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Metazoans parasites of the “lumptail searobin” *Prionotus stephanophrys* (Perciformes: Triglidae) from the Villa María del Triunfo Fishing Terminal, Lima, Peru

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Abstract. The objective of the present study was to determine the parasitic community of the “Lumptail searobin” *Prionotus stephanophrys* (Perciformes: Triglidae) from the Fishing Terminal of Villa María del Triunfo, Lima, Peru. Forty specimens of *P. stephanophrys* were collected, which were captured in the ports of Piura and Tumbes in 2023 and 2024. After dissection, three species of nematodes, two of monogeneans, two of acanthocephalans, two of cestodes, seven of trematodes, two of copepods, and one of hirudinea were identified. The monogenean *Orbocotyle elmernoblei* was the most prevalent (30%), followed by the nematode *Anisakis simplex* (22.5%). The Poulin discrepancy index was determined in the most prevalent parasites, establishing that *O. elmernoblei* and *A. simplex* presented an aggregated distribution. The correlation between total body length and sex of *P. stephanophrys* with parasitological indices was also evaluated. It was observed that the prevalence of *O. elmernoblei* is associated with the total lenght of the host; unlike sex, which showed no relationship with any of the variables. This is the first research work focused on the parasitic fauna of *P. stephanophrys*.

Key words. *Anisakis*, Ichthyoparasitology, *Orbocotyle*, parasitic fauna, teleosts, Trematoda

Resumen. METAZOOS PARÁSITOS DE LA CABRILLA VOLADORA *PRIONOTUS STEPHANOPHRYS* (PERCIFORMES: TRIGLIDAE) DEL TERMINAL PESQUERO VILLA MARÍA DEL TRIUNFO, LIMA, PERÚ. El presente estudio tuvo como objetivo determinar la comunidad parasitaria de la “cabrilla voladora” *Prionotus stephanophrys* (Perciformes: Triglidae) procedentes del Terminal Pesquero de Villa María del Triunfo, Lima, Perú. Se colectaron 40 especímenes de *P. stephanophrys*, los cuales fueron capturados en los puertos de Piura y Tumbes en 2023 y 2024. Tras la disección, se identificaron tres especies de nemátodos, dos de monogeneos, dos de acantocéfalos, dos de cestodos, siete de trematodos, dos de copépodos y una de hirudíneos. El monogeneo *Orbocotyle elmernoblei* fue el más prevalente (30 %), seguido por el nemátodo *Anisakis simplex* (22,5 %). Se determinó el índice de discrepancia de Poulin en los parásitos con mayor prevalencia, estableciendo que *O. elmernoblei* y *A. simplex* presentaron una distribución agregada. También se evaluó la correlación entre la longitud corporal total y el sexo de *P. stephanophrys* con los índices parasitológicos. Se observó que la prevalencia de *O. elmernoblei* está asociada con la longitud total del hospedero; a diferencia del sexo, que no mostró relación con ninguna de las variables. Este es el primer trabajo de investigación centrado en la fauna parasitaria de *P. stephanophrys*.

Palabras claves. *Anisakis*, fauna parasitaria, ictioparasitología, *Orbocotyle*, teleósteos, Trematoda

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INTRODUCTION

The Peruvian Sea is one of the most productive and biodiverse ecosystems in the world, thanks to the influence of the Humboldt Current, which harbors more than 1,000 fish species. This rich fauna has made this a subject of study in the fields of biodiversity, ecology, and marine conservation (Tarazona *et al*., 2003).

Among the fish species found in Peru is the "lumptail searobin" *Prionotus stephanophrys* Lockington, 1881, a demersal species belonging to the family Triglidae, which is distributed along the coastal regions of the Eastern Pacific, from southern California (USA) to Chile (Chirichigno & Vélez, 1998; Robertson *et al*., 2024). Its diet consists mainly of crustaceans, with the remainder consisting of fish, annelids, mollusks, and others (Samamé & Fernández, 2000). This species has been recorded at depths of up to 220 m on the continental shelf (Mendieta & Samamé, 1985). Like many marine fish, it has an oviparous reproductive mode, with spawning occurring during summer (Samamé *et al*., 1983; Schmitter, 1989, 1992), and sexual maturation taking place in late winter (Mendieta & Samamé, 1985). According to the IUCN (International Union for Conservation of Nature), *P. stephanophrys* is classified as a species of "Least Concern" (IUCN, 2025).

This species has economic and commercial importance in the demersal landings, as it is used for the production of frozen products, such as surimi and frozen paste in blocks, whose exports have generated significant revenue for Peru (Castillo *et al*., 2000).

Although its general ecology and distribution in the Peruvian sea are relatively well known (Castillo *et al*., 2000), parasitological studies on *P. stephanophrys* are very scarce, being limited to records in two bibliographic compilations. In the review by Luque *et al.* (2016), the presence of the acanthocephalan *Corynosoma* sp. Lühe, 1904 was reported in the mesentery and visceral surface of the fish, while Tantaleán *et al.* (2005) recorded the juvenile form of *Corynosoma australe* Johnston, 1937 in the peritoneum.

The ichthyoparasitological study is a highly important tool that supports various biological aspects, such as health (Chero *et al*., 2016; Céspedes *et al*., 2017; Tessema, 2020), ecology (Timi & Poulin, 2020), and conservation of the hosts (Nuwer, 2022). Aquatic parasites within natural ecosystems could have negative (reduce host energy reserves, body condition, and fitness) (Hasegawa & Poulin, 2025) and positive effects on individual hosts, host populations, biodiversity and overall ecosystem health (Louvard *et al*., 2025). Ichthyoparasites are also considered excellent bioindicators, as they are key components of ecological environment with negative and positive effects, and achieving substantial biomass, abundance, and productivity in some marine ecosystems (Timi, 2025). Further, the use of parasites as biological markers has provided new insights into the biology and migration of various fish species, as well as stock assessments on a global scale (Timi & MacKenzie, 2015; Timi & Buchmann, 2023).

Ecological patterns and processes in fish host-parasite relationships (Fuentes Olivares *et al*., 2024) have been poorly described from the north marine coast of Peru. Fish host body size (length) is probably the most frequently reported parameter determining parasite infection levels (intensity/abundance), and host characteristics (*e.g.*, body length) can influence parasite diversity (Hasegawa & Poulin, 2025; Simões *et al*., 2025). The reproductive system and the sex of the host is an important factor in determining ecological fish parasitism, amd it has been widely investigated (Renner & Duggan, 2024).

Therefore, the objective of this study is to describe and analyze quantitatively the metazoan parasite fauna of the lumptail searobin *P. stephanophrys* from the Villa María del Triunfo (VMT) Fish Terminal, Lima, Peru, and analyze their relationship with the host's sex, total length, weight, and condition factor.

MATERIALS AND METHODS

Lumptail searobin

A total of 40 specimens of the lumptail searobin *P. stephanophrys* were randomly acquired from the Villa María del Triunfo (VMT) Fish Terminal (12° 09′ 25″ S; 76° 55′ 53″ W), Lima, Peru. These samples were captured with artisanal fishing gear, such as purse seines, and, hooks in the ports of Paita (5° 05′ 28″ S; 81° 06′ 23″ W) and Pizarro (3° 30′ 07″ S; 80° 23′ 33″ W), in the departments of

Piura and Tumbes, respectively, during February (n = 7), March (n = 9), April (n = 7), and, August (n = 6) from 2023 to April (n = 6), and, May (n = 5) from 2024. Fresh fish were transported in refrigerated trucks to maintain the cold chain and following strict quality standards from ports Paita and Pizarro to VMT Fish Terminal. The fish were frozen and transported to Universidad Ricardo Palma, Lima, Peru, where they were immediately processed at the Zoology Laboratory of the Faculty of Biological Sciences (FCB) for the collection of metazoan parasites.

Fish parasites

In the laboratory, the fish were measured (Total length in cm), and weight (in g) using a measuring tape and a digital balance, respectively. Petri dishes with distilled water were prepared, in which the host's gill arches and eyes were placed and examined under a Leica®-EZ4W stereomicroscope. Meanwhile, the viscera (stomach, liver, intestine, gonads, spleen, and swim bladder) were thoroughly inspected in dissection trays. The metazoan parasites were fixed in AFA (alcohol-formalin-acetic acid), and preserved in vials with 70% ethanol (Jerônimo *et al*., 2012).

The helminths were stained with Semichon's acetic carmine for 10 minutes. They were then decolorized in acid alcohol and sequentially dehydrated in 70%, 90%, and 100% ethanol for 10 minutes each. Finally, they were cleared in eugenol (clove oil) and mounted in Canada balsam (Payne, 1987), using a Euromex®-SB.1904 trinocular stereomicroscope. The nematodes, copepods, and leech were cleared with Amann's lactophenol and preserved in 70% ethanol (Rey *et al*., 2022).

The identification of the parasites was based on the following studies: Payne (1987) and Theisen *et al*. (2017) for monogeneans; Oosthuizen *et al*. (2021) for cestodes; Anderson (2000) for nematodes; Gibson *et al*. (2002) for trematodes; De León *et al*. (2021) for leeches, Kabata (1988) for copepods, and finally, Arai (1989) for acanthocephalan. All observations were conducted using Nikon®-ECLIPSE Si RS and Euromex®-Oxion trinocular microscopes.

