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Some features of biology of tubenose goby *Proterorhinus marmoratus* (Pallas, 1814) (Gobiidae, Perciformes) in the Kerch strait

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ABSTRACT. The present paper provides data on length-weight composition and sex ratio, respectively information about spawning and feeding of tubenose goby (*Proterorhinus marmoratus*) from the Kerch strait. A total number of 1200 specimen of tubenose goby (*Proterorhinus marmoratus*) was collected and analysed. In the studied region tubenose goby (*Proterorhinus marmoratus*) occurs along all coastline and is registered on depths to 1.5 m, but the specimens are more concentrated/numerous in the bays of northern and central parts of the Kerch strait. The species main habitat are sea grass meadows in the coastal zone. The main number of individuals had length ranging between 4.0 cm and 7.5 cm and weight was ranging between 0.8 g and 5 g. Males and females of tubenose goby in the Kerch Strait do not differentiate by length and weight. Females of tubenose goby prevail notably over males. Females ripen before males. The most intensive spawning time for tubenose goby in the Kerch strait is end of May. Spawning areas are in shallow water zone with depth 0.2-1.5 m, with timed sandy and sandy-stony grounds (with a mixture of shell rock). In case of the tubenose gobies (*Proterorhinus marmoratus*) from the Kerch strait the main food-components are Isopoda, Amphipoda and Polychaeta.

Key words: *Proterorhinus marmoratus*, the Kerch Strait, size composition, sex ratio, spawning period, feeding

INTRODUCTION

Development of the “Black Sea Basin 2007-2013” program foresees implementation of researches on monitoring of environment of the Black sea with the purpose of slow down the negative trends in aquatic life.

According to it one of the primary concerns is an assessment of biological diversity, respectively the ecological and biological features of various components of the fish community from one of the inspected aquatoriums – Kerch strait.

In the Kerch strait gobies are the dominant group of the demersal finfishes. They represent the basis of ichthyofauna of all bottom habitats. According to our data there are 15 species of gobies. Among them there are species of commercial interest (round-goby - *Neogobius melanostomus*, monkey goby - *N. fluviatilis*, knout goby - *Mesogobius batrachocephalus*) and species which are objects of the amateur fishing (ratan goby - *N. ratan*, mushroom goby - *N. eurycephalus*). Other species that don't have a practical value are also widely widespread in the strait. Due to their number, they are playing an important role in bottom communities. The most abundant species of this group are tubenose goby (*Proterorhinus marmoratus*) and marbled goby (*Pomatoschistus marmoratus*).

Although tubenose goby is not the object of fishing, sometimes this species is caught (quite many specimens) as a side object during the commercial catching of grass prawn, Black Sea sand smelt and commercial species of gobies with bottom traps. This fact can negatively influence the tubenose goby populations, as the most intensive off-shore fishing period is overlapping with the period of its mass ripening.

This article provides data related to some aspects of the biology of tubenose goby from the Kerch strait, the life history of the species being not well known and publications are absent.

MATERIALS AND METHODS

Materials for this article were gathered by author and V. Shaganov alongside west coast of the Kerch strait in 1999 - 2013 period (Fig. 1).

Fish were caught with landing-nets and bottom traps in the off-shore zone to 2 m depth. During the research period 1200 specimens of tubenose goby were collected and analysed. Analyses were conducted on the standard methods of ichthyological researches ([2]; [4]). Fish were analysed right after catching, or after the preliminary fixing with 4% solution of formaldehyde. Species was identified with the use of the key from the publication signed by E. D. Vasil'eva [6].

The Kerch strait connects Azov Sea and Black Sea. The length of the Kerch strait is 43 km, but on a waterway there are 48 km. The width of strait ranges between wide limits: from 3.7 km in the North (in the district of ferriage) to 42 km in Southern part of the strait. The surface of the Kerch strait is 805 KM², the volume of waters is at about 4.56 KM³.

The coasts of the Kerch strait are steep and built on limestones or pelitic clay. There are outputs of rocks on capes. There are also several bays. The largest of them are Kamysh-Burunskaya and Kerch bays in the Western part of the Kerch strait, and Tamanskiy gulf in the Eastern part of the Kerch strait. Along the banks of the strait (mostly in its Eastern part) there are sandy spits, as Tuzla, Chushka and Arshincevskaya.

