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THE METAZOAN PARASITES OF *STELLIFER MINOR* (TSCHUDI, 1844): AN ECOLOGICAL APPROACH

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A quantitative and qualitative analysis of the parasite fauna of the sciaenid Stellifer minor *(Tschudi) from Chorrillos, Perú, was made. Some characteristics of the infectious processes, in terms of intensity and prevalence of infection, as a function of host sex and size, are given. Moreover, comments on the characteristics of the parasite fauna, related with host role in the marine food webs are included. The parasite fauna of* Stellifer minor *taken off Chorrillos, Perú, include the monogeneans* Pedocotyle annakohni, Pedocotyle bravoi, Rhamnocercus *sp. and* Cynoscionicola *sp., the digenean* Helicometra fasciata, *the adult acantocephalan* Rhadinorhynchus *sp. and the larval* Corynosoma *sp., the nematode* Procamallanus *sp., the copepods* Caligus quadratus, Clavellotis dilatata *and* Bomolochus peruensis *and one unidentified isopod of the family Cymothoidae. A distinctive characteristic of the parasite fauna (Metazoa) of* S. minor *is the almost absence of larval forms.*

Key words: parasite ecology – fish parasites – sciaenid fish – prevalence – intensity – marine food webs – Peruvian coast – *Stellifer minor*

Stellifer minor (Tschudi, 1844) is a benthol litoral sciaenid, with a geographical distribution from Paita-Perú (05° 07'S, 81° 11'W) to Valparaiso – Chile (32° 57'S, 71° 33'W) and represent an important alimentary resource, but no published information about the biology of this fish, including their parasites, is available. In this paper, the results obtained in a quantitative and qualitative analysis of the metazoan parasites of *S. minor* are present. Moreover, comments on some ecological characteristics of the infectious processes that affect this fish, are also presented.

MATERIALS AND METHODS

From September of 1987 to August of 1988, monthly samples of *S. minor* were obtained, freshly, from commercial fishermen at Chorrillos, Perú (12° 30'S, 76° 50'W). The total number of fishes examined was 311. The fishes were carried to the laboratory and the metazoan parasites collected from the gills, oral cavity, internal organs and coelomic cavity. Representative material was kept, in the Coleccion Parasitologica de la Universidad Ricardo Palma, Lima, Perú, for systematic studies. Total length (0.1 cm precision), sex, number and site of infection of each parasite were registered for each fish host.

Statistical analysis performed were the Student "t" test to determine if male and female host lengths were similar. The "r" correlation coefficient was determined for the relation between total length of the fish and intensity and prevalence of infection, previous rank transformation of intensity data (Conover & Iman, 1981) and angular transformation of prevalence data. Analysis included only parasites with prevalence equal or superior to 10%. The effect of host's sex on intensity and prevalence of infection, were tested using the Mann-Whitney "U" test and the Log-Likelihood "G" test respectively. Statistical methods are those indicated by Zar (1984). The parasite community was characterized according to the Importance Value of Bush (Thul et al., 1985). The use of ecological terms follows the recommendations of Margolis et al. (1982).

RESULTS

The size range of the host sample was 9.0 to 19.5 cm. Females were significantly larger than males ($P > 0.005$).

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TABLE I

Ocurrence of parasites (metazoa) in *Stellifer minor*

Parasite	Prev.	I.	Range	I.V.	S2/X	"r"	P	Lc.
Rhamnocercus sp.	98.4	165.4	10-555	96.4	56.6	0.04	>.50	G.
Cynoscionicola sp.	0.3			a			–	G.
Pedocotyle annakohni	30.5	1.7	1-6	0.09	1.9	−0.74	>.02	G.
Pedocotyle bravoi	14.5	1.4	1-3	0.02	1.5	−0.86	>.002	G.
Helicometra fasciata	65.9	13.6	1-377	3.51	71.8	−0.13	>.50	Int.
Rhadinorhynchus sp.	0.9			a				Int.
Corynosoma sp.	0.3			a				C.C.
Procamallanus sp.	1.3			a				Int.
Clavellotis dilatata	12.5	1.8	1-6	0.02	2.5	0.79	<.05	G.
Caligus quadratus	12.5	1.5	1-6	0.01	2.2	0.89	<.05	G.
Bomolochus peruensis	2.5			a				G.
Cymothoid crustacean	0.3			a				M.

Prev. = prevalence of infection; I. = mean intensity; I.V. = importance value of Bush; S2/X = variance mean ratio; "r" = correlation coefficient of the relation between prevalence and mean size in each size class; P = probability level of "r"; Lc. = location of parasites in the host; G. = gills; Int. = intestine; C. C. = coelomica cavity; M. = mouth. a: I.V. less than 0.001.

TABLE II

The six main parasites of *Stellifer minor* (Prevalence > 10%)

Parasite	"r"	n	P	"U"	P	G	P
Rhamnocercus sp.	0.34	306	<0.001	2.91a	<0.005	0.034	>0.75
Pedocotyle annakohni	0.11	95	>0.20	0.68a	>0.25	1.35	>0.10
Pedocotyle bravoi	0.20	45	>0.10	0.09a	>0.25	2.52	>0.10
Helicometra fasciata	0.17	205	<0.02	0.85a	>0.10	0.006	>0.90
Clavellotis dilatata	−0.05	39	>0.50	183	>0.10	0.207	>0.50
Caligus quadratus	0.37	39	<0.02	201	>0.10	1.65	>0.10

"r" = correlation coefficient between parasite number and fish length (previous rank transformation); n = sample size; "U" = Mann-Whitney test value; "G" = "G" test value; P = probability level; a = normal aproximation to "U" test.