Statistical analysis

The data analysis for this research was conducted using Microsoft Excel 2021, the R-4.4.1 statistical package, PAST-Palaeontological Statistics ver. 4.17, and Quantitative Parasitology 3.0, with a significance level of 0.05. The estimated parasitological indices included prevalence percentage (P%), mean infection abundance (MA), and mean infection intensity (MI), following Bush *et al*. (1997) were calculated for were calculated for the total fish sample, not subdivided between months, years or localities. For parasites with P% above 10% were determined a traditional Clopper-Pearson Confidence level at 95%, and for MA and MI Bootstrap confidence intervals at 95% were calculated with Quantitative Parasitology 3.0. The type of strategy of metazoan parasites was classified according to prevalence percentage. Species with a prevalence above 45% were assigned a core strategy; those with a prevalence between 10% and 45% were classified as secondary strategy; and those with a prevalence below 10% were considered rare strategy (Bush & Holmes, 1986).

Poulin's discrepancy index (DI) was used to determine the distribution pattern of parasite species, where a value of 0 indicates a uniform distribution and a value of 1 indicates an aggregated distribution (Vieira *et al*., 2019). This index was selected because it provides an ideal measure of aggregation that would quantify an unequal utilization of hosts, and would be based on both the number of hosts left unoccupied and on the distribution of parasite individuals among the infected hosts, and can be calculated for any aggregated distribution (Morrill *et al*., 2022).

The body condition of each fish was assessed using Fulton's condition factor (K), which provides an index of the individual's overall health and energy reserves. This metric was calculated as $K = 100 \times W/L^3$, where W is the total body weight (g) and L is the total length (mm) of the fish (Ricker, 1975).

Only species with a prevalence greater than 10% (core and secondary strategy) were considered for quantitative analysis (Esch *et al*., 1990). Quantitative data on total length (TL), mean abundance (MA), and mean intensity (MI) were subjected to the Kolmogorov-Smirnov test with Lilliefors correction to verify normality (Zar, 2014). Pearson and Spearman correlation coefficients were used to assess the association between the host's total length (TL) and the prevalence host total length which were divided into ranges using the Sturges rule, and the mean value of each LT in each range was taken, abundance, and mean intensity of helminths (Le, 2003). Additionally, Student's t-test and the Mann-Whitney U test were applied to compare the MA and MI of metazoan parasites between male and female hosts (Esch *et al*., 1990; Rosner, 2011).

To evaluate the influence of host sex and body size on the presence or absence of parasites, we fitted a Generalized Linear Model (GLM) with a binomial distribution or not binomial depending on response variable (Zuur *et al*., 2009). The response variable was binary for prevalence, indicating the presence (1) or absence (0) of parasites in each fish. Also, the response variable for abundance and intensity was by counting data in each fish. The explanatory variables included host sex (two levels: male or female), body length (in mm), weight (in g), Fulton's condition factor (K), and month of the year of survey as random variable (six levels: February 2023, March 2023, April 2023, August 2023, April 2024, and May 2024). This approach allowed us to assess whether the probability of being parasitized (prevalence, abundance, and intensity) was significantly associated with either sex, body size, weight, K and month of the year of survey while controlling for the effect of each variable (Crawley, 2013).

Finally, the calculated alpha diversity indices were as follows: Simpson and Berger-Parker (dominance), Shannon-Wiener and Evenness (equity), Chao-1 (potential richness estimator), and Margalef (richness) (Bego & Von Zuben, 2010). Their application in ecological–parasitological research allows not only the assessment of the number of parasite species (richness) but also the distribution of their abundances (evenness), offering a more comprehensive understanding of community organization.

The samples of metazoan parasite species were deposited in the Zoological Collection of the Natural History Museum of the National Federico Villarreal University (UNFV), under the codes MUFV-HPIA–239 to MUFV-HPIA–286.

RESULTS

The sample size of *P. stephanophrys* consisted of 20 females (TL = 25.16 ± 2.87 cm; W = 175.39 ± 60.56 g; K = 1.07 ± 0.08) and 20 males (TL = 23.45 ± 1.95 cm; W = 138.99 ± 38.48 g; K = 1.05, ± 0.08). Female hosts exhibited a greater TL and W than males ($t = 2.2–2.26$; $p < 0.05$), but was not different between sex for K ($t = 0.76$; $p > 0.05$). A total of 63 metazoan parasites were collected, identifying 19 taxa (Table 1). Among them, the monogenean *Orbocotyle elmernoblei* Payne, 1987 and the nematode *Anisakis simplex* (Rudolphi, 1809) complex showed the highest prevalence, 30% (16.6–46.6), and, 22.5% (10.8–38.5), respectively. Regarding MA and MI, *O. elmernoblei* followed by *A. simplex* with MA [0.65 (0.325–1.08), and 0.25 (0.1–0.4], and MI [2.17 (1.5–2.92), and 1.11 (1–1.33], respectively. However, the copepods Lernaeopodidae gen. sp. 1 and Lernaeopodidae gen. sp. 2 showed MI, even higher than *Anisakis simplex*. *Orbocotyle elmernoblei* and *A. simplex* corresponded to the secondary strategy type, whereas the remaining parasites exhibited the rare strategy type (Table 1). Poulin's discrepancy index for *O. elmernoblei* and *A. simplex* showed a value close to 1, indicating a tendency toward an aggregated or contagious distribution (Table 1).

According to the significance level of the Kolmogorov-Smirnov test, the data on host total length and *O. elmernoblei* intensity provide sufficient evidence to assume a normal distribution. In contrast, the significance level for the abundance of both helminths and the intensity of *A. simplex* leads to rejecting the normality hypothesis (Table 2).

The logistic regression model indicated that sex was a significant predictor of parasite presence of *O. elmernoblei* ($p = 0.030$). For presence of *O. elmernoblei*, length, weight of the fish and month of the survey showed no statistically significant effect (Table 3). However, when the logistic regression model was evaluated for *O. elmernoblei* using sex ($p = 0.017$), k ($p = 0.028$) and the month of evaluation ($p = 0.010$), the three variables were found to have significant levels for prevalence (Table 3). No significant association was detected between sex, body length, weight, K, and month of the year and the probability of being parasitized in *A. simplex* (Table 3).

The GLM model indicated that sex, K and month of the survet was a significant predictor of mean abundance of *O. elmernoblei* ($p = 0.005–0.028$). But when it is the length or weight of the fish with the sex and the month of evaluation, GLM indicated no significant association was found with the mean abundance of *O. elmernoblei* (Table 4). In the case of A. *simplex*, GLM revealed no statistically significant associations were found between host sex and length, or body weight or K of the fish with mean abundance (Table 4). The GLM revealed no statistically significant associations were found between host sex and length, or body weight or K of the fish with mean intensity of *O. elmernoblei* and *A. simplex* (Table 5). GLM models indicate that when K is included, then sex and month of assessment are good predictors of the prevalence and mean abundance of *O. elmernoblei* (Table 3–4).

Table 1. Parasitic indices of metazoan parasites in Prionotus stephanophrys from the Fishing vessel of Villa María del Triunfo, Lima, Peru. * indicates it is omitted because there is only one sample unit. Abbreviastions: %P, prevalence; MA, mean abundance; MI, mean intensity; PD, Poulin's discrepancy index.

Parasite	Deposit code	Location	Host infected	Total parasites	%P	MA	MI	PD	Type of strategy
Monogenea Orbocotyle elmernoblei	HPIA 239, 274–286	Gills	12	26	30	0.650	2.17	0.78	Secondary
Pseudempleurosoma carangis	HPIA 240	Gills	1	1	2.5	0.025	*	-	Rare
Cestoda Grillotia sp.	HPIA 241	Peritoneum	1	1	2.5	0.025	*	-	Rare
Nybelinia sp.	HPIA 242	Gills	1	1	2.5	0.025	*		Rare
Acantocephala Bolbosoma sp.	HPIA 243	Stomach	1	1	2.5	0.025	*	-	Rare
Polymorphidae gen. sp.	HPIA 244	Intestine	1	1	2.5	0.025	*	-	Rare
Trematoda Mecoderus oligoplitis	HPIA 245 and 246	Stomach	2	2	5	0.050	1	-	Rare
Brachyphallus sp.	HPIA 248–249	Gills	2	2	5	0.050	1	-	Rare
Fellodistomidae gen. sp.	HPIA 251	Gills	1	1	2.5	0.025	*	-	Rare
Ectenurus sp.	HPIA 250	Gills	1	1	2.5	0.025	*	-	Rare
Lecithochirium sp.	HPIA 247	Gills	1	1	2.5	0.025	*	-	Rare
Plagiorchiida gen. sp.	HPIA 252	Liver	1	1	2.5	0.025	*	-	Rare
Trematoda gen. sp.	HPIA 253	Gills	3	1	7.5	0.075	1	-	Rare
Nematoda Anisakis simplex complex	HPIA 254, 258, 260–262, 264–267, and 272	Stomach Live Glass Peritoneium Swim bladder	9	10	22.5	0.250	1.11	0.78	Secondary
Phocanema sp.	HPIA 255	Liver	1	1	2.5	0.025	*	-	Rare
Anisakidae gen. sp.	HPIA 259, 263, and 273	Peritoneum Stomach	4	4	10	0.100	1	-	Rare
Copepoda Lernaeopodidae gen. sp. 1	HPIA 256, 268, and 269	Gills	2	3	5	0.075	1.5	-	Rare
Lernaeopodidae gen. sp. 2	HPIA 270, and 271	Gills	1	2	2.5	0.050	2	-	Rare
Hirudinea Piscicolidae gen. sp.	HPIA 257	Gills	1	1	2.5	0.025	*	-	Rare

Table 2. Kolmogorov-Smirnov Normality Test with Lilliefors modification to determine the normality of total length, mean abundance and mean intensity. Abbreviations: %P, prevalence; TL, total length; MA, mean abundance; MI, mean intensity; N, population; L, K-S-Lilliefors test; p, significance level.

