddy substrates with detritus. Encountered mostly at depths exceeding 100 m.

39. Peloscolex cristatus Snimstschikova, 1982

Snimshchikova, 1982: 95-96, fig. 6.

Occurrence. Distributed throughout the water area of the northern extremity of Lake Baikal at depths from 10 to 500 m. Prefers muddy substrates at a depth exceeding 50 m where the abundance amounts to 180 specimens/m^2.

(52)

40. Peloscolex falcatus Snimstschikova, 1982

Snimshchikova, 1982: 98-99, fig. 8.

Occurrence. Near Yarki Is., depth 18 m, mud with sand. Only 2 immature specimens.

41. Peloscolex bekmani Snimstschikova, sp. n.

Occurrence. Near Yarki Is., depth 10-20 m, silted small-grained sand; near Cape Irexocon, depth 10-12 m, large-grained slightly silted sand, gravel. 32 immature specimens.

Description of new species in press.

42. Peloscolex solitarius Snimstschikova, 1982

Snimshchikova, 1982: 96-98, fig. 7.

Occurrence. Kichera estuary, depth 10 m, silted sand (1 mature specimen).

43. Peloscolex discolor Snimstschikova sp. n.

Occurrence. Northern Lake Baikal, Sosnovaya Bank, depth 270-360 m, dark brown mud (20 specimens, 6 mature).

Description of new species in press.

44. Peloscolex paradoxus Snimstschikova, sp. n.

Occurrence. In the study area widely distributed at depths of 5-200 m on various types of soft substrates. Abundance amounts to 1960 specimens/m^2.

Description of new species in press.

45. Peloscolex digitatus (Holmquist, 1979)

Occurrence. In northern Lake Baikal encountered at depths of 7-200 m on soft substrates of various types. Maximum abundance 640 specimens/m^2.

Endemic of Lake Baikal, described by Holmquist (1979) as a new species of the new genus Baicalodrilus Holm. Mature specimens of this species encountered frequently in our material. Since it is very similar to P. cristatus and P. werestschagini Michaelsen in a number of characters, we have left it in the genus Peloscolex.

(53)

46. Peloscolex ferox (Eisen, 1879)

Occurrence. N Baikal sor, depth 1.4 m, mud, detritus, vegetation (1 specimen).

A palearctic species, in Lake Baikal known from the littoral-sor zone and the mouths of the rivers and creeks falling into the lake, mainly along the northern and northeastern shore (Okuneva, 1970, 1972; Cherepanov et al., 1977). Not encountered in the open parts of Lake Baikal.

47. Peloscolex sp.

Occurrence. Encountered in many parts of the northern Baikal shallow zone at depths of 5-100 m on clayey mud with detritus, on mud with sand, on silted and clean sand and on sand with gravel. Not identified to the species because of the absence of mature specimens.

Genus Lycodrilus Grube, 1873

48. Lycodrilus dybowskii Grube, 1873

Occurrence. Opposite the middle of Yarki Is., depth 10 m, mud with fine-grained sand; off Yarki Is. closer to the mouth of

the Upper Angara, depth 5-18 m, sand; Dagarskaya Bay, depth 55 m, silted sand underlain by clay; off Cape Birakan, depth 10 m, large-grained sand; off Cape Kurla, depth 17 m, silted gravel. Species not abundant, most often encountered singly.

An endemic, known from Lake Baikal from data provided by Grube (1873), Michaelsen (1901, 1902, 1905, 1926), Noskova (1967), Akinshina and Lezinskaya (1978, 1980). Outside Lake Baikal, indicated by O.V. Chekanovskaya (1956) for the middle reaches and delta of the Yenisei R.

49. Lycodrilus schizochaetus Michaelsen, 1905

Occurrence. In northern Lake Baikal encountered everywhere at depths of 1.5-360 m, prefers silted sandy substrates, also commonly found on mud with detritus. Abundance usually 10-50 specimens/m^2, in some cases up to 224 specimens/m^2.

An endemic, known in Lake Baikal from depths of 5-100 m (Michaelsen, 1901, 1903, 1905; Noskova, 1967; Akinshina, Lezinskaya, 1978, 1980). Noted in the Posol'sky, Istoksky and N Baikal sors (Noskova, 1967; Snimshchikova, 1977; Cherepanov et al., 1977) and in the Bratsk and Ust Ilim reservoirs (Yerbayeva et al., 1975; Akinshina, Tomilov, 1976).

