Prionospio caspersi Laubier (Polychaeta, Spionidae) in the Black Sea: long-term monitoring of a population

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ABSTRACT

Numerous specimens of the spionid polychaete *Prionospio caspersi* Laubier were found in benthic samples from Kapsel Bay, the southeastern coast of the Crimean Peninsula. This was the first record of this species in the Black Sea. *P. caspersi* was very abundant in sandy and silty sand communities at depths of 9 to 23 m. We monitored this community from 1986 to 1991, a period in which the density of *P. caspersi* varied seasonally, being highest in spring (up to 730 ind. m^2) and decreasing in the months of August and September (to 96 ind. m^2). From April 1986 to April 1989, the frequency of occurrence in grab samples varied from 50 % to 100 %, decreasing at the end of each summer. Interpretation of size-frequency histograms suggests that recruitment took place in the second half of the summer. In autumn 1989 *P. caspersi* disappeared from Kapsel Bay and was not found at the study site or adjacent areas in 1990 or 1991. Possible causes for its disappearance were discussed.

RÉSUMÉ

***Prionospio caspersi* Laubier (Polychaeta, Spionidae) en mer Noire : suivi à long terme d'une population**

De nombreux exemplaires du polychète spionide *Prionospio caspersi* Laubier ont été recueillis sur les fonds de la baie de Kapsel, sur le côtes du Sud-Est de la Crimée, mer Noire. Il s'agit de la première découverte de cette espèce en mer Noire. *P. caspersi* apparaît avec une très grande abondance sur les fonds sableux et sablo-vaseux entre 9 et 23 mètres de profondeur. Nous avons suivi cette communauté de 1986 à 1991, période au cours de laquelle la densité de *P. caspersi* a varié selon les saisons, atteignant au printemps son maximum (jusqu'à 730 ind. m^2) et diminuant ensuite dans les mois d'août et de septembre (à 96 ind. m^2). D'avril 1986 à avril 1989, sa fréquence dans les échantillons a varié de 50 % à 100 %, diminuant à la fin de chaque été. L'interprétation des histogrammes taille-fréquence suggère que le recrutement advient dans la seconde moitié de l'été. Au cours de l'automne 1989, *P. caspersi* a disparu de la baie de Kapsel, aucun exemplaire n'ayant été retrouvé ni en 1990, ni en 1991. Les causes possibles de cette disparition sont discutées.

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INTRODUCTION

Prionospio caspersi Laubier, 1962 was first discovered in Venice Lagoon (LAUBIER, 1962) and later found in many areas of the western Mediterranean and Adriatic seas (LAUBIER, 1965; GUÉRIN, 1970). This species inhabits sand and silty-sand sediments of the upper sublittoral zone (LARDICCI, 1989). In the Black Sea, *P. caspersi* was recently found and described from the southeastern coast of the Crimean Peninsula (BRITAYEV *et al.*, 1991, Fig. 1). In this paper we suggested that *P. caspersi* had earlier been misidentified as *P. malmgreni* Claparède, 1868 and that its distribution in the Black Sea was thus probably considerably wider than realized.