	TL	MA	MI		
	Host	*O. elmernoblei*	*A. simplex*	*O. elmernoblei*	*A. simplex*
N	40	40	40	12	9
L	0.10	0.40	0.47	0.23	0.52
p	0.36	0.00	0.00	0.09	0.00

Table 3. Logistic regression models for prevalence for the two most prevalent parasites (*O. elmernoblei* and *A. simplex*) in *Prionotus stephanophrys*. * indicates significance. Abbreviation: ns, not significant; p, significance level.

	Term	Estimate	Std. Error	z value	p	Significance
O. elmernoblei	Intercept	-6.171	4.298	-1.436	0.151	ns
	Sex	2.467	1.137	2.170	0.030	*
	Length	-0.035	0.219	-0.162	0.871	ns
	Month	0.698	0.381	1.834	0.067	ns
	Intercept	-6.991	2.444	-2.860	0.004	*
	Sex	1.996	1.110	1.798	0.072	ns
	Weight	0.008	0.012	0.703	0.482	ns
	Month	0.501	0.359	1.395	0.163	ns
	Intercept	-24.377	9.028	-2.7	0.007	*
	Sex	2.805	1.176	2.39	0.017	*
	K	14.726	6.718	2.19	0.028	*
	Month	0.968	0.374	2.59	0.010	*
A. simplex	Intercept	-5.99	4.013	-1.493	0.136	ns
	Sex	0.40	0.935	0.428	0.669	ns
	Length	0.195	0.199	0.980	0.327	ns
	Month	-0.214	0.291	-0.734	0.463	ns
	Intercept	-2.550	1.679	-1.519	0.129	ns
	Sex	0.661	0.937	0.705	0.481	ns
	Weight	0.003	0.009	0.421	0.674	ns
	Month	-0.111	0.297	-0.373	0.709	ns
	Intercept	2.904	5.437	0.534	0.593	ns
	Sex	0.938	0.833	1.128	0.259	ns
	K	-5.017	4.879	-1.028	0.304	ns
	Month	-0.096	0.253	-0.384	0.701	ns

Sturges rule, and the mean value of each Lt in each range was taken, and its prevalence (Table 6). It is worth noting that the significance level was 0.05, implying a significant relationship between

Table 4. Logistic regression models for mean abundance for the two most prevalent parasites (*O. elmerobllei* and *A. simplex*) in *Prionotus stephanophrys*. * indicates significance. Abbreviation: ns, not significant; p, significance level.

	Term	Estimate	Std. Error	z value	p	Significance
O. elmernoblei	Sex	1.973	0.986	2.002	0.045	*
	Length	0.104	0.208	0.499	0.618	ns
	Month	0.444	0.322	1.378	0.168	ns
	Sex	1.457	0.936	1.557	0.12	ns
	Weight	0.016	0.010	1.612	0.107	ns
	Month	0.204	0.301	0.680	0.496	ns
	Sex	2.416	0.903	2.680	0.007	*
	K	10.316	4.694	2.200	0.028	*
	Month	0.751	0.267	2.810	0.005	*
A. simplex	Sex	0.24	0.922	0.370	0.711	ns
	Length	0.185	0.197	0.938	0.348	ns
	Month	-0.205	0.285	-0.722	0.471	ns
	Sex	0.585	0.925	0.633	0.527	ns
	Weight	0.003	0.009	0.393	0.694	ns
	Month	-0.109	0.291	-0.375	0.708	ns
	Sex	0.833	0.827	1.007	0.314	ns
	K	-4.927	4.851	-1.016	0.310	ns
	Month	-0.103	0.249	-0.413	0.679	ns

the variables. Likewise, in the Student's t-test and Mann-Whitney U test, no significant differences were found in the abundance and mean intensity of *O. elmernoblei* and *A. simplex* between male and female hosts, as the significance levels were considerably higher than 0.05 (Table 6). In the abundance model, weight showed a marginal tendency (p = 0.090) to be positively associated with parasite number, but without reaching statistical significance. No significant associations were found between the Fulton condition index and any of the parasitological parameters (Table 6).

Regarding alpha diversity indices, the values for richness, evenness, and diversity were slightly higher in female *P. stephanophrys* than in males, except for the Berger-Parker dominance index. The Chao-1 richness estimate suggests that parasites richness is underestimated by the current sampling (Table 7). These large estimated increases (24.2%, 83.1%, and 71.2% respectively) reflect the presence of numerous singletons (12 species observed only once) and point to incomplete sampling, especially in females (Table 7).

DISCUSSION

In the present study, the metazoan parasite community in *P. stephanophrys* was determined, consisting of 19 taxa (Table 1). 19 taxa of parasitic metazoans are new records for Peru, and 18 taxa are new records for *P. stephanophrys* (Supplementary material). Among them, the monogenean *O. elmernoblei* had only been previously recorded by Payne (1987) parasitizing this host in the Gulf of California, Mexico.

In the literature on the genus *Prionotus*, the monogenean *Orbocotyle marplatensis* Euzet & Suriano, 1975 has been documented as a more widely studied species. Bicudo *et al*. (2005b) and Timi & Lanfranchi (2009) found a prevalence exceeding 40% in *P. punctatus* (Bloch, 1793) and *P. nudigula* Ginsburg, 1950 in Brazil and Argentina, respectively. In the present study, *O. elmernoblei* was recorded with a prevalence of 30%, the highest among metazoan parasites collected from *P. stephanophrys* in Mexico, expanding its geographic distribution to the northern coast of Peru. This is likely due to the specificity and attraction that monogeneans exhibit toward their hosts, influenced by factors such as chemical substances present in the fish's surface mucus (Poulin, 1992; Scheifler *et al*., 2022).

Table 5. Logistic regression models for mean intensity for the two most prevalent parasites (*O. elmernoblei* and *A. simplex*) in *Prionotus stephanophrys*. Abbreviation: ns, not significant; p, significance level.

	Term	Estimate	Std. Error	z value	p	Significance
O. elmernoblei	Sex	1.722	1.389	1.240	0.215	ns
	Length	0.258	0.180	1.430	0.152	ns
	Month	0.058	0.334	0.167	0.867	ns
	Sex	1.645	1.394	1.180	0.238	ns
	Weight	0.0136	0.008	1.590	0.112	ns
	Month	-1.077	0.828	-1.300	0.193	ns
	Sex	2.146	1.556	1.379	0.168	ns
	K	-1.600	7.519	-0.213	0.831	ns
	Month	0.262	0.445	0.590	0.555	ns
A. simplex	Sex	-30.85	191980	0.0001	0.999	ns
	Length	-23.69	74515	0.0004	0.999	ns
	Month	-6.92	104421	0.0001	0.999	ns
	Sex	-27.01	165045	0.0001	0.999	ns
	Weight	-1.42	3811	0.0003	0.999	ns
	Month	-9.5	81793	0.0001	0.999	ns
	Sex	-414.3	3644421	-0.001	0.999	ns
	K	4308.6	0.00003	0.001	0.999	ns
	Month	31.1	37755	0.0004	0.999	ns

The monogenean of the genus *Pseudempleurosoma* (Yamaguti, 1965) was first described for the species *P. carangis*, found in the hosts *Caranx lugubris* Poey, 1860, *Caranx sexfasciatus* Quoy & Gaimard, 1825, and *Myripristis berndti* Jordan & Evermann, 1903 in Hawaii, United States. Unlike most monogeneans, which are highly host-specific, *Pseudempleurosoma* has the unique ability to infect different species, genera, and families of hosts (Theisen *et al*., 2017). This genus has been recorded in the gills of *Prionotus punctatus* in Brazil (Bicudo *et al*., 2005b). In the present study, *P. carangis* showed a prevalence of 2.5%, comparable to the value reported by Bicudo *et al*. (2005b) (P = 1.3%). The low prevalence in both studies could be due to accidental infection, as the genus *Pseudempleurosoma* is specialized for an endoparasitic lifestyle, as evidenced by its anchoring apparatus adapted for attachment to esophageal folds (Gerasev *et al*., 1987; Theisen *et al*., 2017).

Among the records of the cestode genus *Grillotia* Guiart, 1927 in Peru, *Grillotia dollfusi* Carvajal, 1971 has been identified on the visceral surface of *Merluccius peruanus* Ginsburg, 1954 (Chero et *al*., 2014a). Regarding the genus *Prionotus*, Menoret & Ivanov (2009, 2012) collected the species *Grillotia carvajalregorum* Menoret & Ivanov, 2009 in *P. nudigula* and *P. punctatus* in Argentina. However, Menoret (2012) suggested that the hosts were likely accidental, as the plerocercoids of the cestode had a low infection intensity (2–5 plerocercoids per examined individual). In the present study, *Grillotia* sp. had a prevalence and mean intensity of 2.5% and 1, respectively.

The genus *Prionotus* has only one record of *Nybelinia* sp. in the intestine of *P. punctatus* in Rio de Janeiro, Brazil (Luque & Poulin, 2004; Bicudo *et al*., 2005b). In the present study, *Nybelinia* sp.

showed a prevalence, mean abundance, and mean intensity of 2.5%, 0.025, and 1, respectively, values close to those reported in the aforementioned study (P = 5%, AM = 0.1, IM = 1).

