

**ON PREDATION ON POLYCHAETES (ANNELIDS)  
BY THE SQUIRRELFISH *ADIORYX RUBER* (HOLOCENTRIDAE),  
WITH A NEW POLYCHAETE RECORD FOR THE MEDITERRANEAN COAST OF ISRAEL**

M.N. BEN-ELIAHU, D. GOLANI and A. BEN-TUVIA

Department of Zoology,  
The Hebrew University of Jerusalem, 91904 Jerusalem, Israel

**Résumé.** — Prédation des Polychètes par *Adioryx ruber* (Holocentridae), avec une signalisation nouvelle de Polychète pour la côte méditerranéenne d'Israël. Les polychètes constituent une petite partie du régime alimentaire du poisson *Adioryx ruber* (Forsk.), jusqu'à une moyenne de 6 % en poids du contenu de l'estomac. Les espèces qui les plus souvent deviennent la proie de poissons sont les espèces les plus grandes, c'est à dire : *Pontogenia chrysocoma*, un aphroditid, *Eunice torquata* et d'autres polychètes appartenant à la superfamille Eunicea. Il apparaît que la plupart de ces espèces sont associées à des habitats bioconstruits, mais il y en a qui sont associées avec des fond argileux. *Goniada emerita* (Goniadidae) qui a été récoltée en deux occasions représente une signalisation nouvelle pour la faune de polychètes de la côte méditerranéenne orientale. On peut supposer que toutes les espèces de polychètes qui ont été identifiées ont une activité nocturne.

**Summary.** — Polychaetes form a small component of the diet of the squirrelfish *Adioryx ruber* (Forsk., 1775) averaging 6 % by weight of the stomach contents. Most frequently taken are larger species, *Pontogenia chrysocoma*, an aphroditid; *Eunice torquata*, and other polychaetes belonging to the Superfamily Eunicea. Most species appear to be associated with biogenic rock habitats, but there are some associated with clay bottoms. *Goniada emerita* (Goniadidae) found in the stomach contents on two separate occasions, is a new record for the polychaete fauna of the eastern Mediterranean coast. All identified polychaete species are presumed to be nocturnally active.

Polychaetes form an important part of the diet of two of three Indo-Pacific holocentrid coral fishes investigated by Vivien and Peyrot-Clausade (1974) at Tulear (Madagascar) in a study embracing both fishes and habitats. An Indo-Pacific holocentrid fish, *Adioryx ruber* (Forsk., 1775) has migrated into the eastern Mediterranean (Haas and Steinitz, 1947; Ben-Tuvia, 1978) and now comprises part of the fish fauna here.

Eastern Mediterranean polychaetes (Egypt, Sinai, Israel and Lebanon) and their habitats have been investigated by different authors (Monro, 1937; Fauvel, 1937, 1955, 1957; Gottlieb, 1959; Tebble, 1959; Harlock and Laubier, 1966; Laubier, 1966; 1970; Lipkin and Safriel, 1971; Ben-Eliahu, 1975 a,b; 1976 a,b,c; 1977 a,b and unpublished catalogue of eastern Mediterranean species; Amoureux, 1976;

Zibrowius and Bitar, 1981) providing some information for associating polychaetes obtained from stomachs of fish with possible foraging sites of the fish.

The feeding habits of *Adioryx ruber* were investigated by Golani, 1981 and Golani, Ben-Tuvia and Galil, ms. by studying stomach contents of fish caught by commercial fishing gear in the vicinity of Akko (Acre). The polychaete component, set aside, is dealt with in this paper. Analysis of the major groups of prey, but particularly of crustaceans, the preferred prey, suggests that *A. ruber* feeds mainly upon benthic substrates from 10 - 40 m depth, preferably foraging on rocky habitats but on soft substrate habitats as well (Golani, Ben-Tuvia and Galil, ms.). As in the holocentrids studied by Vivien and Peyrot-Clausade (1974), *A. ruber* is predominantly a nocturnal feeder (Golani, 1981; Golani, Ben-Tuvia and Galil, ms.). The present paper assesses the feeding habits of *A. ruber* based on the information from the polychaete component of the diet.

Polychaetes form a minor part of the diet of *A. ruber*, averaging only 6 % by weight of the total stomach contents. Some worms which were not in an advanced stage of digestion could be confidently assigned to species. These are enumerated below, along with habitats recorded from the eastern Mediterranean coast for them. The polychaete species are all presumed to be nocturnally active, but there are differences in vagility between the species.

