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THE OLIGOCHAETES OF TYUP RIVER AND TYUP BAY ON LAKE ISSYK-KUL'

by

N.P. Finogenova

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The present report is a result of studying 15 samples from the /115*
mountain river of Tyup and 29 samples from Tyup Bay on Lake Issyk-Kul'.

The fauna of tubificid worms from the mountain rivers and streams of Central Asia and Lake Issyk-Kul' has been exceedingly little researched. Some data about the oligochaetes of the mountain rivers of the Tien Shan and the Pamirs can be found in the works of Cernovitov [1930], Grib [1950], and Brodskii [1976]. Four species of oligochaetes are listed in Hrabe's [1935] unique faunistic work on Lake Issyk-Kul': Tubifex tubifex, T. bergi, Enchytraeus przewalskii, and E. issykkulensis, the latter three being described by Hrabe as new to the world's fauna. He noted yet another species (Lumbriculus variegatus Mull.) in the delta of the Dzhergalan River, which flows into Lake Issyk-Kul'. Eighteen species from the following families

* Numbers in the right-hand margin refer to the corresponding page in the Russian text. - Translator.

are found in our material: Aeolosomatidae (1), Naididae (9), Tubificidae (4), and Enchytraeidae (4).

Family Aeolosomatidae

1. Aeolosoma hemprichi Ehrenberg

In Tyup River at Station 4 in washings from rocks, up to 12,300 specimens per m², and at Station 5 on clear and silted sand on the shore, 320-9,200 specimens per m². This species was found once (80 specimens per m²) in Tyup Bay on a sandy beach on the shore.

Widely distributed in fresh waters with little salinization.

Family Naididae

2. Nais pseudobtusa Piguet

Five specimens (550 specimens per m²) were found once in quantitative washings from rocks at Station T4.

Common in fresh waters on some of the continents. Noted by Brodskii [1976] in the mountain river Tien Shan Issyk.

3. Nais communis Piguet

Found, like the preceding species, in washings from rocks at Station T4. Count of up to 1,430 specimens per m².

Its occurrence is worldwide.

4. Nais elinguis Mull.

One of the most frequently encountered species of naidds in Tyup River. Recorded at all stations in washings from rocks and in silted sand on the banks. Its count is 17-5,500 specimens per m².

Found in Tyup Bay at a depth of up to 1.5 m on sandy beaches of the northern and southern shores and in Chisty Pool in clayey sand and in washings from macrophytes. Its count in the bay is 20-520 specimens per m². /116

Cosmopolitan. Known from fresh and saline waters. Found in mountain rivers of Central Asia [Cernosvitov, 1930; Grib, 1950].

5. Nais pardalis Piguet

Found in Tyup River at Stations T2-T5 in washings from rocks and on silted sand. Its count is 20-8,690 specimens per m².

It possesses a geographic range that is almost worldwide. Known from mountain rivers of the Tien Shan and Pamirs [Cernosvitov, 1930; Grib, 1950].

6. Paranais frici Hrabe

Found in the river mouth zone of the Tyup on clayey silt at a depth of 6.5 m.

This species occurs widely in fresh and saline water of the Ponto-Caspian Basin. It has also been recorded in the basin of the Baltic Sea, on the shores of Sweden, in North America, and in Africa (?).

7. Paranais tjupensis sp. n.

Found in Chisty Pool, Tyup Bay, in sand and in clayey silt, at a depth of up to 0.5 m. The holotype (inv. No. 1/4335) is preserved in the Zoological Institute of the USSR Academy of Sciences.