Table 6. Correlation between host total length and sex, and the prevalence, mean abundance, and mean intensity of the most prevalent metazoan parasites. *NA indicates that the statistical test was not applicable. Abbreviations: p, significance level; r_s, Spearman's correlation coefficient; r_p, Pearson's correlation coefficient; X^2, chi-square; Y, Yates' correction; U, Mann-Whitney U test; F, Levene's test; t, Student's t-test; TL, total length; W, Weight; K, Fulton condition index; %P, prevalence; MA, mean abundance; MI, mean intensity.

		O. elmernoblei	*A. simplex*
TL vs. %P	r_s	0.87	-0.3
	p	0.05	0.7
TL vs. MA	r_s	0.27	0.00
	p	0.09	1
TL vs. MI	r_s	NA*	-0.27
	P	NA*	0.48
	r_p	0.42	NA*
	P	0.17	NA*
W vs MA	r_s	0.23	0.03
	P	0.14	0.86
W vs MI	r_s	0.15	NA*
	P	0.63	NA*
	r_p	0.50	NA*
	P	0.09	NA*
K vs MA	r_s	-0.16	0.08
	P	0.33	0.59
K vs MI	r_s	-0.15	NA*
	P	0.62	NA*
	r_p	-0.06	NA*
	P	0.85	NA*
Sex vs MA	U	218	207.5
	P	0.57	0.79
Sex vs. MI	U	NA*	7.5
	P	NA*	0.37
	F	0.45	NA*
	P	0.52	NA*
	T	-0.46	NA*
	P	0.66	NA*

In the present study, the genus *Bolbosoma* was identified, which differs from the previous findings of *Corynosoma* sp. and *C. australe* reported in Peru by Luque *et al.* (2016) and Tantaleán et al. (2005), respectively. In Peru, only one record of the acanthocephalan *Bolbosoma* sp. has been reported on the visceral surface of *M. peruanus* in Lima (Chero *et al.*, 2014a). Regarding the genus *Prionotus*, there is no record of the acanthocephalan in question, unlike its sister genus *Corynosoma*, which has been found in *P. punctatus* (Luque & Poulin, 2004; Bicudo *et al.*, 2005b); *P. stephanophrys* (Luque *et al.*, 2016; Tantaleán *et al.*, 2005); and *P. nudigula* (Timi & Lanfranchi, 2009). This discrepancy could be attributed to the small sample size, regional variations, or temporal factors.

Table 7. Alpha diversity indices to compare the parasitic community component between male and female *Prionotus stephanophrys* from the Villa María del Triunfo Fishing Terminal, Lima, Peru.

Index	Males	Females	Total
Richness	10	14	19
Individuals	30	33	63
Simpson	0.76	0.85	0.80
Shannon-Wiener	1.91	2.36	2.32
Evenness	0.83	0.90	0.79
Chao-1	12	26	33

The trematode *M. oligoplitis* was first described by Manter (1940) in the stomach and gills of *Oligoplites saurus* (Bloch & Schneider, 1801) in San Francisco, Ecuador. Unfortunately, there are no records of *M. oligoplitis* in Peru or in the database of the genus *Prionotus*; thus, its role in *P. stephanophrys* remains unclear.

Some records of the genus *Brachyphallus* include its presence in the stomachs of *Pterois volitans* (Linnaeus, 1758), *Hypomesus nipponensis* McAllister, 1963, and *Gasterosteus aculeatus* Linnaeus, 1758, in Venezuela (López *et al*., 2016), Japan (Shimazu, 2018), and Canada (Hanek & Threlfall, 1969), respectively. Regarding the genus *Prionotus*, *Brachyphallus parvus* (Manter, 1947) has been reported in the intestine of *P. punctatus* in Brazil (Bicudo *et al*., 2005b; Overstreet *et al*., 2009). In the present study, *Brachyphallus* sp. showed a prevalence of 5%, a figure significantly different from that of Bicudo *et al*. (2005b) (P = 53.8%).

In Peru, species of the Fellodistomidae family have been recorded in fish species such as: *Trachurus murphyi* Nichols, 1920, *Anisotremus scapularis* (Tschudi, 1846), and *Isacia conceptionis* (Cuvier, 1830) (Tantaleán & Huiza, 1994; Luque & Oliva, 1993a; Chero *et al*., 2014b). Fellodistomidae gen. sp. has been observed parasitizing *P. stephanophrys*. However, no parasites from this trematode family have been found in other species of the *Prionotus* genus. Low prevalence values = 5%, MI = 1, and MA of 0.05 of *Proctoeces* sp. parasitizing *A. scapularis* have been found (Chero *et al*., 2014b). No records of prevalence, MI and MA of the fellodistomidae *Proctoeces lintoni* Siddiqi & Cable, 1960 and *Monascus* sp. parasitizing *I. conceptionis* and *T. murphy*, respectively, have been reported, in order to compare them with Fellodistomidae gen. sp. parasitizing *P. stephanophrys* (Tantaleán & Huiza, 1994; Luque & Oliva, 1993a).

Species of the genus *Ectenurus* Looss, 1907 have been recorded in the intestine of *Labeo rohita* (Hamilton, 1822) and in the gills of *Crenidens indicus* Day, 1873 in Pakistan (Bilqees, 1971; Khan & Bilqees, 1990), as well as in the stomach of *Spicara maena* (Linnaeus, 1758) in Spain (Carreras *et al*., 2012). In Peru, *Ectenurus* sp. has been reported in *Trachinotus rhodopus* Gill, 1863 and *Alphestes afer* (Bloch, 1793) (Tantaleán & Huiza, 1994). Regarding the genus *Prionotus*, the collection of *E. virgula* in *P. punctatus* in Brazil has been documented in 1 out of 23 host (prevalence = 4.3 %) (Pantoja & Kudlai, 2022).

Pantoja & Kudlai (2022) argue that the identification of *Lecithochirium* species is truly problematic due to inadequate descriptions and the lack of distinctive features. Thus, they conclude that the genus can only be evaluated based on detailed morphological descriptions that incorporate DNA sequence data. For this reason, several authors find it difficult to delimit its taxonomy. There are generalist species of *Lecithochirium* that parasitize various marine fish species (Shih *et al*., 2004; Mendoza *et al*., 2013; Radujković & Sundić, 2014). Luque *et al*. (2016) compiled four species identified in Peru: *L. genypteri* Manter, 1954 in *Merluccius gayi peruanus* Ginsburg, 1954, *L. macrorchis* (Crowcroft, 1946) in *Labrisomus philippii* (Steindachner, 1866), *L. muraenae* Manter, 1940 in *Gymnothorax porphyreus* (Guichenot, 1848), and *Lecithochirium* sp. Lühe, 1901 in *Centropomus nigrescens* Günther, 1864, and *L. philippii*. Similarly, the genus *Lecithochirium* has been recorded in several species of fish of the genus *Prionotus*. In *Prionotus* sp., *Lecithochirium musculus* (Looss, 1907) and *L. floridense* (Manter, 1934) have been recorded; in *P. punctatus*, *L. microstomum* Chandler, 1935;

in *P. stearnsi* Jordan & Swain, 1885, *L. musculus* and *L. floridense*; and finally, in *P. scitulus* Jordan & Gilbert, 1882, *L. monticellii* (Linton, 1898) (Manter, 1934; Corkum, 1954; Overstreet *et al.*, 2009; Pantoja & Kudlai, 2022).

The parasitic nematode *A. simplex* complex present in *P. stephanophrys* with a P = 22.5% could be a public health problem in Peru, affecting marine fish and other frequently consumed marine products, and causing Anisakiasis (a disease) and allergic reactions in humans, especially through the consumption of raw fish such as ceviche (Fujisawa *et al.*, 2025; Nonković et al., 2025).

Hernández *et al.* (2013) reported that at least 40 species of marine fish on South American coasts have been infested with species of the nematode genus *Phocanema* (Krabbe, 1878), including "mackerel" *Scomber japonicus* Houttuyn, 1782, "cacique" *Congiopodus peruvianus* (Cuvier, 1829), and "golden conger" *Genypterus blacodes* (Forster, 1801) (See Bloch & Schneider, 1801: after the Forster death, they completed, corrected, and interpolated the work Forster had begun). Additionally, in Peru, *Phocanema decipiens* (Krabbe, 1878) has also been recorded in the muscles of *S. japonicus* and "jack mackerel" *Trachurus murphyi* Nichols, 1920 (Tantaleán & Huiza, 1994; Sarmiento *et al.*, 1999; Cabrera & Trillo, 2004). This increases the risk of contracting zoonotic diseases by consuming raw or undercooked fish (Cabrera *et al.*, 2003; Torres *et al.*, 2007).

In Hernández *et al.* (2013) findings, *P. nudigula* was revealed as the primary first host for *Phocanema,* as it presented a prevalence of 100% in a population of 32 specimens. In contrast, in the present study, *Phocanema* sp. showed a prevalence of 2.5%, suggesting that, unlike *P. nudigula*, *P. stephanophrys* would not be considered a habitual host for the helminth in question.

The genus *Prionotus* shows no records of any copepods from the family Lernaeopodidae. In the present study, Lernaeopodidae gen. sp. 1 and Lernaeopodidae gen. sp. 2 showed prevalences of 5% and 2.5%, respectively.