## METHODS

Sampling of *A. ruber* and methods of analysis of stomach contents are detailed in Golani, Ben-Tuvia and Galil (ms.). Polychaete material was sorted to individuals where possible. Some of the digested material could be diagnosed from the setae, e.g., *Pontogenia chrysocoma*. In order to supplement information on soft parts of worms which had undergone digestion, comparison was made with polychaetes from coral substrates [*Cladocora cespitosa* L., syn. *Dendrophyllia* sp. (Gottlieb, 1959)] from Haifa Bay and from samples of "coralligène", biogenic rock, collected by diving with aqualung in the vicinity of Shikmona, Haifa Bay at 29 m.

## RESULTS

All the polychaetes were benthic species. Totalling the pooled samples, polychaetes averaged  $6.19 \pm 9.16\%$  of the wet weight of the filled stomachs of *Adioryx ruber* (Golani, 1981), ranging from 0.00 to 32.78% (tabl. 1). Some twenty-four species of polychaetes were found. In the richest sample (June, 1981), at least 16 species were present. Few individuals were complete specimens, but sometimes fragments with pygidia could be made out, suggesting the species might be fully vagile. The preponderance of the material, however, seemed to be anterior fragments, suggesting that hind ends of the worms were kept in the substrate and only the anteriors which projected out were available for cropping by the fish.

Eastern Mediterranean records for the identified species are as follows.

*Pontogenia chrysocoma* (Baird, 1965)

Fauvel, 1955:5; Tebble, 1959:14; Laubier, 1966:11; Lipkin and Safriel, 1971:10; Amoureux, 1976:1049. Additional records, Ben-Eliahu catalogue of eastern Mediterranean polychaetes.

Depth: infralittoral fringe to 80 m.

Habitats: grey mud; sandy mud; biogenic rock.

*Odontosyllis fulgerans* (Audouin and Milne-Edwards, 1833)

Amoureux, 1976:1049; Ben-Eliahu, 1977a:3.

Depth: lower mid-littoral to 50 m.

Habitats: sandy mud, *Caulerpa* and biogenic rocks; intertidal vermetid reefs.

*Goniada emerita* Audouin and Milne-Edwards, 1833 Harmelin, 1969, Crete from *Halophila*, 5-11 m.

Note: This is the first record from the eastern Mediterranean coast. Preyed upon on two separate occasions (tabl. 1). Length, 40 mm, 168 setigers, 6 chevrons, complete specimen; 63 mm, 140 setigers (3 fragments), 9 chevrons.

*Eunice ? indica* Kinberg, 1865

Ben-Eliahu, 1972:224; 1976c:167.

Depth: 8-80 m, Mediterranean coast of Sinai; 96, Tantara.

Habitat: grey mud.

Remarks: *Eunice indica*, a Red Sea species believed to have migrated through the Suez Canal, is very close to *Eunice vittata*, and local records for both may refer to the same species. *E. indica* is distinguished from *E. vittata* by the number of acicular setae and by a greater number of branchial filaments (Ben-Eliahu, 1972, 1976). Fauvel and Rullier (1958) noted these differences but did not consider them as sufficient to separate to species. However, similarly sized larger individuals from