The Kerch strait is shallow, the deepest parts of the strait being: nearby the Azov Sea less than 10.5 m, meanwhile nearby the Black Sea it reaches 18 m. In the central part of the Kerch strait the depth gradually decreases and on a greater area its average m about 5.5 m.

Main bottom grounds are clay sands, there is pebble in a coastal zone and coquina.

The minimum average temperature of surface-water is observed in January (4°C), and in benthic areas in March (5.5°C).

Salinity of waters of the Kerch strait ranges between 11‰ and 18‰.

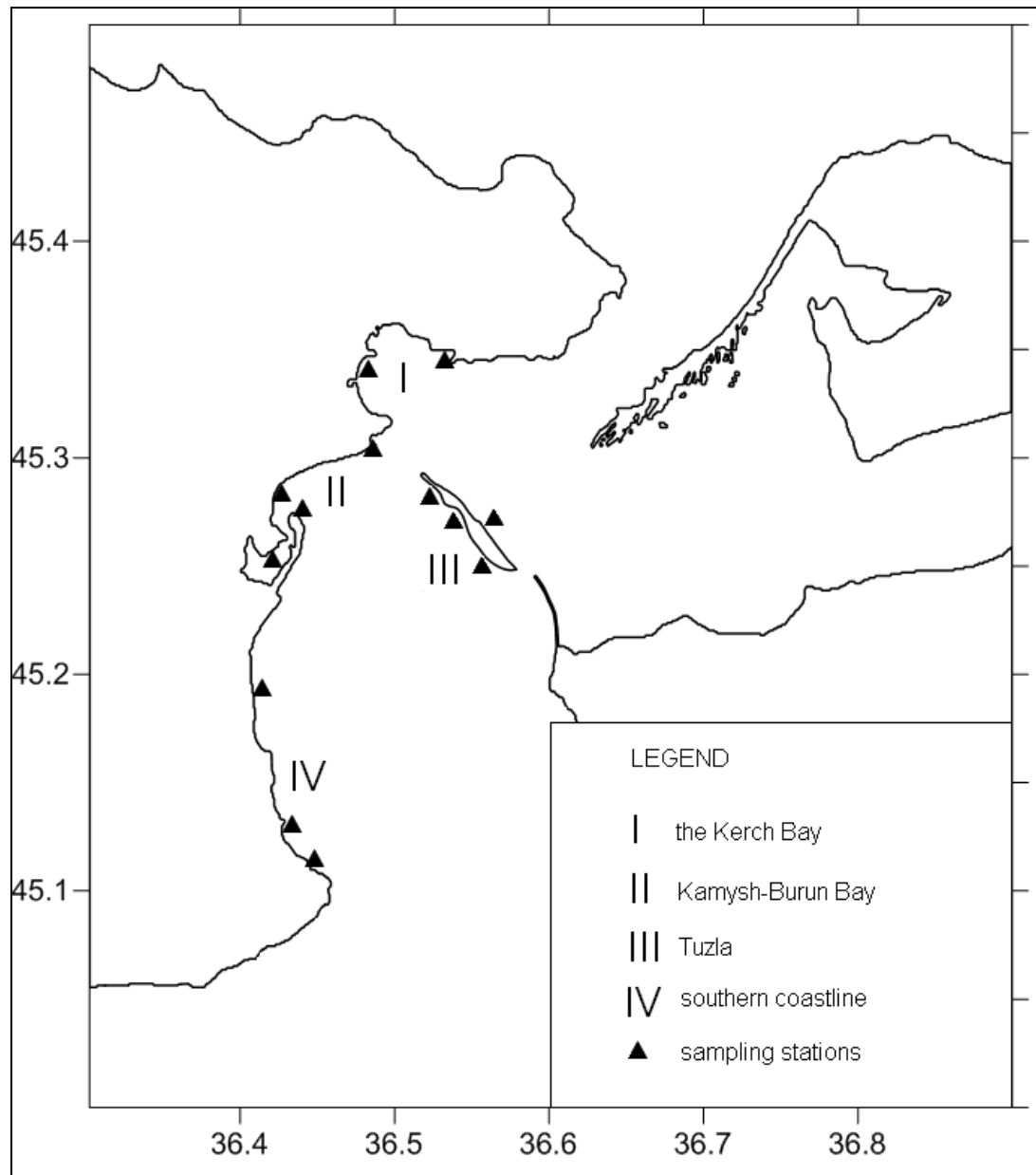


Fig. 1. Map-chart of research area with the sampling stations.

