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FISH LARVAE AS FOOD ITEM OF PLANKTONIC PREDATOR (CHAETOGNATHA)

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Photos of predation of sagitta (Chaetognatha) to fish larvae are presented for the first time for the Black Sea. While analyzing ichthyoplankton samples obtained in May and November in 2017 (94th and 98th cruises of RV "Professor Vodyanitsky") several sagittas were found with their guts containing fish larvae. Fish larvae seem to have been captured by sagittas in the same way as sagittas in cannibalism cases, with both folding in half at the spot of capture. The data obtained allow us to assume sagittas in conditions of high abundance of eggs and fish larvae in the plankton to be not only a food competitor of larvae and juveniles of fish, as a fodder plankton consumer, but an active predator, being able to play a significant role in the elimination of ichthyoplankton.

Keywords: food items, fish larvae, sagitta, predation, Black Sea

According to numerous studies, predation is one of the main causes of fish larvae mortality. The paper [2] focuses on the analysis of some biotic factors affecting fish larvae survival, and larvae and juveniles of Decapoda, nauplii of *Balanus* are considered as some of the most dangerous predators. Consumption of fish eggs by amphipods, decapods and isopods was studied both in natural fish spawning grounds and experimentally [6]. Based on field observations and experimental data of different scientists the following conclusion has been made: high abundance of predators in the plankton in summer period can have a negative effect on the number of fish larvae [2, 5]. Feeding of the Black Sea sagittas (*Sagitta setosa* Müller, 1847) was studied in detail in the 1950s, using both field samples (including those collected at daily stations) and experimental ones [7]. Sagittas were shown to feed actively at the sea surface at night and in layers of plankton swarm in the daytime [3]. Since food items in the guts of sagittas are usually heavily digested, it makes quantifying of the consumed items difficult in most cases. The content of weakly digested food items can be determined through sagittas guts [7]. According to the data available in literature zooplankton (specifically copepods) are the main food items of sagittas, along with fish larvae as well as sagittas themselves [3, 4, 7]. Location of the consumed items allowed to assume that sagittas capture crustaceans mainly by the head while sagittas capture other sagittas by any part of their body, with the captured sagittas folding in half at the spot of capture [7]. There are no data available for the Black Sea on the way sagittas capture fish larvae, and there are no photos confirming this fact.

The analysis of ichthyoplankton samples obtained in May and November in 2017 (94th and 98th cruises of RV "Professor Vodyanitsky") showed that guts of several sagittas contained fish larvae. Fish larvae seem to have been captured by sagittas in the same way as sagittas in cannibalism cases, with both folding

in half at the spot of capture (Fig. 1B), as described by O. G. Mironov [7]. Several occurrences of fish larvae capture by sagittas by caudal fin have also been observed (Fig. 1A).

Sagitta length of 9.4 mm is shown in (Fig. 1B). Fish larvae which we identified as sprat – *Sprattus sprattus* (Linnaeus, 1758) with the size of about 4 mm – is clearly seen through the transparent covers of the of sagitta body (Fig. 1B, C, D).