Table 1. — Polychaetes from *Adioryx ruber* stomachs

		1979				1980							
		30/10	19/11	26/12	14/1	21/2	24/3	7/5	13/6 17/6	16/7	19/8	16/9	16/10
Lunar Cycle		9	29	6	25	4	6	7	29	3	7	6	6
Number of fish in sample		20	19	13	20	34	21	32	39	50	21	20	25
Number of stomachs with food		12	2	7	9	9	15	25	37	44	17	16	18
Total weight of food (g.)		4.40	0.79	4.54	2.43	1.34	1.65	10.44	23.34	31.33	23.83	12.65	9.58
Weight of polychaetes (g.)		0.30	0.02	0.07	0.92	0.16	0.00	0.26	7.65	0.09	0.09	1.12	0.37
Percent by weight of polychaetes		6.81	1.89	1.54	3.78	11.96	0.00	2.16	32.78	0.29	0.38	8.87	3.87
Aphroditidae	<i>Pontogenia chrysocoma</i>	+	.	.	.	.	.	.	+C	.	.	+	+
Polynoidae	Sp. 1	.	.	.	.	+	.	.	.	.	+	.	.
Palmyridae	Sp. 1	.	.	.	.	.	.	.	+	.	.	.	.
Phyllodocidae	Sp. 1	.	.	.	+	+	.	.	.	.	.	.	.
	Sp. 2	.	.	.	.	+	.	.	+	.	.	.	.
	Sp. 3	.	.	.	.	+	.	.	.	.	.	.	.
Syllidae	<i>Syllis</i> sp.	.	.	.	.	.	.	.	+	.	.	.	.
	Syllinae	.	+	.	.	.	.	.	+	.	.	.	.
	<i>Odontosyllis fulgerans</i>	.	.	.	.	.	.	.	+	.	.	.	.
Goniadidae	<i>Goniada emerita</i>	.	.	.	+C	.	.	.	+C	.	.	.	.
Eunicidae	<i>Eunice indica</i> or <i>vittata</i>	.	.	.	.	+i	.	.	++v	.	.	.	.i
	<i>Eunice torquata</i>	.	.	.	.	.	.	+	+++	+	.	.	.
	<i>Eunice</i> sp.	.	.	.	.	.	.	.	+	.	.	.	.
	? <i>Eunice</i> sp.	.	.	.	.	.	.	.	+	.	.	.	.
	eunicid	.	.	.	+	.	.	.	+	+	.	.	.
	<i>Lysidice ninetta</i>	.	.	.	.	.	.	.	+	.	.	.	.
Lysaretidae	? <i>Halla</i> sp.	.	.	.	.	+	.	.	.	.	.	.	.
Lumbrineridae	<i>Lumbrineris coccinea</i>	.	.	.	.	+	.	+	+	.	.	.	.
	<i>Lumbrineris</i> sp.	.	.	+	.	+	.	+	.	+	.	.	.
Arabellidae	<i>Arabella iricolor</i>	.	.	.	+	.	.	.	.	+	+	.	.
Dorvilleidae	Sp. 1	.	.	.	.	.	.	.	+	.	.	.	.
Chaetopteridae	Sp. 1	.	.	.	.	.	.	.	+	.	.	.	.
Capitellidae	<i>Dasybranchus ? caducus</i>	.	.	.	.	+	.	.	+	.	.	.	.
Flabelligeridae	<i>Pherusa eruca</i>	.	.	.	.	.	.	+	.	.	.	.	.
Number of Polychaete Species in Sample		1	1	1	5	10	0	5	16	5	1	1	2

eastern Mediterranean populations had as many as 4 acicula, and more than 2 branchial filaments, as compared with some from Cyprus with a maximum of 2 acicula and 2 branchial filaments, differences which justify maintaining the distinction. In small individuals it is not possible to distinguish between the individuals and young worms may be diagnosed as *E. vittata*. Records for both are appended. *A. ruber* ate complete specimen, 28 mm length, 85 setigers, 7 branchial filaments and 1 acicular seta; other individuals with 3 acicular setae and 3 branchial filaments (see tabl. 1).

*Eunice vittata* (Delle Chiaje, 1828)

Fauvel, 1957: 214; Gottlieb, 1959: 27; Laubier, 1966: 13, Amoureux, 1976: 1050. Ben-Eliahu catalogue of eastern Mediterranean polychaetes.

Depth: 19 m - 73 m.

Habitats: muddy sand with biogenic rock; sand, gravel, biogenic rock; biogenic rock.

*Eunice torquata* Quatrefages, 1865.

Fauvel, 1957: 214; Gottlieb, 1959: 27; Tebble, 1959: 14; Laubier, 1966: 14; Amoureux, 1976: 1050; Ben-Eliahu catalogue of the eastern Mediterranean polychaetes.

Depth: 16-73 m.

Habitats: muddy sand with biogenic rock; biogenic rock.

Remarks: The most abundant species in Haifa Bay (Gottlieb, 1959), and particularly abundant in the biogenic rock habitats of the Israel coast. Radula of gastropod noted in gut of one individual.

*Lysidice ninetta* Audouin and Milne-Edwards, 1833.

Fauvel, 1957: 214, Gottlieb, 1959: 27; Laubier, 1966: 14; Amoureux, 1976: 1051.

Depth: 21 m - 66 m.

Habitats: mud and biogenic rock; biogenic rock.

*Lumbrineris coccinea* (Renier, 1804)

Fauvel, 1957: 214; Gottlieb, 1959: 28; Ben-Eliahu catalogue of the eastern Mediterranean polychaetes.

Depth: 16 - 24 m.

Habitat: biogenic rocks.

*Arabella iricolor* (Montague, 1804)

Fauvel, 1957: 214; Gottlieb, 1959: 28; Safriel and Lipkin, 1971: 8; Ben-Eliahu, 1976c: 172, Ben-Eliahu catalogue of the eastern Mediterranean polychaetes.

Depth: intertidal - 87 m.