The prostomium is in the form of a small distension. There are no eyes. The setae are forked. The ventral setae of the 2nd-4th segments with longer (but smaller by a factor of 2) distal fork; in subsequent segments the forks are equal or the distal slightly longer than the proximal. The dorsal setae with forks of equal length or with distal fork slightly longer than proximal (Figure 1). The nodule on the setae is located on the distal part. The number of setae in the ventral bundles of the 2nd segment is 5-7; of the 3rd-4th, 2-4; in the bundles of the middle section of the body, 1-3. There are 2-4 setae in the dorsal bundles of the 5th segment and 1-2 in the other bundles. The length of the setae is 57.5-65 μm . In the ventral bundles of the 5th segment in sexually mature individuals there are 2 (less commonly 3) penial setae, similar in shape to the ventral setae of the 2nd segment (Figure 2), but longer (75 μm). In the 4th segment there are esophageal glands. The intestine is distinct, in the 8th segment. The circular vessels are in the 5th-7th segments, but branching. The clitellum is on half the 4th-6th segments. The male sexual opening is beside the penial setae, laterally from them. The opening of the spermathecae is in front of the bundle of setae of the 4th segment. The sperm funnels are large (42.5 μm in diameter) and shallow (25 μm) in the shape of wine glasses. The thickness of their walls is 12.5 μm . The vasa deferentia are short, non-looping, and enter into the distal part of the atria somewhat above the efferent ducts. The ampulla of the atrium is thin-walled (3-7.5 μm ; muscle layer only 2-3 μm), almost globular (long axis, 100 μm ; short axis, 90 μm). The efferent duct of the atrium is long (65 μm), 15 μm thick, and the width of the lumen is 6 μm (Figure 3). The spermathecae are large, thin-walled (2.5-7.5 μm),

FIGURE 1 Setae of Paranais tjupensis sp. n.

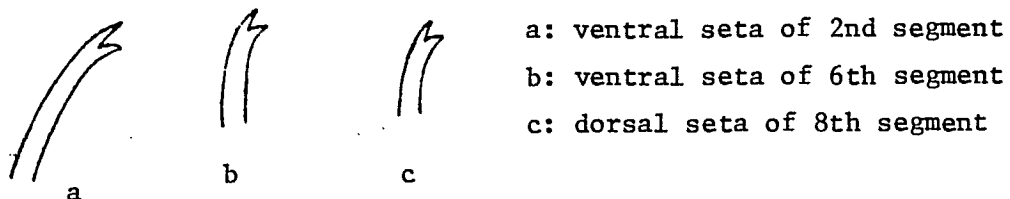
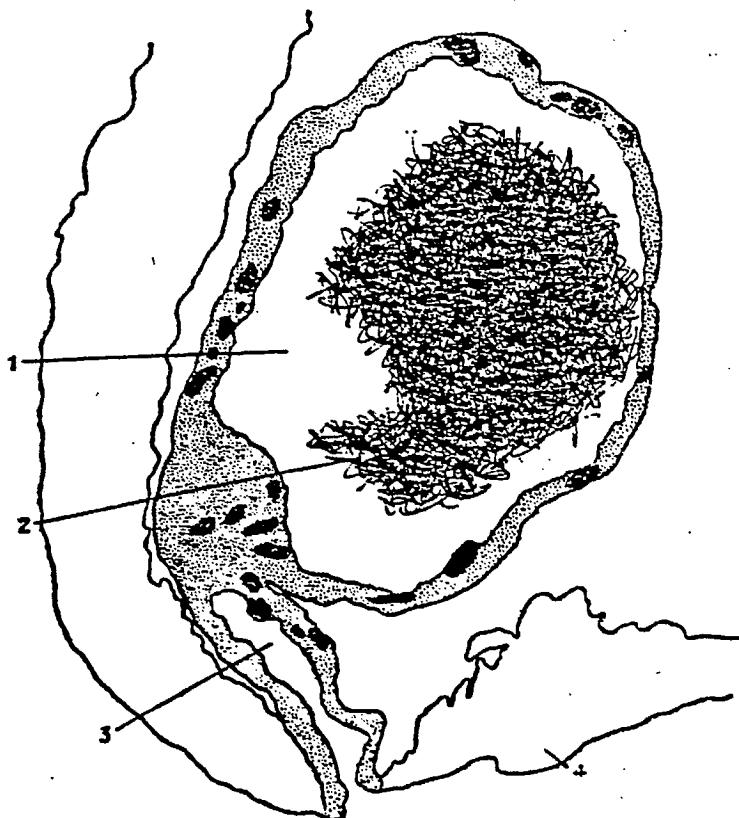


FIGURE 2 Penial seta of Paranais tjupensis sp. n.



FIGURE 3 Section through the atrium of Paranais tjupensis sp. n.

- 1: ampulla of the atrium
- 2: spermia
- 3: efferent duct
- 4: body wall



of irregular pouch shape. Its dimensions depend on the degree of fullness with spermia and can have the following parameters:

| length, μm | width, μm |
|-----------------------|----------------------|
| 82.5 | 105 |
| 100 | 80 |
| 140 | 100 |

The efferent duct of the spermatheca is clearly separated. Its length is 50 μm , its thickness is 20-25 μm , and the width of its lumen is 5-10 μm . The seminal sac, formed by a protrusion of the dissepiment 4/5, extends to the 8th segment. The body length of a sexually mature specimen is 5-6 mm and the thickness in the area of the clitellum is 200-430 μm . The number of segments of a sexually mature individual is 42-46.