In Peru, four unidentified species from the fish leeches' family Piscicolidae have been recorded in the gills of *Cilus gilberti* (Abbott, 1899), *L. philippii*, *Paralonchurus peruanus* (Steindachner, 1875), and *Sciaena deliciosa* (Tschudi, 1846) (Luque & Oliva, 1993b; Oliva & Luque, 1998; Iannacone *et al.*, 2011; Chero *et al.*, 2014c). In the genus *Prionotus*, only one unidentified specimen was found on the body surface of *P. punctatus* from Brazil (Bicudo *et al.*, 2005b). In the present study, Piscicolidae gen. sp. showed a prevalence of 2.5%, which is equivalent to the previous study (P = 1.3%).

The strategy type for *O. elmernoblei* and *A. simplex* was secondary, as their prevalences are between 10% and 45% (Table 1). De Carvalho et al. (2022) and Minaya *et al.* (2021a) documented the same strategy type for the monogeneans *Ancistrohaptor* sp. Agarwal & Kritsky, 1998 and *Bicentenariella peruensis* (Cruces, Chero, Sáez & Luque, 2017), respectively, while Diniz *et al.* (2022) documented it for the nematode *Spiroxys* sp..

Similarly, Poulin's discrepancy index showed an aggregated distribution for *O. elmernoblei* (0.78) and *A. simplex* (0.78) (Table 1). Rey *et al.* (2022), Diniz *et al.* (2022), and Chero *et al.* (2016) also reported an aggregated distribution *for Callorhynchocotyle callorhynchi* (Manter, 1955), *Spiroxys* sp., and *Anisakis* sp. 2 in *Callorhinchus callorynchus* (Linnaeus, 1758), *Hoplias malabaricus* (Bloch, 1794), and *S. chiliensis*, respectively. According to Iannacone *et al.* (2012), the main factors influencing the aggregated distribution of fish parasites are: increased opportunities for infection, spatial heterogeneity of the host's habitat, and the influence of the parasite's evolutionary history. The latter could be related to the specificity of *O. elmernoblei*, as this monogenean has only been recorded in *P. stephanophrys*, both in the present study and in Payne's (1987) study. However, further studies are required to confirm its host range.

GLM models indicate that when K is included, then sex and month of assessment are good predictors of the prevalence and mean abundance of *O. elmernoblei.* K is widely used in fisheries and general fish biology studies. This K factor is calculated from the relationship between the weight of a fish and its length, with the intention of describing the "condition" of that individual. The K also indicates the wellness of fish species, suggesting that heavier fish live in better conditions and suitable aquatic habitats (Bhaskar & Ansari, 2025). Mean values of mean K of greater than one in males and females recorded in *P. stephanophrys* showed the well-being of fishes (Nur *et al.*, 2020). Hasegawa & Poulin (2025) suggested that K could be affected by various external and internal factors such as resource availability, population density and host sex. A systematic review on 102 species of monogenean parasite taxa did not show consistently negative nor positive effects on fish host K (Hasegawa & Poulin, 2025). On the contrary, in the present research work, the prevalence and mean abundance of the monogenean *O. elmernoblei* showed an association with the K factor.

On the other hand, researchers should use more than two parasite fish infection measures in their analyses, especially both infection measures that include uninfected hosts (*e.g.*, abundance) and those that exclude uninfected hosts (*e.g.*, intensity) for the relationships between K and fish parasitic infections (Hasegawa & Poulin, 2025). When K is included, then sex is a good predictors of the prevalence and mean abundance of *O. elmernoblei*, which agrees with Hasegawa & Poulin (2025) that was pointed out by negative effects of parasites on fish health generally differ among sexes, a host biological factors.

A positive linear correlation was observed between the total length of *P. stephanophrys* and the prevalence of *O. elmernoblei*. Hagras *et al*. (1995) and Khidr (1990) noted that the increase in parasitic prevalence, along with the fish's length, may be due to the growth of the host's internal organs, which in turn increases the infection surface area. This increase may also be related to the host's exposure time (Ahmad *et al*., 2018).

No relationship was found between the parasitological indices of *O. elmernoblei* and *A. simplex* and the sex of the lumptail searobin. This lack of association has also been observed in other marine fish species from the Peruvian coast (Iannacone *et al*., 2011, 2012). A possible explanation is the similarity in ecological relationships, such as behavior, habitat, and diet, between male and female fish (Cezar & Luque, 1999; Chero *et al*., 2014a,c,d; Rodríguez *et al*., 2011, 2014). However, the logistic regression model indicated that sex was a significant predictor of parasite presence of *O. elmernoblei* when length and month of the survey is included.

Regarding alpha diversity indices, the Simpson index indicated higher parasitic dominance in females than in males. This pattern has also been observed in other fish species, such as *Brama japonica* Hilgendorf, 1878, *Sarda chiliensis* (Cuvier, 1832), *Sphyraena ensis* Jordan & Gilbert, 1882 and species of the Scorpaenidae family (Jordan & Gilbert, 1882) (Iannacone & Alvariño, 2013; Chero *et al*., 2016; Rodríguez *et al*., 2020; Minaya *et al*., 2021b). Additionally, the total population value was 0.80, reflecting low parasitic diversity. Further, the Margalef diversity index showed that females have a greater species richness compared to males (2.65 and 3.72). Iannacone & Alvariño (2009) argue that the selection of parasites towards one sex is due to variations in behavior, habitat, and feeding between males and females. Furthermore, Ahmad *et al*. (2018) suggests that the slight increase in infection in female fish can be attributed to their reproductive and physiological functions.

CONCLUSIONS

The metazoan parasite community of the "lumptail searobin" *Prionotus stephanophrys* from the Fish Market of Villa María del Triunfo, Lima, Peru, is composed of 19 taxa of parasitic metazoans, all of which are new records for Peru, and 18 taxa are new records for *P. stephanophrys*. *Orbocotyle marplatensis* and *Anisakis simplex* complex exhibited prevalences of 30% and 22.5%, respectively, corresponding to a secondary parasite strategy. A significant positive correlation was found between the total length of *P. stephanophrys* and both the prevalence and mean abundance of *O. marplatensis*. The L3 larvae of *A. simplex* s.l. and *Phocanema* sp. are potential zoonotic agents, which may pose a risk to public health. It is very important to continue researching the ecology of the parasite fauna, ecto and endoparasite life cycle, length and sex of *P. stephanophrys*-parasite community interaction, and different environmental variables by seasons, could play key roles in the parasite communities, such as ecological interactions are fundamental to understand the community structure and diversity of metazoan parasites in *P. stephanophrys*.

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REFERENCES

Abbott, J.F. 1899. The marine fishes of Peru. *Proceedings of the Academy of Natural Sciences of Philadelphia* 51: 324–364

Agarwal, N. & D. Kritsky. 1998. Neotropical Monogenoidea. 33. Three new species of *Ancistrohaptor* n. g. (Dactylogyridae, Ancyrocephalinae) on *Triportheus* spp. (Teleostei, Characidae) from Brazil, with checklists of ancyrocephalines recorded from neotropical characiform fishes. *Systematic Parasitology* 39(1): 59-69.

Ahmad, F., B.A. Sheikh, O.M. Sofi, & T.A. Sofi. 2018. Prevalence of helminth parasites in fishes (*Salmo trutta* and *Schizothorax plagiostomus*) in India. *Revista veterinaria* 29(1): 45–51.

Anderson, R.C. 2000. *Nematode parasites of vertebrates: their development and transmission.* CABI Publishing, London, 650 pp.

Andres, M.J., C.L. Ray, E.E. Pulis, S.S. Curran, & R.M. Overstreet. 2014. Molecular characterization of two opecoelid trematodes from fishes in the Gulf of Mexico, with a description of a new species of *Helicometra*. *Acta Parasitologica* 59(3): 405–412.

Arai, H.P. 1989. Acanthocephala. In: L. Margolis & Z. Kabata (eds), *Guide to the parasites of fishes of Canada*, pp. 1–95, Publication of Fisheries and Aquatic Sciences.

Bego, N.M. & C.J. Von Zuben. 2010. *Métodos quantitativos em parasitologia*. FUNEP, Jaboticabal, 72 pp.

Bhaskar, M. & M.Z. Ansari. 2025. Evaluating the parasite infestation and condition factor analysis in Gangetic fishes in the Kanpur region. *International Journal of Fisheries and Aquatic Studies* 13(1): 35–40.

Bicudo, A.J.A., L.E.R. Tavares, & J.L. Luque. 2005a. Larvas de Anisakidae (Nematoda: Ascaridoidea) parasitas da cabrinha *Prionotus punctatus* (Bloch, 1793) (Osteichthyes: Triglidae) do litoral do estado do Rio de Janeiro, Brasil. *Revista Brasileira de Parasitologia Veterinária* 14(3): 109–118.

Bicudo, A.J.A., L.E.R. Tavares, & J.L. Luque. 2005b. Metazoários parasitos da cabrinha *Prionotus punctatus* (Bloch, 1793) (Osteichthyes: Triglidae) do litoral do Estado do Rio de Janeiro, Brasil. *Revista Brasileira de Parasitologia Veterinária* 14(1): 27–33.

Bilqees, F.M. 1971. Marine fish trematodes of West Pakistan. Part VII. *Ectenurus crenidensis* n. sp. from *Crenidens indicus* Day, from the Karachi coast. *Pakistan Journal of Scientific and Industrial Research* 14(6): 512–513.

Bloch, M. E. 1793. *Naturgeschichte der ausländischen Fische*. Berlin. 7:1–144, Pls. 325–360.