Habitats: sea weed; under rocks on muddy bottom; biogenic rock; intertidal vermetid reefs-abundant.

*Dasybranchus caducus* (Grube, 1846)

Fauvel, 1957: 215; Gottlieb, 1959: 29.

Depth: 87 m.

Habitat: clay.

*Pherusa eruca* (Claparede, 1870)

Fauvel, 1957: 215; Gottlieb, 1959: 29; Tebble, 1959: 15.

Depth: 36 - 87 m.

Habitat: clay.

## DISCUSSION

Vivien and Peyrot-Clausade (1974) reported on the feeding of three holocentrid coral fishes, two of whom take polychaetes as an important component of their diet. *Mypristes bowditchae* fed abundantly on Nereidae and, after that, on Glyceridae and, at night the nereids were mainly in the heteronereid phase; thus it feeds in midwater as well as on the bottom. For *Holocentrus diadema*, which forages on reef flats with scattered coral growth, eunicids were the main polychaete food, as with *A. ruber*.

As noted above, *Adioryx ruber* does not feed greatly on polychaetes. Except during the summer (tabl. 1), polychaetes were a minor part of the diet. The most frequently taken worms belong to larger species, an aphroditid, *Pontogenia chrysocoma*, and species belonging to the Superfamily Eunicea, particularly *Eunice torquata*. No nereids were represented among the prey. For caution, we note that sampling of *A. ruber* was not carried out with reference to the lunar cycle (tabl. 1), so that free-swimming reproductive stages of benthic species may not have been present in the water column. Thus, their absence from stomach contents may not be an indication that *A. ruber* does not feed in midwater. Nonetheless the species complement of the polychaete prey fully demonstrates that *A. ruber* is a benthic feeder. The strong eunicid component is indicative of rocky substrates (Gottlieb, 1959), thus, *A. ruber* is perceived as foraging primarily on habitats of biogenic rock. However, the species, *D. caducus* and *P. eruca* are associated by Gottlieb (1959) with clay habitats (87 m). Thus *A. ruber* seems to forage over level bottoms occasionally, too. With the exception of *D. caducus*, all the identified species have been reported from the western Mediterranean coralligène at Alberes (Laubier, 1966). In characterizing the species as vagile or sessile, Laubier (1966) noted all the Eunicea as sessile, excepting *A. iricolor*. *Pontogenia chrysocoma*, *Goniada emerita* and *Pherusa eruca* are considered to be vagile.

Thus, impression on feeding of *A. ruber* based on crustaceans and other previously analyzed taxa (Golani, Ben-Tuvia and Galil, ms.) is supported by the results from the investigation of the polychaetes. However, the polychaete records permit the speculation that the fish may be feeding in slightly deeper waters (from ca. 15 - 10 m) than previously suggested.

*A. ruber* is a nocturnal species, thus the polychaete species taken are to be perceived as ones with nocturnal

activity. During the day, few worms are found on the surfaces of biogenic rocks, although these same rocks are a ferment of crawling worm activity at night (S. Pisanti; personal communication, from observations of coralligène at Shikmona, Haifa Bay, 29 m depth). In this regard, the day-night changes towards greater selectivity of feeding at night of *M. bowditchae*, suggested by Vivien and Peyrot-Clausade (1974) based on a greater proportion of polychaete material in the stomach following nocturnal feeding, may be a reflection of greater availability of the polychaete prey taken randomly by the fish at night rather than of differences in behaviour of the fish. To ascertain whether difference in selectivity of feeding occurs between night and day, quantitative samples of plankton and of fish gut contents would need to be studied.