In its features, the species we are describing is most similar to the Baltic Sea salt-water species Paranais botniensis [Sperber, 1948-1950]. It is like P. botniensis in the shape of the penial setae (forked), the location of the intestinal distension (8th segment) and of the ring vessels (5th-8th segments), and in the structure of these vessels (non-branching in both species), as well as in characteristics of the reproductive system (thin-walled spermatheca and atria; thin muscle layer in the atria; clearly separated and relatively long efferent ducts of the spermathecae). The differences between these species are the following:

| Feature | <u>Paranais tjupensis</u> | <u>Paranais botniensis</u> |
|---|--|---|
| Ventral setae or 2nd segment | Distal fork less than half as long as proximal fork | Distal fork twice as long as proximal fork |
| Ventral setae of median and posterior parts of body | 1-3 per bundle, forks equal or distal slightly longer than proximal | 2-4 per bundle, forks of approximately equal length |
| Dorsal setae | Forks even or distal slightly longer | Forks of equal length |
| Body length | 5-6 mm | 6-10 mm |
| Ampulla of spermatheca | Large (length: 82.5-140 μ m; diameter: 80-105 μ m), irregular sac-like shape | Small (length: 50-60 μ m; diameter: 40-50 μ m), almost globular |
| Thickness of ejaculatory duct | 12.5-15 μ m | 4.5-6 μ m |
| Ampulla of atrium | Almost globular (long axis: 100 μ m; short axis: 90 μ m) | Oval (length: 65-75 μ m; diameter: 36-54 μ m) |

8. Amphichaeta leydigi Tauber

Some 258 individuals (5,160 specimens per m²) were found in a sample taken from Tyup River (Station T5) on silted sand at a depth of 0.3 m.

It has a Palearctic distribution. It is first recorded for water bodies of Central Asia.

9. Chaetogaster diastrophus (Gruith.)

Found in the Tyup River in quantitative washings from coastal rocks at Stations T3, T4 (count of 220-9,900 specimens per m²), and at T5 in sand at a depth of 0.3 m (count of 80 specimens per m²).

It has a geographic range that is almost worldwide. It has been noted on rocks of the mountain river Dyushambinka [Grib, 1950].

10. Pristina jenkiniae (Steph.)

Uncovered sporadically in July and in considerable numbers (13,000 specimens per m²) in August in the Tyup River in washings from coastal rocks at Station T4. It was first found in the USSR by Chekanovskaya [1972] in ground waters of the Kyzyl-Kum. Our specimens differ somewhat from both the typical ones and those described from Kyzyl-Kum in the number of ventral setae (Tyup individuals: 2-5 setae in anterior segments, 2-3 in posterior segments; Kyzyl-Kum specimens: 3-5 and 1; typical: 4-6 and 2-3, respectively), the length of the hair-like setae (Tyup individuals: 100-260 μ m; Kyzyl-Kum: 133.2-228 μ m; typical: 165-234 μ m), and the location of the stomach (Tyup individuals: 7th or 8th segment; Kyzyl-Kum: 8th segment; typical: 7th segment). The length of a single zooid in our samples was equal to 1.8-2.5 mm (as opposed to the typical 2.5-3 mm), but we did not have a sufficient number of adult sexually-mature individuals at our disposal.

Distribution: Africa, South America, India, Turkey, Central Asia, Sumatra (?), Japan (?), Romania.

Family Tubificidae

11. Limnodrilus helveticus Figuet

Recorded once in the Tyup River at Station T5 on the shore in silted sand.

Occurs widely in bodies of fresh water. It withstands some salinization.

12. Limnodrilus hoffmeisteri Clap.

Found in the Tyup River together with the preceding species. /119

Its distribution is almost worldwide. Noted in the mountain river of Tien-Shan Issyk [Cernosvitov, 1930].