RESULTS AND DISCUSSION

In the Kerch strait tubenose goby is present in various habitats. The species occurs along the whole coastline but its main habitat are the sea grass meadows in the coastal zone of bays with depths less than 1 m. Here tubenose goby is the basic component of ichthyofauna. Out of all the gobie species dwelling in the *Zostera* meadows the tubenose goby's represents at about 30 to 70% (of the biomass of all gobie species). The tubenose goby also prefers places with weak flows.

In the Kerch strait tubenose goby is concentrated in the bays of north and central parts of the strait with depths less than 1 m. Here tubenose goby is one of main species of the demersal finfishess. **Fig. 2** shows the dynamics of encounter frequency of this species in catches (starting from Northern part and ending with the Southern part of the Kerch strait).

Decreasing of encounter frequency of tubenose goby in Southern part of the Kerch strait is explained by the absence (in shallow zone of that area) of enough habitats with sea grass meadows.

The tubenose goby changes its habitat during its life cycle. During the spawning period tubenose goby is moves into areas with rocky ground, where it is spawning in habitats with green weeds (*Enteromorpha* sp., *Chaetomorpha* sp.). After the spawning this species moves back into the habitat with sea grass meadows.

According to data from literature [3], the maximal size of tubenose goby is 12 cm. In Fig. 3 the size composition of tubenose goby in the Kerch strait is presented. According to our data, in the Kerch strait the largest individuals of tubenose goby have 9.5 cm length. Most of the studied individuals had length ranging between 4.0 and 7.5 cm, and weight ranging between 0.8 and 5 g.

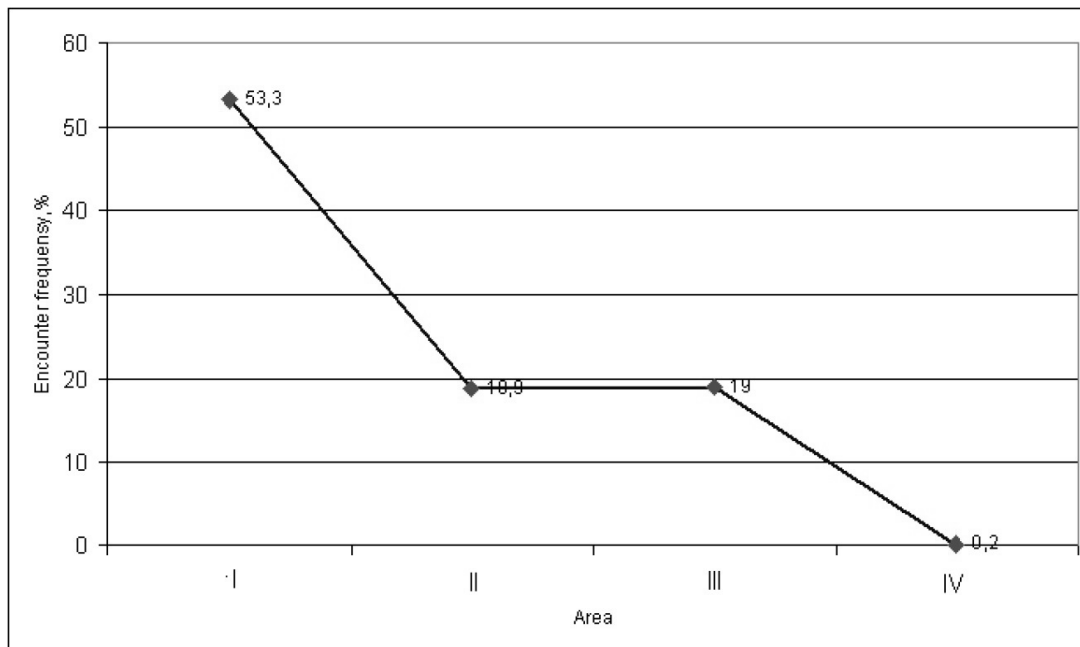


Fig. 2. Encounter frequency (%) tubenose goby in catches.