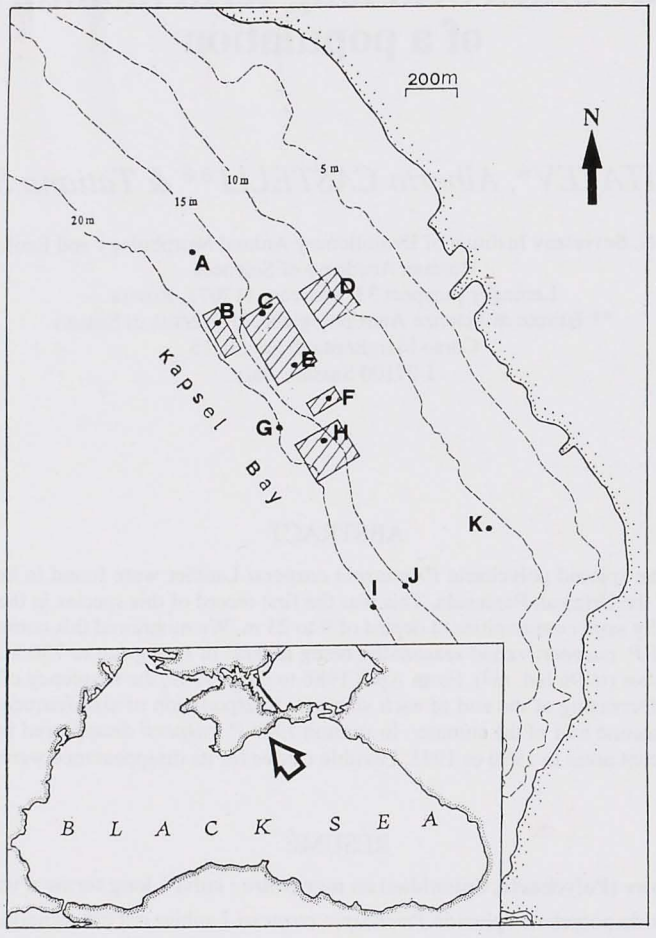

FIG. 1. — Study area in Kapsel Bay, the Black Sea. Sampling stations (A-K) indicated by black dots. Shaded areas show location of mussel (*Mytilus galloprovincialis*) farm.

The ecology of *P. caspersi* in the northern Adriatic, mainly its secondary production in the vicinity of the Po Estuary, was investigated by AMBROGI *et al.*,1985 and AMBROGI, 1990.

During 1986-1991 personnel from the Institute of Fisheries and Oceanology, Moscow, monitored benthic communities in the Black Sea, near Sudak (PERELADOV *et al.*, 1988). During this period benthic samples were collected 2-4 times a year. Since *P. caspersi* was numerically dominant at the study site, the material was suitable for an evaluation of seasonal and long-term changes in the population structure of this species.

MATERIALS AND METHODS

The study was carried out in Kapsel Bay, near the town of Sudak on the southeastern coast of the Crimean Peninsula, in the area of a mussel (*Mytilus galloprovincialis* Lamarck, 1819) farm (Fig. 1). Benthic samples were collected at the same stations twice a year in 1986-1987 and 1989-1991 (spring and late summer or autumn), and once every three months in 1988. Although not all stations were sampled each time, all sampling periods except November 1990 included samples from within and outside the mussel beds, for the most part about half of each (Table 1). At each station 1-4 samples were taken by a Petersen grab (0.025 m^2). The samples were sieved through 0.5 mm mesh and all *P. caspersi* were removed, fixed in a 4 % formalin solution and counted. For study of size-frequency distribution, specimens collected in February, April and August 1988 were used. For each specimen the surface area of the first 10 setigers was calculated according to the method of AMBROGI *et al.* (1985). The material is deposited in the A.N. Severtzov Institute of Evolutionary Animal Morphology and Ecology, Russian Academy of Sciences, Moscow.

RESULTS

Prionospio caspersi inhabited clean fine sand and silty sand at depths of 9 to 23 m in the community of the bivalve mollusc *Chamelea gallina* (L., 1758). At sites where the silty fraction prevailed, *P. caspersi* was absent. It was not found at depths greater than 23 m which may have been the results of the predominance of silty sediments here.

Size-frequency distribution of individuals based on the surface area of the first 10 setigers is shown in Fig. 2. The curves were unimodal in February and April and bimodal in August. The modal area of the first 10 setigers was 0.56 mm^2 (average: 0.62 mm^2, n = 128 specimens) in February, increasing to 0.71 mm^2 (average: 0.76 mm^2, n = 146) by April. The first peak of the size-frequency curve in August was formed by individuals with a modal area of 0.34 mm^2. This peak reflected the appearance of a new generation. The second peak was formed by specimens with a modal area of 0.64-0.71 mm^2. This corresponded to the single peak in winter and spring months formed by specimens of the previous generation. The period from April to August was characterized by negative growth of the population probably reflecting the death of the parent population.