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## REFERENCES

- Amoureux L.**, 1976. *Serpula (Paraserpula) israelitica*, nouvelle espèce de Serpulidae (Annélides polychètes) et une petite collection annélide de la Méditerranée orientale. *Bull. Mus. Hist. nat.*, Paris, (Sén. 3) n° 404 (Zool. 281): 1047-1059.
- Ben-Eliahu M.N.**, 1972. Polychaeta Errantia of the Suez Canal. *Israel J. Zool.*, 21: 189-237.
- , 1975a. Polychaete cryptofauna from rims of similar intertidal vermetid reefs on the Mediterranean coast of Israel and in the Gulf of Elat: Sabellidae (Polychaeta Sedentaria). *Ibid.*, 24: 54-70.
- , 1975. Nereidae (Polychaeta Errantia). *Ibid.*, 24: 177-191.
- , 1976a. Serpulidae (Polychaeta Sedentaria). *Ibid.*, 25: 103-119.
- , 1976b. Polychaeta Sedentaria. *Ibid.*, 25: 121-155.
- , 1976c. Errant polychaete cryptofauna (excluding Syllidae and Nereidae) from rims of similar intertidal vermetid reefs on the Mediterranean coast of Israel and in the Gulf of Elat. *Ibid.*, 25: 156-177.
- , 1977a. Polychaete cryptofauna from rims of similar intertidal vermetid reefs on the Mediterranean coast of Israel and in the Gulf of Elat: Syllinae and Eusyllinae (Polychaeta Errantia: Syllidae). *Ibid.*, 26: 1-58.
- , 1977b. Idem Exogoninae and Autolytinae (Polychaeta Errantia: Syllidae). *Ibid.*, 26: 59-99.
- Ben-Tuvia A.**, 1978. Immigration of fishes through the Suez Canal. *Fish. Bull.*, 76(1): 249-255.
- Fauvel P.**, 1937. Les fonds de pêche près d'Alexandrie. 11. Annélides Polychètes. *Notes Mém. Dir. Rech. Pêch.*, 19: 1-60.
- , 1955. Contribution à la faune des Annélides Polychètes des côtes d'Israel. *Sea Fish Res. Sta., Haifa Bull.*, 10: 3-12.
- , 1957. Contribution à la faune des Annélides Polychètes des côtes d'Israel. 2. *Bull. Res. Counc. Israel*, 6B: 213-219.
- Fauvel P., Rullier F.**, 1959. Nouvelle contribution à la faune des Annélides Polychètes du Sénégal. *Bull. Inst. franc. Afr. Noire*, (Sér. A) 19(1): 24-399.
- Golani D.**, 1981. The biology of *Adioryx ruber* (Forsk., 1775) in the Mediterranean and morphological and meristic comparison of the Mediterranean and Red Sea populations (In Hebrew). M. Sci. Thesis, Hebrew Univ. Jerusalem, Israel.
- Golani D., Ben-Tuvia A., Galil B.** Feeding habits of the Suez Canal migrant, squirrelfish, *Adioryx ruber*, in the Mediterranean Sea. Unpubl. MS.
- Gottlieb E.**, 1959. Study of the benthos in Haifa Bay (In Hebrew). Ph. D. Diss., Hebrew Univ. Jerusalem, Israel.
- Haas G., Steinitz H.**, 1947. Erythrean fishes on the Mediterranean coast of Palestine. *Nature*, London, 160 (4053): 28.
- Harlock R., Laubier L.**, 1966. Notes on *Branchiosyllis uncinigera* (Hartmann-Schroder, 1960) new to the Mediterranean. *Israel J. Zool.*, 15: 18-25.
- Harmelin J.G.**, 1969., Contribution à l'étude d'endofaune des prairies de *Halophila stipulacea* de Méditerranée Orientale, 1. Annélides Polychètes. *Rec. Trav. Sta. Mar. Endoume*, 61 (Bull. 45): 305-316.
- Laubier L.**, 1966a., Le coralligène des Albères, monographie biocénotique. *Ann. Inst. océanogr.*, 43: 137-316.
- , 1966b. Sur quelques Annélides Polychètes de la région de Beyrouth. *Am. Univ. Beirut Misc. Pap. Nat. Sci.*, 5: 9-22.
- , 1970. *Prionospio salzi* sp. nov., un Spionidien (Annélide polychète) des côtes Méditerranéennes d'Israel. *Israel J. Zool.*, 19(4): 183-190.
- Lipkin Y., Safriel U.**, 1971. Intertidal zonation on rocky shores at Mikhmoret (Mediterranean, Israel). *J. Ecol.*, 59: 1-30.
- Monro C.C.A.**, 1937. A note on a collection of polychaetes from the eastern Mediterranean with a description of a new species. *Ann. Mag. nat. Hist.*, (Ser. 10) 10: 82-86.
- Tebble N.**, 1959. On a collection of polychaetes from the Mediterranean coast of Israel. *Bull. Res. Counc. Israel*, 8B: 9-30.

**Vivien M.L., Peyrot-Clausade M., 1974.** A comparative study of the feeding behaviour of three coral reef fishes (Holocentridae), with special reference to the polychaetes of the reef cryptofauna as prey. *Proc. 2nd int. Coral Reef Symp. I. Great Barrier Reef Committee, Brisbane, October 1974*: 179-192.

**Zibrowius H., Bitar G., 1981.** Serpulidae (Annélida Polychaeta) indopacifiques établis dans la région de Beyrouth, Liban. *Rapp. Proc. verbaux Comm. int. Explor. Mer Médit.*, 27(2): 159-160.

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