Note. areas in Fig. 2 are similar to the ones shown in Fig. 1.

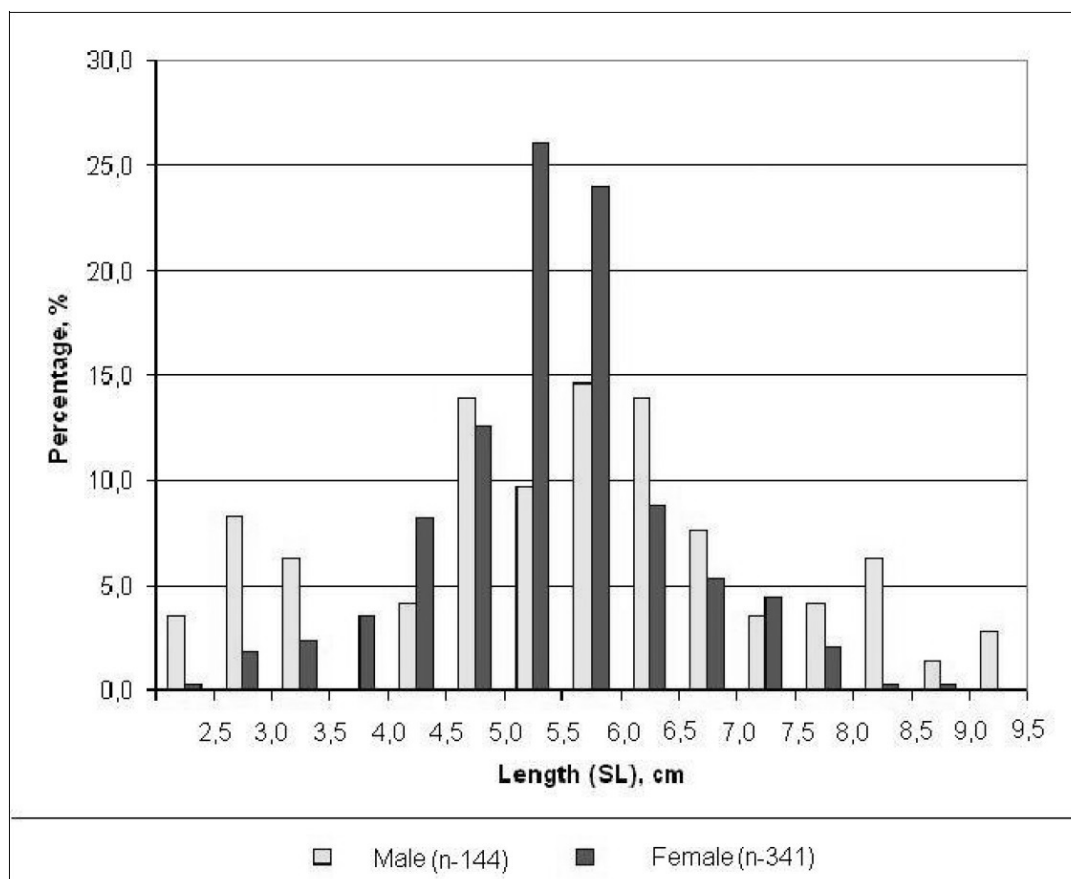


Fig. 3. Size composition of males and females of tubenose goby in the Kerch strait.

In **Table 1** there are provided data on the length and weight of tubenose goby of the Kerch strait.

Length-weight composition of tubenose goby in the Kerch strait (in 1999 – 2013 period)

Table 1

	%	SL (min-max) in cm	P ₁ (min-max), g
Males	30	5,4 (2,3-9,5)	3,14 (0,49-10,14)
Females	70	5,6 (2,5-8,9)	3,41 (0,59-8,54)
Males and females	100	5,7 (2,3-9,5)	3,53 (0,43-10,14)

Note. n = 485 specimens were analyzed.

Comparison of length and weight of individuals of different sex by a twoselective z-test for simple averages shows that there are no statistical differences between males and females. The parameter of z for average length of individuals of both sexes was evened 0.48, that is considerably less then a critical value for this amount of sampling equal 1.96.

Difference in size of males and females is practically absent, although average size of females is a little bit higher than the average size of males. During a year the change in average sizes of males and females is insignificant. At the same time, due to appearance of juveniles, the average length of individuals in the whole population decreases from 5.9 cm (in April) to 3.6 cm (in September).