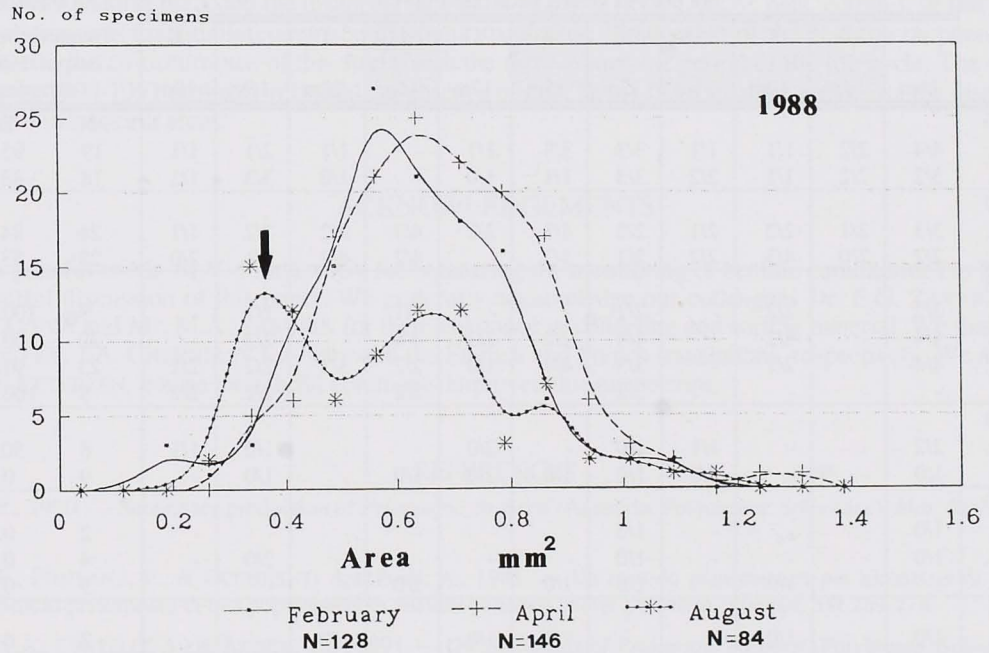

FIG. 2. — *Prionospio caspersi*. Size-frequency curves based on surface area of anterior end calculated according to method of AMBROGI *et al.* (1985). Arrow indicates appearance of recruits.

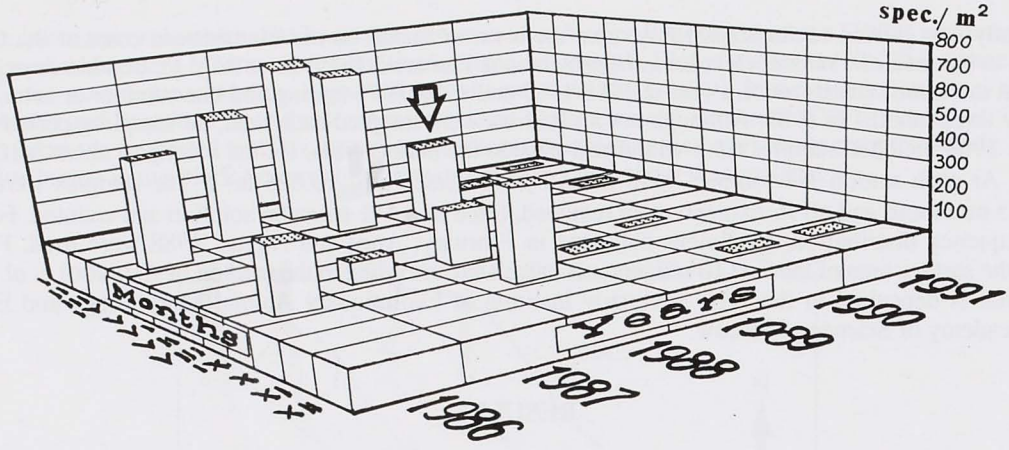

FIG. 3. — *Prionospio caspersi*. Seasonal and long-term changes in population density in Kapsel Bay, Black Sea. Arrow indicates last find of this species.

Prionospio caspersi outstripped other benthic species in terms of density and frequency of occurrence in 1986-1988. The maximum density was about 2440 ind.m^2, and the mean density varied from 96 to 730 ind. m^2.

TABLE 1. — *Prionospio caspersi*. Frequency of occurrence at 11 stations (A-K) in Kapseh Bay, the Black Sea.