13. Tubifex tubifex (Mull.)

In the river and the bay it is characteristic of loamy and sandy bottom. The count of tubifex most frequently varied from 20 to 1,880 specimens per m², averaging 490 specimens per m². The population of this species reached relatively high magnitudes at Station Tz1 in the bay and in the region of the river mouth on clayey loam. Thus, its count in August at the mouth of the Tyup at a depth of 6.5 m was 27,000 specimens per m², while at Station Tz1 at a depth of 10-11 m it varied from 380 to 6,220 specimens per m² over the entire period of study, averaging 2,610 specimens per m².

An exceedingly eurybiontic species with an almost worldwide distribution. Found in the mountain river Issyk of Central Asia [Cernosvitov, 1930].

14. Tubifex bergi Hrabe

Occurs widely in Tyup Bay. Recorded at all bottoms and depths. Its large-scale development was observed at Station Tz1 (up to 14,000 specimens per m²) and at the second section on the shore on a sandy beach (up to 13,000 specimens per m²). Not found in the Tyup River. First described by Hrabe [1935] from Lake Issyk-Kul' and as yet unknown from other bodies of water.

Family Enchytraeidae

15. Fridericia sp. juv.

One specimen found in a washing from rocks in the Tyup River at Station 2.

16. Enchytraeus issykkulensis (?) Hrabe

A number of juvenile individuals similar to E. issykkulensis in external features were found in Tyup Bay on the second and third sections of the shore.

17. Lumbricillus intricatus sp. n.

Tyup Bay, third section, northern shore, depth of 1.5 m, sand, 7 August 1976 - 6 sexually mature individuals (including the holotype, inventory No. 1/43336) and 10 juveniles. The holotype is preserved in the Zoological Institute of the USSR Academy of Sciences.

Prostomium triangular, its width at the base approximately equal to the length. Setae with nodule, slightly curved in an S-shape with length of 40-55 μm . The number of setae per bundle according to the formula of Nielsen and Christensen [1959] is 3, (4)-(1), 2, (3), (4): (3), 4, (5), (6)-3, (4), (5). All segments have regular rows of epithelial glands, barely discernable on fixed material but clearly visible when stained (like Lumbricillus minimus Cern. from Lake Chelkar). Polostnye tel'tsa are not numerous and are oval in shape and flat. Their length is 20-22.5 μm and their width is 8 μm . There are isolated chloragogen cells in the anterior third of the 5th segment and there is a dense layer of them in the 6th segment. The esophagus, gradually distending, passes into the intestine. There are 3 pairs of

FIGURE 4 Septal glands of Lumbricillus intricatus sp. n.; schematic; numbers refer to body segments.

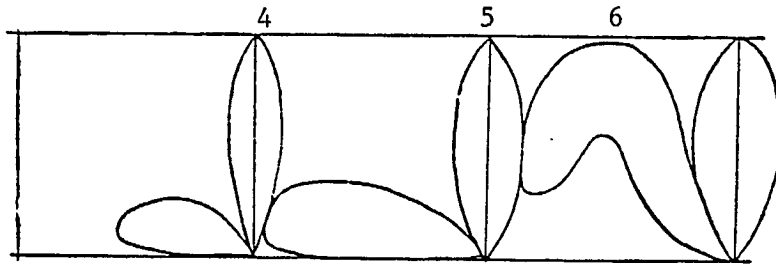


FIGURE 5 Nephridia of Lumbricillus intricatus sp. n.
a: from the anterior part of the body
b: from the posterior part of the body

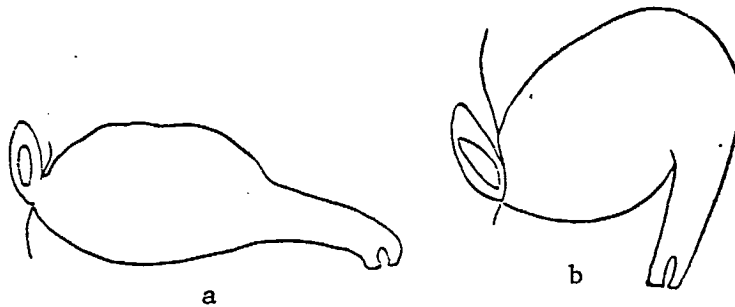


FIGURE 6 Cerebral ganglion of Lumbricillus intricatus sp. n.