According to our data (**Table 1**) sex ratio in population of tubenose goby from the Kerch strait is 1:2.7 in favour of females. This fact does not correspond to data from literature [3], where it is pointed that sex ratio in populations of tunenose goby is 1:1. According to gathered data sex ratio of tubenose goby in catches changes with seasons. In April (prespawning period and beginning of spawning) its value was 1:3.4 (males:females). In May (in the period of active spawning), the number of females increased sharply in catches and the sex ratio already reached to 1:5.7 (males:females). In summer numbers of males and females were gradually evened in catches and at the end of August – beginning of September sex ratio was 1:1.45 (males:females). The increase of number of females in May is explained by that fact that during this period most of the males already guarded their eggs in the nests and were not available for catching.

A. I. Smirnov [5] points out that the first ripening in males of tubenose goby begins after reaching 2.9 cm length and 0.5 g weight, and in females after reaching 2.7 cm length and 0.4 g weight. According to our data, in the Kerch strait males of tubenose goby ripened already at 2.3 cm length and 0.43 g wieght, and females at 2.5 cm length and 0.47 g weight, that corresponds to the sizes of the one-year old specimen. This fact shows that in the Kerch strait tubenose goby ripens at smaller sizes.

It should be noted that in the Kerch strait (as it is shown on a **Fig. 4**), females ripen before males: in the middle of April, at IV and the V stages of maturity), there are 46% and 39% of females, respectively only 13% and 16% of males. Most of the males ripen in the middle of May, when more than 60% of them are ready for spawning.

Tubenose goby's spawning is a la carte: it takes place in spring-summer period - from middle of April to the middle of July. A peak of spawning is on May – first half of June, at 18 - 21⁰C water-temperature. Spawning areas are in shallow water zones with depth ranging between 0.2 – 1.5 m, with timed sandy and sandy-stony grounds with mixture of shell rock. Eggs are laid in the empty shells and cracks between stones covered with green and brown algae (*Enteromorpha* spp., *Chaetomorpha* spp., *Cladophora* spp.).

In the food of tubenose goby a basic role is played by benthic Amphipoda, juveniles of crabs and juveniles of hermits-crabs *Diogenes* in the shells of *Cerithiolum*, shallow-water Polychaeta and molluscs, and also fries of finfishess ([1]; [3]; [5]; [7]).

In the Kerch strait tubenose goby feeds mainly on shallow-water crustaceas from Isopoda and Amphipoda orders, Polychaetas and other bottom organisms (**Table 2**).

Taking into account the indexes of filling of digestine tracts, tubenose goby actively feeds during the whole warm season of a year. However there are differences in composition its food in different periods of its life cycle (**Table 2**).

As it is shown in **Table 2**, in the spawning period the tubenose goby feeds mainly on crustaceas, first of all on species of *Isopoda* (registered in stomachs of 41.2% mature finfishess), than on Amphipoda species (35.3%), respectively on Polychaeta species (17.6%) and crabs (5.9%).

In the feeding period, the tubenose goby is feeding on Amphipoda species (53.3%) and Polychaeta species (25.6%), meanwhile the Isopoda species and shrimps in the food lumps represents 4.5%, and crabs – 1.5%. Young tubenose gobies of 3.5 cm length consume Cumacea (10.6% of the investigated food lumps), too.