(54

50. Lycodrilus grubei Michaelsen, 1905

Occurrence. Encountered during different periods in the Tyya estuary at a depth of 7 m on fine-grained slightly silted sand; off Cape Kurla a a depth of 20 m on silted gravel; near the Toshka creek valley at a depth of 20 m on compact silt with sand; near Nizhneangarsk at a depth of 14 m on silted sand and at a depth of 23 m on mud with detritus; off Yarki Is. at a depth

of 10-20 m; in the Upper Angara estuary at a depth of 20 m on mud with sand. Maximum abundance 130 specimens/m^2.

An endemic, known from Lake Baikal from the data provided by Michaelsen (1905) and Kozhov (1947).

51. Lycodrilus sp. n.

Occurrence. Tyya estuary, depth 11 m, large-grained slightly silted sand (2 specimens); near the Toshka creek valley, depth 105 m, black-gray mud with detritus (60 specimens, 4 mature); Kichera estuary, depth 10 m, small-grained sand with detritus (1 mature specimen); off Yarki Is., depth 14 m, small-grained clean sand (5 specimens); Dagarskaya Bay, depth 134 m, mud underlain by clay (1 specimen); off Cape Irexocon, depth 10-12 m, large-grained slightly silted sand, gravel (3 specimens).

Apparently, this is the smallest member of the genus Lycodrilus (body length approximately 2 mm); it is distinguished from the known species by the presence of spermathecal setae arranged 2 to a bundle.

Genus Tubipenifer Semernoj, 1982

52. Tubipenifer tendens Semernoj, 1982

Occurrence. Distributed in northern Lake Baikal at depths of 5-120 m on clayey and sandy mud, often with a mixture of detritus, and on silted and clean sand. Maximum abundance 130 specimens/m^2, mostly 20-60 specimens/m^2.

Endemic genus and species described in 1982 by V.P. Semernoi with an indication of occurrence (Barguzin Bay, near Baikalsk, near Nizhneangarsk, near Bugul'deyka at a depth of up to 30 m).

53. Tubipenifer nitens Semernoj, 1982

Occurrence. Off Yarki Is., depth 50 m, mud with detritus (1 specimen).

An endemic described by V.P. Semernoi (1982 from Barguzin Bay from a depth of 20 m.

T. tendens and T. nitens are related species, but already quite different morphologically. Both are very similar to the species of the genus Limnodrilus Claparede (family Tubificidae) and may be phylogenetically related to them. (55)

Tubificids are the most common and prolific group of the acquatic oligochaetes. They include both freshwater forms that inhabit different types of substrates, as well as brackish-water and marine forms. Phylogenetically, the Tubificidae are closest of all to the Naididae from which they are derived (Michaelsen, 1921, 1928, 1930; Chekanovskaya, 1962). At the same time, the Tubificidae are similar to the Enchytraeidae, though the interrelations between these groups are more complex, i.e. the enchytraeids have diverged in another direction as to their specialization. O.V. Chekanovskaya believes that the Enchytraeidae represent a lateral branch leading from the Naididae to the Tubificidae.

The large Tubificidae family combines genera of different levels of organization. It includes genera with primitive structural features, which are the closest to the Naididae (Aulodrilus, Epirodrilus, Rhyacodrilus, Monopylephorus - the "lower" tubificids), as well as genera with progressive development of the male genital system (Isochaetides, Limnodrilus, Tubifex, etc. - the "higher" tubificids). In the family Tubificidae, Stephenson (1930) has

singled out a group of genera with a separate prostatic gland and a group of genera without one. Hrabě (1954) has suggested dividing the family Tubificidae into two subfamilies: Rhyacodrilini with the genera Rhyacodrilus, Bothrioneurum and Epirodrilus in which the absence of a separate prostatic gland is correlated with the presence of large granular coelomic bodies, and Tubificini which includes the rest of the genera. Later, Hrabě (1967) divided the family Tubificidae into five subfamilies: Aulodrilinae, Rhyacodrilinae, Tubificinae, Telmatodrilinae and Branchiurinae. According to O.V. Chekanovskaya (1972), Hrabě's grouping of the tubificid genera is the first serious attempt to give a visible form to the variegated diversity of the different and freely intercombining characters and trends of specialization observed in the tubificids. O.V. Chekanovskaya supports and hopes to improve Hrabě's division of the family Tubificidae into subfamilies she disagrees with his establishment of the genus Telmatodrilus as a separate subfamily, and suggests that the genus Bothrioneurum be established as the subfamily Bothrioneurunae. She believes that it is somewhat premature to establish these groups of genera as subfamilies. This will require further detailed study of the morphology of the Tubificidae family which is characterized by a high plasticity of organization.