Bloch, M. E. 1794. D. *Marcus Elieser Bloch's, ausübenden Arztes zu Berlin; der Utrechter, Frankfurter, Göttinger, Harlemmer, Vlieffiager, Mainzischen, Böhmischen und Coppenhagner Gesellschaften der Wissenschaften; der Berliner, Römisch - Kaiserlichen, Danziger, Hallischen und Zürcher Naturforschenden Gesellschaften; der St. Petersburger, Leipziger, Baierschen und Zelüschen* ökonomischen *Gesellschaften. der Ackerbau-Gesellschaft, und des Mufée zu Paris, Mitglieds oder Correspondenten, Naturgeschichte der ausländischen Fische*. Schlesinger, Berlin, Vol. 8 (Naturgeschichte der ausländischen Fische), pp. 1–174, pls. 361–396.

Bloch, M.E. & J.G. Schneider. 1801. M.E. Blochii, *Systema Ichthyologiae iconibus cx illustratum. Post obitum auctoris opus inchoatum absolvit, correxit, interpolavit Jo. Gottlob Schneider, Saxo*. Sumtibus Auctoris Impressum et Bibliopolio Sanderiano Commissum, Berolini, 584 pp, Pls. 1–110.

Bush, A.O., K.D. Lafferty, J.M. Lotz, & A.W. Shostak. 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. *The Journal of Parasitology* 83(4): 575–583.

Bush, A.O. & J.C. Holmes. 1986. Intestinal helminths of lesser scaup ducks: patterns of association. *The Canadian Journal of Zoology* 64: 132–141.

Cabrera, R. & M.P. Trillo. 2004. Anisakidosis: ¿Una zoonosis parasitaria marina desconocida o emergente en el Perú? *Revista de Gastroenterología del Perú* 24(4): 335–342

Cabrera, R., M.A. Luna, & L. Suárez. 2003. Nuevo caso de infección humana por una larva de *Pseudoterranova decipiens* (Nematoda, Anisakidae) en el Perú. *Revista de Gastroenterología del Perú* 23(3): 217–220.

Carreras, M., F.E. Montero, A. Kostadinova, D.I. Gibson, & M. Carrassón. 2012. Redescriptions of two frequently recorded but poorly known hemiurid digeneans, *Lecithochirium musculus* (Looss, 1907) (Lecithochiriinae) and *Ectenurus lepidus* Looss, 1907 (Dinurinae), based on material from the western Mediterranean. *Systematic Parasitology* 82(3): 185–199.

Carvajal, J. 1971. *Grillotia dollfusi* sp. n. (Cestoda: Trypanorhyncha) from the skate, Raja chilensis, from Chile, and a note on *G. heptanchi*. *Journal of Parasitology* 57: 1269–1271.

Castillo, C.R., E. Gómez, & F. Paredes. 2000. Algunos aspectos adicionales sobre la biología y pesquería del falso volador *Prionotus stephanophrys*. *Boletín Instituto del Mar del Perú* 127: 1–27.

Céspedes, R., K. Díaz, A. Salas, & J. Iannacone. 2017. Ecological parasitic descriptors of *Adenocephalus pacificus* (Nybelin, 1931) (Cestoda: Diphyllobothriidae) in *Engraulis ringens* (Jenyns, 1842) "Peruvian Anchovy" (Clupeiformes: Engraulidae) in the coast of Peru. *Neotropical Helminthology* 11(2): 395–404.

Cezar, A. & J.L. Luque. 1999. Metazoan parasites of the Atlantic Spadefish *Chaetodipterus faber* (Teleostei: Ephippidae) from the Coastal Zone of the State of Rio de Janeiro, Brazil. *Journal of the Helminthological Society of Washington* 66(1): 14–20.

Chandler, A.C. 1935. Parasites of fishes in Galveston Bay. *Proceedings of the United States National Museum* 83(2977): 123–157.

Chero, J.D., C. Cruces, J. Iannacone, G.M. Sáez, L. Alvariño, C. Rodríguez, H. Rodríguez, E. Tuesta, A. Pacheco, & N. Huamani. 2014a. Índices parasitológicos de la merluza peruana *Merluccius gayi peruanus* (Ginsburg, 1954) (Perciformes: Merlucciidae) adquiridos del terminal pesquero de Ventanilla, Callao, Perú. *Neotropical Helminthology* 8(1): 141–162.

Chero, J.D., C. Cruces, J. Iannacone, G.M. Sáez, & L. Alvariño. 2014b. Helminth parasites of *Anisotremus scapularis* (Tschudi, 1846) (Perciformes: Haemulidae) "Peruvian grunt" acquired at the Fishing Terminal of Villa Maria del Triunfo, Lima, Peru. *Neotropical Helminthology* 8(2): 411–428.

Chero, J.D., J. Iannacone, C. Cruces, G.M. Sáez, & L. Alvariño. 2014c. Community of metazoan parasites of corvina drum *Cilus gilberti* (Abbott, 1899) (Perciformes: Sciaenidae) in the coastal zone of Chorrillos, Lima, Peru. *Neotropical Helminthology* 8(1): 163–182.

Chero, J.D., G.M. Sáez, J. Iannacone, & W. Aquino. 2014d. Ecological aspects of parasitic helminths of lorna drum *Sciaena deliciosa* (Tschudi, 1846) (Perciformes: Sciaenidae) acquired at the fishing terminal of Ventanilla, Callao, Peru. *Neotropical Helminthology* 8(1): 59–76.

Chero, J.D., G.M. Sáez, J. Iannacone, C. Cruces, L. Alvariño, & J.L. Luque. 2016. Ecología comunitaria de metazoos parásitos del bonito *Sarda chiliensis* Cuvier, 1832 (Perciformes: Scombridae) de la costa peruana. *Revista de Investigaciones Veterinarias del Per*ú 27(3): 539–555.

Chirichigno, N. & J. Vélez. 1998. *Clave para identificar los peces marinos del Perú*. Instituto del Mar del Perú, Callao, 500 pp.

Corkum. K. 1959. Some trematode parasites of fishes from the Mississippi Gulf Coast. *Proceedings of the Louisiana Academy of Sciences* 22:17–29.

Crawley, M.J. 2013. *The R Book*. Wiley & Son, West Sussex, 977 pp.

Crowcroft, P.W. 1946. A description of *Sterrhurus macrorchis* n. sp., with notes on the taxonomy of the genus *Sterrhurus* Looss (Trematoda, Hemiuridae). *Papers and proceedings of the Royal Society of Tasmania* 80: 39–47.

Cruces, C.L., J.D. Chero, G. Sáez, & J.L. Luque. 2017. Dactylogyrids (Monogenea) parasitic on marine fish from Peru including the description of a new species of *Haliotrema* Johnston & Tiegs, 1922 and two new species of *Parancylodiscoides* Caballero & C. & Bravo-Hollis, 1961. *Zootaxa* 4311(1): 111.

Cuvier, G. 1829. Histoire naturelle des poissons. Tome quatrième. Livre quatrième. *Des acanthoptérygiens à joue cuirassée* 4: 1–518, Pls. 72–99.

Cuvier, G. 1830. Histoire naturelle des poissons. *Tome cinquième. Livre cinquième. Des Sciénoïdes* 5(1-9): 1–374.

Cuvier, G. 1832. Histoire naturelle des poissons. Tome huitième. Livre neuvième. *Des Scombéroïdes* 8: 1–470.

Day, F. 1873. Sea-fishes of India and Burma. In: *Report on the sea fish and fisheries of India and Burma*. pp. 153-332, Supt. of Govt. Printing, Calcutta.

De Carvalho, M.N.M., W.B.B. De Sousa, M.F.B.G. Diniz, & F. Yamada. 2022. Diversity and community ecology of metazoan parasites in *Tetragonopterus argenteus* Cuvier, 1816 (Characiformes, Characidae) from Jaguaribe River basin in Brazil. *Annals of Parasitology* 68(4):737–748.

De León J.A., R. Bastida, L.F. Carrera, M.E. García, S.I. Sergio, V. Solís, & M.A. Tovar. 2021. Hirudinida Lamarck, 1818. In: A. Oceguera-Figueroa, F. Ruiz-Escobar, & G. Torres-Carrera (eds), *Marine Annelids of Mexico and Tropical America*, pp. 347–353, Universidad Autónoma de Nuevo León, Monterrey.

Diniz, J.B., M. Knoff, M.C.G. Fonseca, D.C. Gomes, & S.C. São Clemente. 2022. Cestode and nematode larvae of hygienic-sanitary importance parasitizing Percophis brasiliensis (Actinopterygii) collected from fish markets of the municipality of Niterói, RJ, Brazil. *Food Science and Technology* 42: e33021.

Esch, W.G., A.W. Shostak, D.J. Marcogliese, & T.M. Goater. 1990. Patterns and process in helminth parasite communities: an overview. In: W.G. Esch, A.C. Bush, & J. Aho (eds), *Parasite Communities: Patterns and Processes*, pp. 1–19, Chapman and Hall, New York.

Euzet, L. & D.M. Suriano. 1975. *Orbocotyle marplatensis* ng, n. sp. (Diclidophoridae) Monogene parasite branchial de Téléostéens marins du genre *Prionotus* (Triglidae) en Argentine. *Bulletin du Muséum National d'Histoire Naturelle* 282(192): 11–22.

Fábio, S. 1996. Study on *Mabiarama prevesiculata* (Freitas & Kohn, 1966) and *Myosaccium opisthonema* (Siddiqi & Cable, 1960) (Trematoda) in marine fishes from the coast of Rio de Janeiro State, Brazil. *Boletim do Museu Nacional de Zoologia* 372: 1–6.