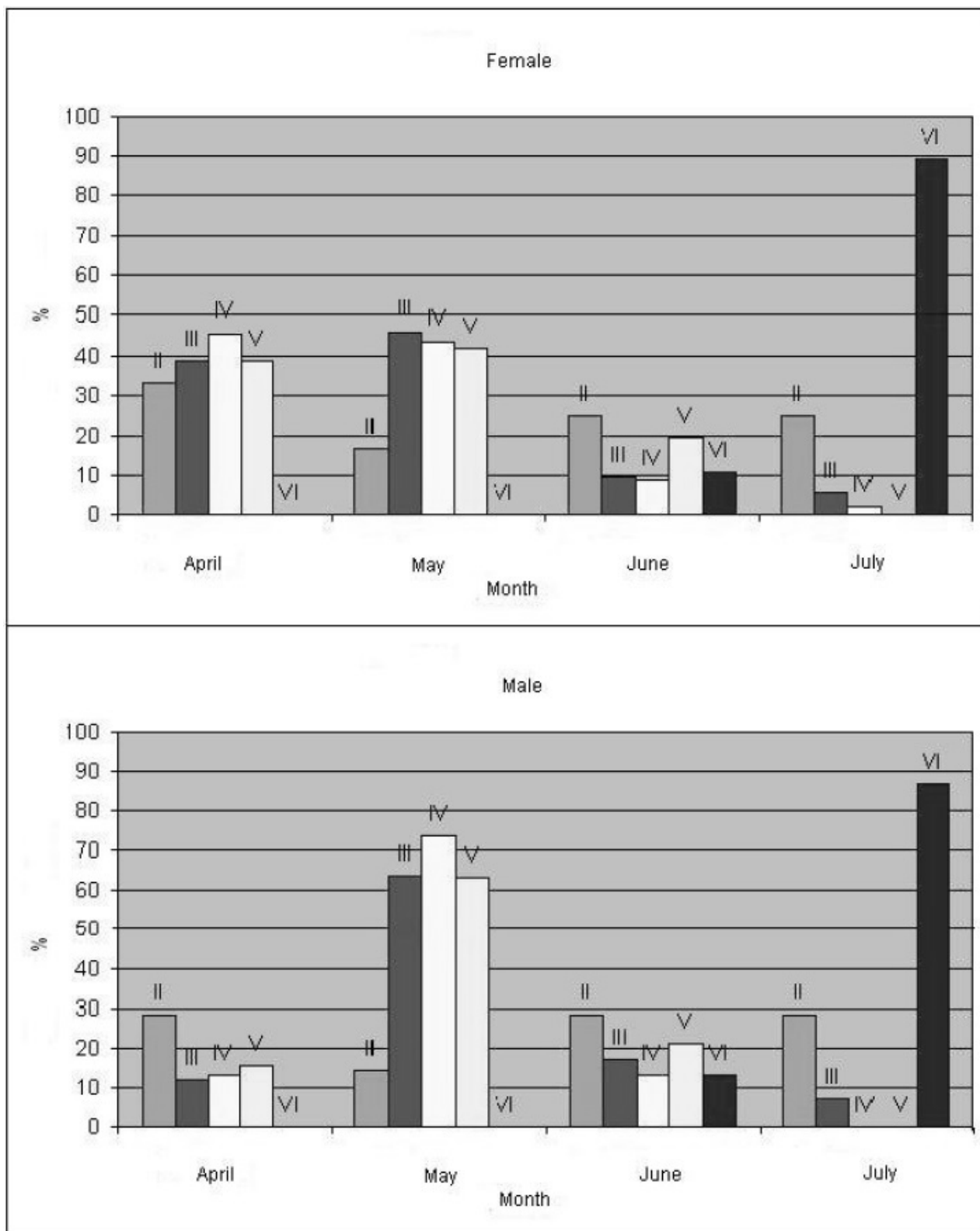


Fig. 4. Changes of the state of gonads of tubenose goby from the Kerch strait during the spawning period of year (April-July).

Food composition of tubenose goby (%) in the Kerch strait

Table 2

Food object	Spawning period	Feeding period
Polychaeta	17,6	25,6
Isopoda	41,2	4,5
Amphipoda	35,3	53,3
Decapoda	5,9	6,0
Cumacea	-	10,6

Note. n = 535 specimens were analyzed.

CONCLUSIONS

1. Tubenose goby (*Proterorhinus marmoratus*) occurs along the whole coastline of the Kerch strait, but it is more numerous in the sea grass habitats of off-shore areas, in the bays of Northern and central parts of the Kerch strait with depths less than 1 m and weak water-flow.
2. During a life cycle the tubenose goby changes by season its habitat (due to spawning), but presence of algae and flows of water is compulsory of its dwelling.
3. The maximal size of tubenose goby in the Kerch strait is 9.5 cm, the main part of population has sizes ranging between 4 and 7.5 cm.
4. The spawning period of tubenose goby in the Kerch strait lasts from middle of April to the middle of July, with a peak from May to the beginning of June.
5. In case of the tubenose goby from the Kerch strait, the basic food-items are bottom crustaceans of Amphipoda and Isopoda orders.

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