In Chekanovskaya's opinion (1972), the taxonomy of the Tubificidae at the present level of knowledge is in a state of chaos. The literature contains a multitude of inconsistent data regarding synonymy, the generic assignment of species and a number of other taxonomic problems. This also applies to the tubificids of Lake Baikal. (5)

V.V. Izosimov (1972) has described a new species of tubificids, Limnodrilus infundibuliferus, from the abyssal zone of Lake Baikal. It was assigned to the genus Limnodrilus strictly on the basis of its external characters (forked setae and a funnel-shaped chitinous penial tube). Izosimov maintains that the presence of a chitinous penial tube, which is typical of the genus Limnodrilus, distinguishes it from the genus Isochaetides.

V.P. Semernoi (1982) has described two new subspecies of Tubifex kessleri Hrabě from the small depths of Lake Baikal, T. kessleri baicalensis and T. kessleri variabilis. As in L. infundibuliferus, the dorsal and ventral bundles of the second subspecies contain only forked setae, there are no hairlike or flabellate setae, and a funnel-shaped chitinous penial tube is present. The differences between the given taxa lie in a greater number of setae in a bundle and their larger size.

Isochaetides acapillatus, described by S. Hrabě (1982) from southern Lake Baikal, has the same type of chitinous penial tube as T. kessleri variabilis, but for some reason the author has assigned it to the genus Isochaetides. This appears even stanger since the same author (Hrabě, 1962) described the nominative subspecies T. kessleri kessleri from Lake Onega. I. acapillatus and T. kessleri variabilis bear other similarities as well, i.e. they have no hairlike, flabellate or modified spermathecal setae, and the spermathecal apertures are located in the lateral line of segment X. Obviously, the species described as I. acapillatus is a synonym of the subspecies T. kessleri variabilis Semernoj.

It is possible that Izosimov's abyssal L. infundibuliferus also belongs to the group of T. kessleri Hrabě.

Until recently, we knew of five species of Peloscolex in Lake Baikal: P. inflatus, P. velutinus, P. werestchagini, P. kozovi and P. malevici, and from the littoral-sor zone P. ferox as well. Holmquist (1978, 1979) has revised the genus Peloscolex, dividing it into 8 independent genera, including the new genus Baicalodrilus with the type species B. kozovi. In this new genus, Holmquist included B. digitatus, a new species described by her (Holmquist, 1979), which was previously regarded as P. werestschagini (Okuneva, 1972). Holmquist's material did not contain the true P. werestschagini as described by Michaelsen. The taxonomic position of P. inflatus remained uncertain. The species did not fit into any of the 8 genera established by Holmquist. The author of the revision assigned P. velutinus to the genus Embolocephalus Randolph, and P. ferox to the genus Spirosperma Eisen.

Having reviewed Holmquist's work, V.P. Semernoi (Semernoi, Shidlovskaya, 1983) spoke out against the division of the genus Peloscolex, proposing that the complex of "armoured" oligochaetes remain indivisible. I am of the same opinion as V.P. Semernoi. (57
I believe that the motives for dividing the genus Peloscolex into several independent genera are insufficient. The latest data on the morphology of Baikal Peloscolex hardly support this type of division either.

We have placed the six species found by us in northern Lake Baikal, i.e. P. malevici, P. exilis, P. cristatus, P. solitarius, P. discolor and P. paradoxus, and probably P. falcatus

and P. bekmani (the last two species have been described only on the basis of external characters), in the new subgenus Crystallifer subgen. n. on the basis of their common organizational features: the apical entry of the vas deferens; the medial or almost medial entry of the prostatic gland; the cylindrical form of the atrium which is distally narrowed, curved and ends in a soft short penis; the presence of a crystal inside the atrium (with the exception of P. solitarius which, instead of a single crystal, has a group of crystals in the curve of the atrium on the outside). These common features, together with the truly distinct species differences, indicate that we have here a unified group of closely related species which have diverged in the process of evolution in Lake Baikal itself.

Additional research has shown that this subgenus also includes P. werestschagini which is common in southern and central Lake Baikal.

We later found that the species described by Holmquist (1979) as Baicalodrilus digitatus (mature specimens of this species were frequent in our material) was very similar to P. cristatus and P. werestschagini, and should be included in the new subgenus. We may later find that the new subgenus should also include P. kozovi and particularly P. inflatus which is similar to P. solitarius and P. discolor.