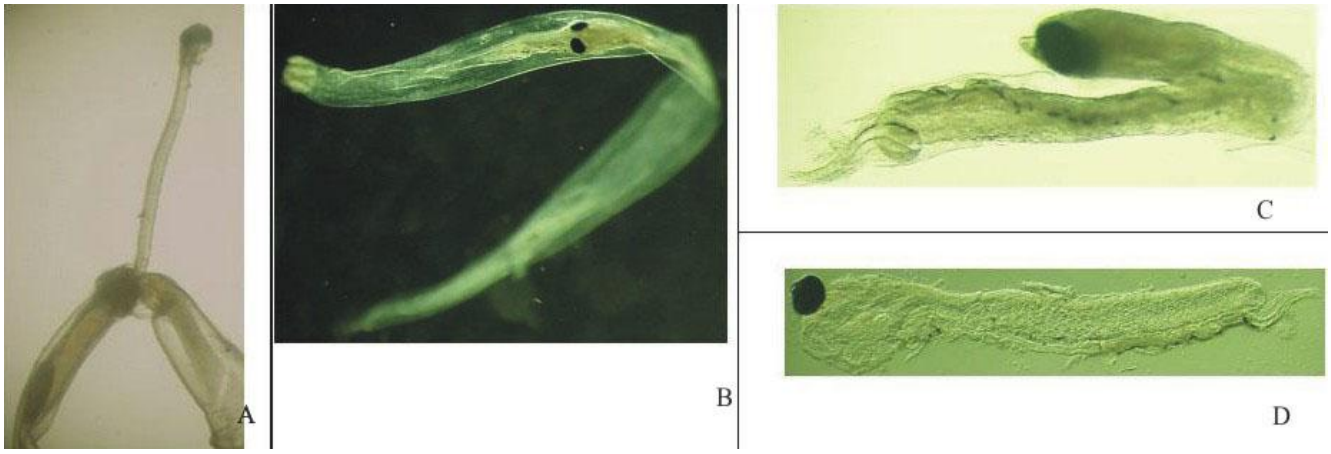

Fig. 1. Sagitta with the larvae of *Sprattus sprattus* (Linnaeus, 1758): A – sagittas in the process of capturing of *S. sprattus* larvae by caudal fin (May 2017); B – sagitta with *S. sprattus* larvae in the gut; C – folded in half *Sprattus sprattus* larvae from the gut of sagitta; D – *S. sprattus* larvae from the gut of sagitta straightened under a cover glass (November 2017)

Рис. 1. Сагитта с личинкой шпрота *Sprattus sprattus* (Linnaeus, 1758): A — сагитты в процессе захвата личинки шпрота за хвостовой плавник (май 2017 г.); B — сагитта с личинкой шпрота в кишечнике; C — сложенная вдвое личинка шпрота из кишечника сагитты; D — личинка шпрота из кишечника сагитты, выпрямленная под покровным стеклом (ноябрь 2017 г.)

The share of the consumed ichthyoplankton in the daily diet of sagittas for the Sea of Okhotsk was studied in [4]. It was shown that the share of ichthyoplankton in the daily diet of sagittas with the length of less than 15 mm in winter-spring period was 0.1 %, and in summer-autumn period it was 0.5 % (% of body weight of sagitta) [4]. According to [4] sagittas consume those groups of hydrobionts that dominate in zooplankton, and are available in sizes, preferring items of a relatively large size. It should be noted that in May and November 2017 there was a high abundance of larvae *S. sprattus* in the Black Sea near Crimea. In the first decade of May it reached 54 ind.·m^{-2}, and in November – 70 ind.·m^{-2}, with average being 18 and 20 ind.·m^{-2}, respectively. In the 1950–1960s at the coasts of Crimea *S. sprattus* larvae were generally observed as single individuals and their maximum number even at spawning peak did not exceed 30 ind.·m^{-2}. There are no reliable data available on feeding the Black Sea sagittas on fish eggs as membranes of eggs seem to be easily destroyed when being captured by sagittas. But considering that average number of *S. sprattus* eggs in November 2017 off Crimea was 262 ind.·m^{-2} and maximum number was over 800 ind.·m^{-2}, these values being four times higher than in the 1950–1960s [1], it can be assumed that *S. sprattus* eggs were easily available food items for sagittas.

The data obtained allow us to assume sagittas in conditions of high abundance of eggs and fish larvae to be not only a food competitor of larvae and juveniles of fish, as a fodder plankton consumer, but an active predator, being able to play a significant role in the elimination of ichthyoplankton.

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ЛИЧИНКИ РЫБ КАК КОРМОВОЙ ОБЪЕКТ ПЛАНКТОННОГО ХИЩНИКА (CHAETOGNATHA)

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Впервые для Чёрного моря представлены фотодокументы, свидетельствующие о хищничестве сагитты по отношению к личинкам рыб. При разборе ихтиопланктонных проб, полученных в 2017 г. в мае и ноябре (94-й и 98-й рейсы НИС «Профессор Водяницкий»), были отмечены несколько сагитт, в кишечниках которых обнаружили свежезаглоченные личинки рыб. Личинки рыб захватывались хищниками так же, как сагитты при каннибализме, и в месте захвата складывались вдвое. Полученные данные позволяют сделать предположение о том, что при высокой численности икры и личинок рыб в планктоне сагитты являются не только конкурентами в питании личинок и молоди рыб как потребители кормового планктона, но и активными хищниками, и могут играть существенную роль в элиминации ихтиопланктона.

Ключевые слова: пищевые объекты, личинки рыб, сагитта, хищничество, Чёрное море