Date	Total number of Petersen grab samples (each 0.025 m^2) per station per sampling period/number of samples with *P. caspersi*. Bold stations are ones in mussel beds (see Fig. 1).											N = Total no. of samples % = Percent frequency of *P. caspersi* in all samples	
	A 16m	B 14m	C 12m	D 11m	E 12m	F 15m	G 17m	H 16m	I 22m	J 16m	K 10m	N	%
1986													
Apr.	4/4	2/2	1/1	1/1	3/3	3/3	1/1	-	1/1	2/1	1/1	19	95.0
Sep.	3/2	2/2	1/1	2/2	3/3	1/1	1/0	-	1/0	3/3	1/1	18	83.3
1987													
Mar.	3/3	2/1	2/2	2/1	2/2	4/3	2/2	4/3	2/2	2/2	1/1	26	84.6
Aug.	2/2	2/0	4/3	2/2	2/1	4/2	-	4/2	4/2	2/1	2/0	28	53.6
1988													
Feb.	2/2	-	2/2	-	2/2	-	-	1/1	-	1/1	-	8	100.0
Apr.	4/4	-	2/2	-	4/4	2/2	2/2	4/4	-	2/2	-	20	100.0
Aug.	4/4	-	2/2	-	3/3	4/4	1/0	2/2	3/3	2/2	2/1	23	91.3
Oct.	-	-	-	-	2/2	-	-	2/2	-	2/2	2/2	8	100.0
1989													
Apr.	2/2	-	-	1/1	1/0	-	2/0	-	-	1/0	1/1	8	50.0
Sep.	1/0	-	-	2/0	1/0	1/0	2/0	1/0	-	1/0	-	9	0.0
1990													
Feb.	1/0	-	-	-	1/0	-	-	-	-	-	-	2	0.0
Aug.	1/0	-	-	-	1/0	-	-	-	-	2/0	-	4	0.0
Nov.	-	-	1/0	-	1/0	1/0	-	2/0	-	-	-	5	0.0
1991													
Jan.	1/0	-	1/0	-	-	2/0	1/0	-	1/0	-	-	7	0.0
Apr.	2/0	-	2/0	-	1/0	-	-	2/0	-	2/0	-	7	0.0
Nov.	1/0	-	1/0	-	-	1/0	-	-	-	-	1/0	5	0.0

In 1988, benthic samples were collected in all seasons, so this year is more suitable than the others for an analysis of the seasonal dynamics of the population. Population density was maximal in winter and spring, decreasing in summer and increasing in autumn (Fig. 3). A decrease of population density in summer was noted also in 1986 and 1987. The decrease in population density in August-September was accompanied by a reduced frequency of occurrence (Table 1).

As a result of benthic community monitoring from 1986 to 1991, the population of *P. caspersi* population may be followed until April 1989 when it was taken for the last time (Fig. 3). *P. caspersi* was absent from samples taken in September 1989 through 1991.

DISCUSSION

The size-frequency histograms suggest that a recruitment took place in the second part of the summer. These data agree with AMBROGI's (1990) observations. He found that *P. caspersi* had an annual life cycle with intensive recruitment in the beginning of July in the Adriatic Sea. The decrease in density and frequency of occurrence in August-September was probably related with the change of generations. High mortality eliminated the parent population, and at the same time the density of the new generation was low as a result of the prolonged period of recruitment which was not yet over.

The population density of *P. caspersi* in the Adriatic Sea (AMBROGI, 1990) was about 15-20 times higher than in the Black Sea. The trophic conditions in these areas are similar. The concentration of organic carbon in the Black Sea varied from 4.5 to 8.1 $gC.kg^{-1}$ in winter and summer, respectively (PERELADOV, pers. comm.). This is similar to the values found in the Adriatic Sea by AMBROGI (1990) (2.1-8.2 $gC.kg^{-1}$). The sediment structure was similar at both sites. However, the hydrodynamic conditions in the two areas were different. AMBROGI (1990) emphasized the stability of environmental parameters in the Adriatic. In contrast, Kapsel Bay is an exposed bay and the upper layer of sediment is influenced by wave action to 15-20 m, the lower depth of the distribution of *P. caspersi*. This species inhabits the thin upper layer of sediments and is usually disturbed during storms. Therefore, wave action is probably the main factor causing a decrease in the density of *P. caspersi* on the southeastern coast of Crimea.

This theory provides an explanation for the disappearance of *P. caspersi* in the autumn of 1989. In early September 1989 a storm preceded the disappearance of *P. caspersi* (PERELADOV, pers. comm.). In this period the entire population was essentially comprised of young specimens. Destruction of the *P. caspersi* population was probably due to the co-occurrence of this storm with the most vulnerable period of the life cycle. The absence of recruitment in 1990-1991 probably reflected the absence of drift larvae from adjacent areas, i.e., the disappearance of *P. caspersi* in adjacent areas.

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