Fuentes-Olivares, M., M.A. Rodríguez-Santiago, K.C. Garcés-García, & E. Ávila-Torres 2024. Community of metazoan parasites in a commercial fish *Mugil curema* Cuvier and Valenciennes, 1836 in Tuxpan, Veracruz México. *World Journal of Advanced Research and Reviews* 24: 233–245.

Fujisawa, Y., D.P. Barton, & S. Shamsi. 2025. Risk Factors of Anisakidosis at the Global Level: A Review. *Current Clinical Microbiology Reports* 12:17.

Gerasev, P.I., A.V. Gaevskaya, & A.A. Kovaleva. 1987. New genera of monogeneans of the group of diplectanotrems (Ancyrocephalinae). *Parazitologicheskii Sbornik* 34: 192–210.

Gibson, D.I., A. Jones, & R.A. Bray. 2002. *Keys to the Trematoda. Vol I*. CABI Publishing, London, 521 pp.

Gill, T.N. 1863. Catalogue of the fishes of Lower California, in the Smithsonian Institution, collected by Mr. J. Xantus. Part IV. *Proceedings of the Academy of Natural Sciences of Philadelphia* 15: 80–88.

Ginsburg, I. 1950. Review of the western Atlantic Triglidae (fishes). *Texas Journal of Science* 2(4): 489–527.

Ginsburg, I. 1954. Whitings on the coasts of the American continent. *United States Fish and Wildlife Service Fishery Bulletin* 56(96): 187–208.

Guiart, J. 1927. Classification des Tetrarhynques. *Association Francaise pour l'advancement des sciences* 50: 397–401.

Guichenot, A. 1848. Fauna Chilena. Peces. In: C. Gay (ed.), *Historia fisica y politica de Chile, Zoología. v. 2*. pp.

137–370, Dirección de Bibliotecas, Archivos y Museos, Paris & Santiago.
Günther, A. 1864. Report of a collection of fishes made by Messrs. Dow, Godman, and Salvin in Guatemala. Part first. *Proceedings of the Zoological Society of London* 3: 144-154.
Hagras, A.E.M., M.M. El-Naggar, M.F. Mansour, & A.M. El-Naggar. 1995. Influence of age, length and sex of the catfish *Clarias lazera* on infestation with six monogenean parasites. *Bulletin of the Faculty of Science, Mansoura University* 22(2): 37–56.
Hamilton, F. 1822. *An account of the fishes found in the river Ganges and its branches.* Edinburgh & London, 405 pp, Pls. 1–39.
Hanek, G. & W. Threlfall. 1969. Digenetic trematodes from Newfoundland, Canada. 1. Three species from *Gasterosteus aculeatus* Linnaeus, 1758. *Canadian Journal of Zoology* 47(5): 793–794.
Hasegawa, R. & R. Poulin. 2025. Effect of parasite infections on fish body condition: a systematic review and meta-analysis. *International Journal for Parasitology* 55: 417–426.
Hernández, J.S., F.J. Aznar, I. Blasco, N.A. García, M. Víllora, E.A. Crespo, J.A. Raga, & F.E. Montero. 2013. Description, microhabitat selection and infection patterns of sealworm larvae (*Pseudoterranova decipiens* species complex, nematoda: ascaridoidea) in fishes from Patagonia, Argentina. *Parasites & Vectors* 6(1): 252.
Hilgendorf, F.M. 1878. Über das Vorkommen einer *Brama*-Art und einer neuen Fischgattung Centropholis aus der Nachbarschaft des Genus *Brama* in den japanischen Meeren. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1878: 1–2.
Hopkins, S.W. 1941. The excretory systems of *Helicometra* and *Cymbephallus* (Trematoda), with remarks on their relationships. *Transactions of the American Microscopical Society* 60: 41–44.
Houttuyn, M. 1782. Beschryving van eenige Japanese visschen, en andere zee-schepzelen. *Verhandelingen der Hollandsche Maatschappij der Wetenschappen, Haarlem* 20: 311–350.
Iannacone, J. & L. Alvariño. 2009. Dinámica poblacional de la diversidad parasitaria de la "cabrilla" *Paralabrax humeralis* (Teleostei: Serranidae) en Chorrillos, Lima, Perú. *Neotropical Helminthology* 3(2): 73–88.
Iannacone, J. & L. Alvariño. 2013. Parasitological indices of Pacific pomfret *Brama japonica* Hilgendorf, 1878 (Osteichthyes, Bramidae) acquired at the fishing terminal of Chorrillos Lima, Peru. *Neotropical Helminthology* 7(1): 117–132.
Iannacone, J., J.P. Cerapio, J.M. Cárdenas, K. Sánchez, F. Briceño, & A. Dueñas. 2011. Parasite communities of the trambollo, *Labrisomus philippii* (Steindachner, 1866) (Perciformes: Labrisomidae), off coastal zone of Chorrillos, Lima, Peru. *Neotropical Helminthology* 5(1): 73–84.
Iannacone J, V. Sánchez, N. Olazábal, C. Salvador, L. Flores, & J. Molano. 2012. Ecological indices of parasites of *Scartichthys gigas* (Steindachner, 1876) (Perciformes: Blenniidae) of the coasts of Lima, Peru. *Neotropical Helminthology* 6(2): 191–203.
IUCN. 2025. The IUCN Red List of Threatened Species. Version 2025-1. https://www.iucnredlist.org. Accessed on [25 july 2025].
Jerônimo, G.T., M. Tavares, M.L. Martins, & M.M. Ishikawa. 2012. *Coleta de parasitos em peixes de cultivo*. Embrapa, Brasília, 33 pp.
Johnston, T. H. 1937. Entozoa from the Australian hair seal. *Proceedings of the Linnean Society of New South Wales* 62: 9–16.
Jordan, D.S., & B.W. Evermann. 1903. Descriptions of new genera and species of fishes from the Hawaiian Islands. *Bulletin of the U. S. Fish Commission* 22(1902): 161–208.
Jordan, D. S. & C.H. Gilbert. 1882. Notes on fishes observed about Pensacola, Florida, and Galveston, Texas, with description of new species. *Proceedings of the United States National Museum* 5(282): 241–307.
Jordan, D.S. & J. Swain. 1885. Description of three new species of fishes (*Prionotus stearnsi*, *Prionotus ophryas*, and *Anthias vivanus*) collected at Pensacola, Florida, by Mr. Silas Stearns. *Proceedings of the United States National Museum* 7(465): 541–545.
Kabata, Z. 1988. Copepoda and Branchiura. In: L. Margolis & Z. Kabata (eds), *Guide to the parasites of fishes of Canada. Part II – Crustacea*, pp. 3–127, Publication of Fisheries and Aquatic Sciences.
Khan, A. & F.M. Bilqees. 1990. On a new digenetic trematode, *Ectenurus papillatus* new species (Family: Hemiuridae) from freshwater fishes of Sind, Pakistan. *Pakistan Journal of Zoology* 22(4): 329–334.
Khidr, A.A. 1990. Population dynamics of *Enterogyrus cichlidarum* (Monogenea: Ancyrocephalinae) from the stomach of *Tilapia* spp. in Egypt. *International Journal for Parasitology* 20(6): 741–745.
Krabbe, K. 1878. Saelernes og tandhvalernes spolorme (hertil tavle I), in: *Overs. over DetK. Danske Vidensk*. Selsk. Forh, pp. 43–51.
Lanfranchi, A.L. & N.H. Sardella. 2010. Anisakids survival after microwaving, freezing and salting fish from Argentina. *Food Science and Technology Research* 16(5): 499–504.
Le, C.T. 2003. *Introductory biostatistics*. John Wiley & Sons, New Jersey, 536 pp.
Linnæus, C. 1758. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis.* Laurentii Salvii, Holmiae I, Editio decima, reformata, 824 pp.
Linton, E. 1898. Notes on trematode parasites of fishes. *Proceedings of the United States National Museum, Washington* 20: 507–548.
Lockington, W. N. 1881. Description of a new species of *Prionotus* (*Prionotus stephanophrys*) from the coast of