One hundred percent of the fishes, were parasitized with one or more species of the parasites which are listed in Table I.

Table I also shows prevalence, mean intensity, range, variance/mean ratio, "r" value of the relationship between intensity and host length, probability level, importance value, and location. All the infectious processes have a variance/mean ratio larger than 1, that is indicative of an overdispersed distribution patter.

Table II shows the main six parasite species (prevalence = or > than 10%), and the "r" value of the relation between prevalence and host length, the value of "U" (Mann-Whitney test) and "G" with their respective probability levels. All the main parasites show independence between intensity and prevalence of infection as a function of host's sex. Exception is made by *Rhamnocercus* sp. with mean intensity larger in females than males. *Rhamnocercus* sp., *H. fasciata* and *C. quadratus* are the only parasites that show intensities of infection that are directly and significantly related to host length.

DISCUSSION

The results now obtained agree well with those reported for other host-parasite systems. Overdispersed distribution is the rule in parasitic infection and is due to the heterogeneity in host behaviour and aggregate spatial patterns of infective stages and/or differential susceptibility or defensive ability, that is shown by specimens in a host population (Anderson & Gordon, 1982; Rohde & Hobbs, 1986).

TABLE III

Some fishes of different ecological residences and the proportion of their parasites represented by larval forms (%)

Fish host	%	Authors
Cheilodactylus macropterus	100.0	Vooren & Tracey (1976)
Trachurus murphyi	83.3	Oliva (unpublished)
Fundulus zebrinus	67.0	Janovy & Hardin (1987)
Genypterus maculatus	67.0	George-Nascimento & Huet (1984)
Trachurus capensis	64.3	Gaevskaja & Kovaleva (1980)
Micromesistius poutassou	63.6	MacKenzie (1979)
Xiphias gladius	63.2	Hogans et al. (1983)
Genypterus chilensis	62.5	Vergara & George-Nascimento (1982)
Merluccius gayi peruanus	62.5	Durán & Oliva (1980)
Merluccius australis	54.5	Fernandez (1985)
Clupea harengus pallasi	46.7	Arthur & Arai (1984)
Merlangius merlangius	36.4	Shotter (1976)
Mugil cephalus	31.0	Skinner (1975)
Stellifer minor	8.3	This paper

The effect of host's sex on the mean intensity and prevalence of infection is a phenomenon that is not clear; for instance, infectious processes originated by different parasitic species in the same host species, show different patterns of infection, according to the host's sex (Fernandez, 1985; Moore et al., 1987). The inverse situation, i. e. no differences in relation to host's sex in the patterns of infection, originated by different parasitic species in the same host has been reported (Forrester et al., 1984; Batra, 1984). The only parasite that shows significant differences in the intensity of infection, but not prevalence, in relation to the host's sex is *Rhamnocercus* sp. with females harbouring more parasites than males, but females are larger than males, thus there has been more time available for cumulative infection, that can explain the observed difference.

A distinctive characteristic of the parasite fauna of *S. minor* is the absence of larval stages of parasites that reach sexual maturity in another host, of higher trophic level. Only one among twelve parasites is represented by larval forms (*Corynosoma* sp.), and this amount is just 8.3%. When the total number of parasites, as individuals, is considered, only 0.002% are larval forms. This picture is strongly contradictory with the observed patterns in other host-parasite systems which involve teleost fishes as host, where the proportion of larval stages is very high.

Table III shows some examples of host-parasite systems in which the hosts are teleost fishes of different ecological residences. The absence of larval stages is dramatically demonstrated by the presence of only one unsuccessful pioneer in the parasite community structure, that correspond to larval stages of parasites which are proper of another parasitic community (Pence & Eason, 1980; Thul et al., 1985).

George-Nascimento (1987) proposed that fishes of intermediate trophic levels harbour the highest parasitic richness, when compared with fishes of higher trophic levels, because the former have their own parasites, plus larval stages of the parasites of their predators. Price & Clancy (1983) also considered the dietary influence on the composition of the parasitic fauna that can harbour one host species. Esch (1971) emphasized that the nature of the parasitic fauna is mainly influenced by what eats the fish as predator, and/or whether they are predated by fish-eating birds and mammals. In the marine environment, the action of fish-eating fishes must be considered, too.

Stellifer minor is a fish of intermediate trophic level, and its food is based on a very narrow dietary spectre. Tarazona et al. (1988) studied a sample of *S. minor* caught in the same year as our material, and a short distance from our sample locality (ca. 60 km). They found that the dietary items were just four: an unidentified crustacean, an unidentified mollusc, algal remains and the sand crab *Emerita analoga*

(Stimpson, 1857). The parasites that are transmitted by trophic relations in *S. minor* are mainly *H. fasciata*, a digenean with a very low specificity (Oliva & Munõz, 1985). The absence of larval stages of Tetraphyllidea, Trypanorhyncha and Pseudophyllidea (Eucestoda), Anisakidae (Nematoda) and Corynosomatinae (Acanthocephala), that are common larval parasites of teleost fishes, can be considered as parasitological evidence which allows us to postulate that this fish is not an important dietary component of elasmobranchs (both, sharks and skates), marine mammals and/or marine birds, although their role as prey for another teleosts cannot be discarded.

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