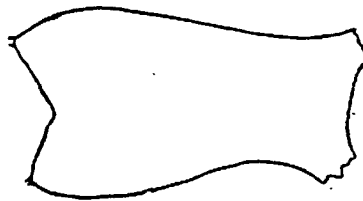


FIGURE 7 Spermatheca of Lumbricillus intricatus sp. n. (from prepared specimen)

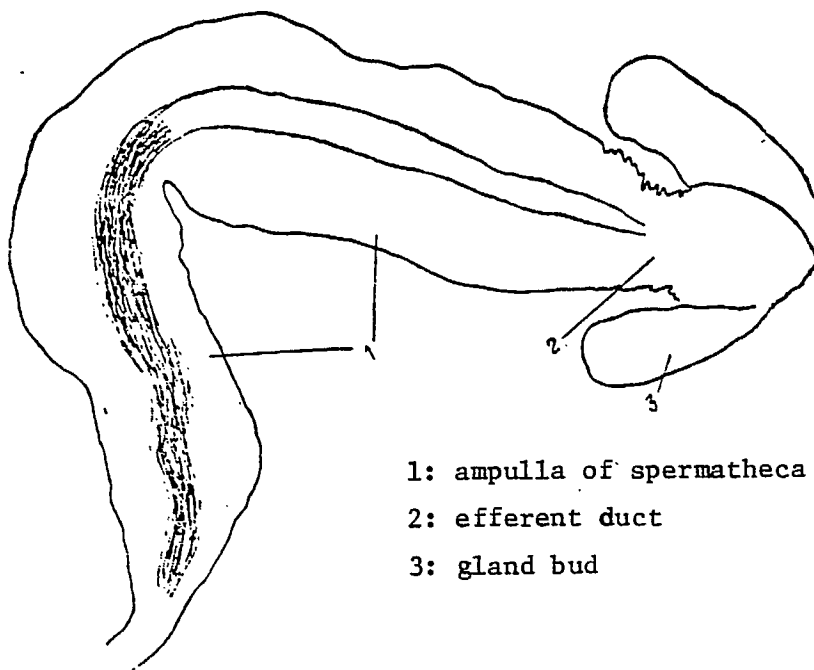
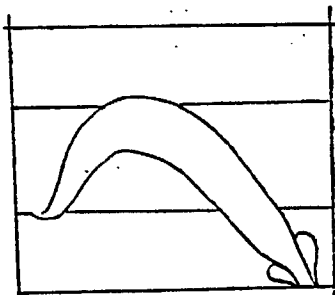


FIGURE 8 Lumbricillus intricatus sp. n., 5th segment. Diagram of the location of the spermatheca.



septal glands; the anterior 2 pairs are fused and the poslednyaya is free. They have ventral lobes, which are particularly large in the anterior pair (Figure 4). The dorsal vessel begins with the 12th segment. The first pair of nephridia is attached to the 7th-8th dissepiment. The anteseptal part of the nephridia consists only of the funnel. The postseptal part is of irregular or round shape with a terminally exiting efferent duct. In the nephridia of the anterior segments, the efferent duct is frequently stretched along the segment; in the nephridia of the median and posterior parts of the body, it is bent under the body of the nephredium (Figure 5a, b). The dimensions of the nephredia are not large: length of the body, 50 μm ; width, 37.5 μm ; length of duct, 32 μm . The cerebral ganglion is in back with a small cleft and slightly narrows to the front (Figure 6). Its length is 100 μm and its width in the lower part is 62.5 μm . The clitellum is on the 12th-13th segments. The testes are large and lobed. The seminal funnels are short (length of funnel: width of funnel = 1:1) and small (125 μm). The ejaculatory ducts are long, looped, relatively thick (10-12.5 μm), and they blow into the penial bulb laterally into the lower part. The penial bulbs are small: length, 80 μm ; width, 65 μm . There are abdominocerebral copulatory glands in the 14th segment. Spermatheca with weakly distended tube-like ampulla and short sinewy efferent duct otkryvayushchimsya abdominal pore u dissepimenta 4/5. At dissepiment 5/6 the spermatheca enter the esophagus on the abdominal side. At the distal end of the efferent duct there is a slight bud of glands (Figures 7, 8). The parts of the spermatheca have the following dimensions: length of ampulla, 165 μm ; thickness of ampulla, 25-30 μm ; length of efferent duct, 33.5 μm ; thickness,

14-17.5 μm . One specimen had a small quantity of spermia in the spermathecae. Body length is 3.4 mm and the thickness in the area of the clitellum is 140-250 μm . The number of segments is 26-31.