On the basis of a study of the reproductive system, S. Hrabě (1982) transferred Lycodrilus dybowskii Grube and L. schizochaetus Michaelsen from the family Lycodrilidae to two different genera of the family Tubificidae, Lycodrilus Grube, 1873 and Lycodrilides Hrabě, 1982. However, it appears that the two specimens identified

by Hrabě as L. dybowskii do not fit the original description of this species. According to Grube (1873) and Michaelsen (1901, 1905), the atrium in L. dybowskii is pyriform, while the atrium in Hrabě's two specimens is spindle-shaped, the penis is enclosed in a cuticular penial tube, and the penial bursa does not have a thick cuticular covering. However, despite these differences, Hrabě still believes that he is dealing with L. dybowskii. According to the description and drawing presented by Hrabě, his two specimens are not L. dybowskii, but sooner Tubipenifer tendens Semernoj, 1982, with which Hrabě is apparently not familiar.

We cannot at the given time present histological sections of L. dybowskii for comparsion with T. tendens, since there were no mature specimens in our collections; we can only refer to the descriptions of Grube (1873) and V.P. Semernoi (1982) and note (58
that these two taxa are quite different in their external appearance.

On the basis of all this, we have left L. dybowskii and L. schizochaetus in the genus Lycodrilus. Besides these two species, the genus includes L. grubei Michaelsen and L. phreodriloides Michaelsen.

Hrabě has transferred L. parvus Mich. to the family Lumbriculidae, changing the name of the genus to Pseudolycodrilus Hrabe, which is absolutely correct.

As shown by S. Hrabě (1982) and V.P. Semernoi (1982), the genera Lycodrilus and Tubipenifer are characterized by a tubificid structure of the reproductive system, and the species belonging to these genera have every right to be regarded as "higher" tubificids (the spermathecae are distinctly located in segment X

and the male gonoducts in segment XI, the copulatory organ is well-developed, a separate prostatic gland is present, and the sperm in the spermathecae is formed into spermatozeugmata).

The genus Lycodrilus was initially assigned to the family Lumbriculidae by Grube (1875). Michaelsen (1905) transferred it to the family Tubificidae, noting that the genus Lycodrilus was so similar to the genus Limnodrilus that it was difficult to distinguish it from the latter. Later, Michaelsen (1926) combined these two genera into one, Limnodrilus. O.V. Chekanovskaya (1962) also agrees that there is a very great similarity in the structure of the reproductive system of the lycodrilids and tubificids, but regards it as a convergence and includes the family Lycodrilidae in the order Lumbricomorpha, bringing it closer to the primitive family Haplotaxidae. The setal characteristics were the main motive for establishing the genus Lycodrilus as a separate family. O.V. Chekanovskaya believes that the inclusion of the genus Lycodrilus in the family Tubificidae means that it is necessary to alter the diagnosis of the latter in the sense of rejecting any general characterization of the setae in its representatives. In her opinion, the presence of an indefinitely large number of setae which definitely include forked setae is one of the major diagnostic characters of this family. On the other hand, Hrabě (1982) believes that a small number of setae in a bundle is no reason for keeping lycodrilids out of the family Tubificidae. Indeed, in the Baikal peloscolexes of the subgenus Crystallifer, we also see a decrease in the number of setae to 2 and even 1 per bundle, and, at the

same time, the complete reduction of their proximal tooth. Thus, 2 and 1 single-toothed setae per bundle is also characteristic of certain tubificids. On the basis of the research of Michaelsen (1905, 1926), Hrabě (1982) and Semernoi (1982), we believe that the family Lycodrilidae can be regarded as closed.

SUMMARY

According to O.V. Chekanovskaya's review (1972), there were 22 genera and approximately 150 species in the family Tubificidae. Since then, more than 30 species and 5 genera have been described from Lake Baikal alone. Another 2 genera and 6 species have been added to them from the family Lycodrilidae. More than 50 species and 11 genera are known from Lake Baikal at the present time.

At the northern end of Lake Baikal, we know of 53 taxa of this family, and if we take into account the earlier data on the oligochaetes of the N Baikal sor (Cherepanov et al., 1977), this number increases to 55 taxa, of which 49 are endemics and only 6 species have an extensive geographic range (Rhyacodrilus coccineus, R. sibiricus, Isochaetides michaelseni, Tubifex tubifex, T. hubsugulensis, Peloscolex ferox). The cosmopolitan species T. tubifex and the palearctic species I. michaelseni and P. ferox are encountered only in the sor in northern Lake Baikal. The Eastern Siberian species R. sibiricus and T. hubsugulensis have been noted in the open parts of Lake Baikal for the first time.

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