The new species is similar to Lumbricillus minimus from the saline Lake Chelkar [Hrabe and Cernovitov, 1929] in a number of features: (a) the location of the epithelial glands, (b) inception of the dorsal vessel with the 12th segment, (c) the proportions of the seminal funnel, (d) the weakly distended ampulla and the short efferent duct of the spermatheca, (e) body length, and (f) the number of segments. The basic differences between these species involve the structure of the setal apparatus (L. minimus has fewer setae per bundle), the postseptal part of the nephridia (the efferent duct of L. minimus is positioned vertically), and the spermathecae (L. minimus lacks glands on the distal end of the spermathecae and the entry of the spermathecae into the esophagus is on the dorsal side). Moreover, L. minimus lacks abdominocerebral copulatory glands.

/121

18. Enchytraeidae Genus sp. juv.

In samples from Tyup River (T3, T4), Karakol River, and Tyup Bay, we encountered enchytraeids, but were unable to determine to which species they belonged due to the absence of mature individuals.

Fourteen species of oligochaetes were found in the river. The distribution of species depends on the rate of flow and the quality of the bottom. Stations T1-T4 are characterized by a rocky substrate. In the upper reaches of the Tyup (Station T1), where the rate of flow is greatest (2.2 m/second), oligochaetes are rare and sporadic. In a number of qualitative samples from that locale, we found 1 specimen of

/122

Nais elinguis. Lower down (Stations T2-T4) the current weakens somewhat (1.4-1.65 m/sec) and oligochaetes become a regular component of the rock fauna. It should be noted that for the mountain rivers of the Pamirs, Grib [1950] noted the absence of oligochaetes at flow rates greater than 1 m/sec. Downstream on the Tyup the count of oligochaetes increases (Station T2, 100 specimens per m²; T3, 890 specimens per m²; T4, 42,000 specimens per m²) and their species spectrum broadens due to aeolosomatids, naidids, and enchytraeids (Table 1).

In the lower reaches of the Tyup (Station T5) the rate of flow drops to 0.5 m/sec and the rocky bottom is replaced by silted, clayey sand. Here on the shore at a depth of 0.3-0.5 m the aeolosomatids and naidids are joined by tubificids (Limnodrilus hoffmeisteri, L. helveticus, Tubifex tubifex). The average count of aeolosomatids and naidids is 5,360 specimens per m², that of tubificids is 390 specimens per m². In the middle of the mouth zone (Station T6) on clayey loam at a depth of 6.5 m the count of tubificids reaches 82,180 specimens per m². Here, besides the tubificids, we find the naidid saline-water species Paranais frici. In Tyup Bay, which has saline water, the species composition of the oligochaetes is poor. Aeolosoma hemprichi, Nais elinguis, and Tubifex tubifex of the freshwater species, are encountered on the shore in growths of macrophytes on sand, while only T. tubifex is found in the central zone. There are also species specific to Lake Issyk-Kul' and not as yet found in other bodies of water. Inshore these are Paranais tjupensis, Enchytraeus issykkulensis (?), Lumbricillus intricatus, and Tubifex bergi; in the abyssal part, only T. bergi. The count of oligochaetes both inshore and in the central abyssal section decreases from east to west

TABLE 1 Species composition of the oligochaetes at different stations on the Tyup River

| Station T2 | Station T3 | Station T4 |
|--|---|---|
| <u>Nais elinguis</u> <u>N. pardalis</u> <u>Fridericia</u> Gen. sp. juv. | <u>Nais elinguis</u> <u>N. pardalis</u> <u>Chaetogaster diastro-</u> <u>phus</u> | <u>Nais elinguis</u> <u>N. pardalis</u> <u>N. communis</u> <u>N. pseudobtusa</u> <u>Ch. diastrophus</u> <u>Pristina jenkiniae</u> <u>Aeolosoma hemprichi</u> <u>Enchytraeidae</u> Gen. sp. juv. |

TABLE 2 Count of oligochaetes in Tyup Bay, specimens per m²

| | Inshore | Deep-water section |
|----------------------------|---------|--------------------|
| Eastern part (section I) | 1950 | 8660 |
| Central part (section II) | 1560 | 2400 |
| Western part (section III) | 1070 | 1700 |

(Table 2). The character and the features of the quantitative development of oligochaetes in Tyup Bay can evidently be explained by the influence of Tyup River, which flows into the eastern angle of the bay and, along with its water, carries into it organic matter favorable for utilization by these bottom dwelling animals.

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