California. *Proceedings of the United States National Museum* 3(182): 529–532.
Looss, A. 1907. Zur Kenntnis der Distomenfamilie Hemiuridae. *Zoologischer Anzeiger* 31: 585–620.
López, D.D., Y.M. Mago, & O.L. Chinchilla. 2016. Primer hallazgo en Venezuela de *Lecithochirium* cf. *floridense* (Manter, 1934) Crowcroft, 1946 y *Brachyphallus* cf. *crenatus* (Rudolphi, 1802) Odhner, 1905 (Trematoda, Digenea, Hemiuridae) parásitos del pez invasor *Pterois volitans* Linneo, 1758 (Scorpaenidae). *Boletín del Instituto Oceanográfico de Venezuela* 55(1): 69–77.
Louvard, C., K.A. Hadfield, M.P.M. Vanhove, B. Sures, & N.J. Smit. 2025. Unveiling the hidden players: exploring the intricate dance of aquatic parasites, host biodiversity and ecosystem health. In: N.J. Smit, & B. Sures (eds.), *Aquatic Parasitology: Ecological and Environmental Concepts and Implications of Marine and Freshwater Parasites,* pp. 167–198, Springer, Cham.
Luque, J.L. & M.E. Oliva. 1993a. Análisis cuantitativo y estructura de la comunidad parasitaria de *Paralonchurus peruanus* (Pisces: Scianidae) en la costa peruana. *Parasitología al Día* 17(3–4): 107–111.
Luque, J.L. & M.E. Oliva. 1993b. Trematodes of marine fishes from the Peruvian faunistic Province (Peru and Chile), with description of *Lecithochirium callaoensis* n. sp. and new records. *Revista de Biologia Marina* 28(2): 271–286.
Luque, J.L. & R. Poulin. 2004. Use of fish as intermediate hosts by helminth parasites: a comparative analysis. *Acta Parasitologica* 49(4): 353–361.
Luque, J.L., C. Cruces, J. Chero, F. Paschoal, P.V. Alves, A.C. Da Silva, L. Sanchez, & J. Iannacone. 2016. Checklist of metazoan parasites of fishes from Peru. *Neotropical Helminthology* 10(2): 301–375.
Lühe, M. 1901. Ueber Hemiuriden. (Ein Beitrag zur Systematik der digenetischen Trematoden). *Zoologischer Anzeiger* 24: 394–403, 473–488.
Lühe, M. 1904. Geschichte und Ergebnisse der Echinorhynchen-Forschung bis auf Westrumb (1821). (Mit Bemerkungen über alte und neue Gattungen der Acanthocephalen). *Zoologische Annalen, Zeitschrift* für *Geschichte der Zoologie* 1: 139 − 354.
Manter, H.W. 1934. Some digenetic trematodes from deep-water fish of Tortugas, Florida. *Papers from the Tortugas Laboratory of the Carnegie Institution of Washington* 28(435): 257–345.
Manter, H.W. 1940. Digenetic trematodes of fishes from the Galapagos Islands and the neighboring Pacific. *University of Southern California publications* 2(14): 329–497.
Manter, H.W. 1947. The digenetic trematodes of marine fishes of Tortugas, Florida. *American Midland Naturalist* 38(2): 257–416.
Manter, H.W. 1955. *Two new monogenetic trematode from elephant fishes (Callorhynchus) from South Africa and New Zealand*. Essays in the natural sciences in honor of Captain Hancock. University of Southern California Press, Los Angeles, pp. 211–220
McAllister, D.E. 1963. A revision of the smelt family, Osmeridae. *Biological Series. No. 71. Bulletin. National Museum of Canada* 191: 1–53.
Mendieta, A. & M. Samamé. 1985. *Avance de las investigaciones del vocador Prionotus stephanophrys en el área de su distribución. I Congreso Nacional de Biología Pesquera* 1: 6–17.
Mendoza, M.M., I. Valles, H. Lozano, R. María del Carmen, & P.N. Castro. 2013. Parasite fauna of *Paranthias colonus* (Valenciennes, 1846) from el Sargento, Baja California Sur, Mexico. *Neotropical Helminthology* 7(1): 13–28.
Menoret. A. 2012. *Relaciones tróficas y parasitismo en peces marinos: uso de cestodes Trypanorhyncha como marcadores biológicos*. Tesis Doctoral, Universidad de Buenos Aires. Buenos Aires, Argentina, 239 pp. https://bibliotecadigital.exactas.uba.ar/collection/tesis/document/tesis_n5371_Menoret
Menoret, A. & V.A. Ivanov. 2009. New name for *Progrillotia dollfusi* Carvajal et Rego, 1983 (Cestoda: Trypanorhyncha): description of adults from *Squatina guggenheim* (Chondrichthyes: Squatiniformes) off the coast of Argentina. *Folia Parasitologica* 56(4): 284–294.
Menoret, A. & V. Ivanov. 2012. Description of plerocerci and adults of a new species of *Grillotia* (Cestoda: Trypanorhyncha) in teleosts and elasmobranchs from the Patagonian shelf off Argentina. *The Journal of parasitology* 98(6): 1185–1199.
Minaya, D., L. Alvariño, R.M. Urbano, & J. Iannacone. 2021a. Community structure of metazoan parasites in the Splittail bass *Hemanthias peruanus* (Serranidae) from northern Peru. *Revista Medicina Veterinaria y Zootecnia Cordoba* 26(3): e2125.
Minaya, D., D. Ferre, M. Garcia, L. Alvariño, & J. Iannacone. 2021b. Community of macroparasites of the Pacific barracuda *Sphyraena ensis* Jordan and Gilbert, 1882 (Perciformes, Sphyraenidae) from the north coast of Peru. *Arxius de Miscel·lània Zoològica* 19: 273–287.
Morrill, A., Ó.K. Nielsen, K. Skírnisson, & M.R. Forbes. 2022. Identifying sources of variation in parasite aggregation. *PeerJ* 10: e13763.
Nichols, J.T. 1920. A key to the species of Trachurus. *Bulletin of the American Museum of Natural History* 42(13): 477–481.
Nonković, D., V. Tešić, V. Šimat, S. Karabuva, A. Medić, & J. Hrabar. 2025. Anisakidae and Anisakidosis: A Public Health Perspective. *Pathogens 14*: 217.
Nur, I., Yusnaini, M. Idris, & A.I. Sari. 2020. Study on the impact of environmental pollution: Parasitic infestation

and conditions factor of fish living in amalgamation ponds. *IOP Conference Series: Earth and Environmental Science* 465: 012042.

Nuwer, R. 2022. Parasites Lost: Body-invading organisms play an outsize role in nature. Do some deserve protection? *Scientific American* 326(5): 62–69.

Oliva, M.E. & J.L. Luque. 1998. Metazoan parasite infracommunities in fivesciaenids from the central Peruvian coast. *Memórias do Instituto Oswaldo Cruz* 93(2): 175–180.

Oosthuizen, G., A.A. Acosta, N.J. Smit, & B.C. Schaeffner. 2021. A new species of *Grillotia* Guiart, 1927 (Cestoda: Trypanorhyncha) from the spotted skate, *Raja straeleni* Poll, in South Africa. *Parasitology International* 82: 102307.

Overstreet, R.M., J.O. Cook, & R.W. Heard. 2009. Trematoda (Platyhelminthes) of the Gulf of Mexico. In: D.L. Felder & D.K. Camp (eds.), *Gulf of Mexico origin, waters, and biota*, pp. 419–486, Faculty Publications from the Harold W. Manter Laboratory of Parasitology, Texas.

Palm, H.W. 1997. Trypanorhynch cestodes of commercial fishes from northeast Brazilian coastal waters. *Memórias do Instituto Oswaldo Cruz* 92(1): 69–79.

Palm, H.W. 2004. *The Trypanorhyncha Diesing, 1863.* Bogor Agricultural University, 710 pp.

Pantoja, C. & O. Kudlai. 2022. Hemiurid Trematodes (Digenea: Hemiuridae) from Marine Fishes off the Coast of Rio de Janeiro, Brazil, with Novel Molecular Data. *Animals* 12(23): 3355.

Payne, R.R. 1987. Some diclidophorid Monogenea (Trematoda), including two new species, from marine fishes of the eastern Pacific Ocean off California, USA and Baja California, Mexico. *Transactions of the American Microscopical Society* 106(3): 256–264.

Poey, F. 1860. *Memorias sobra la historia natural de la Isla de Cuba, acompañadas de sumarios Latinos y extractos en Francés*. Imprenta de la viuda de Barcina, Habana, 2: pp. 97–336.

Poulin, R. 1992. Determinants of host specificity in parasites of freshwater fishes. *International Journal for Parasitology* 22(6): 753–758.

Quoy, J. R. C. & J.P. Gaimard. 1825. Description des Poissons. Chapter IX. In: L. de Freycinet (ed.), *Voyage autour du Monde...exécuté sur les corvettes de L. M*. Ches Pillet Aîné, Paris, pp. 329–616, Atlas pls. 43–65.

Radujković, B.M. & D. Sundić. 2014. Parasitic flatworms (Platyhelminthes: Monogenea, Digenea, Cestoda) of fishes from the Adriatic Sea. *Natura Montenegrina* 13(1): 7–280.

Renner, E.D. & I.C. Duggan. 2024. Season, size, and sex: factors influencing monogenean prevalence and intensity on *Gambusia affinis* in New Zealand. *Parasitology Research* 123: 228.

Rey, C., D. Minaya, & J. Iannacone. 2022. Comunidad de metazoos parásitos del pejegallo *Callorhinchus callorynchus* (Linnaeus, 1758) (Chimaeriformes: Callorhinchidae) procedentes de la pesca artesanal en Pisco, Ica, Perú. *Revista del Museo Argentino de Ciencias Naturales* 24(1): 77–87.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. *Bulletin of the Fisheries Research Board of Canada*, 191: 1–382.

Robertson, D.R., G.R. Allen, E. Peña, & A. Estape. 2024. *Peces Costeros del Pacífico Oriental Tropical: sistema de Información en línea.* Instituto Smithsonian de Investigaciones Tropicales, Balboa, 75 pp. https://biogeodb.stri.si.edu/sftep/es/pages. Accessed on [20 June 2025].

Rodríguez, S.M.A. & C.J.A. Rosales. 2011. Parasite structure of the ocean whitefish *Caulolatilus princeps* from Baja California, México (East Pacific). *Helgoland Marine Research*, 65: 197–202.

Rodríguez, S.M.A., C.J.A. Rosales, & M.M.I. Grano. 2014. Dynamics of a parasite assemblage of the Vermilion Rockfish *Sebastes miniatus* from northwestern Baja California, México. *Helgoland Marine Research* 68: 299–306.

Rodríguez, S.M.A., C.J.A. Rosales, M.M.I. Grano, C.J.A. Vázquez, S. Laffón, & L. Nuñez. 2020. Parasitological records of eight rockfish species (Scorpaeniformes: Scorpaenidae) from Pacific Baja California, Mexico. *Pacific Science* 74(4): 395–403.

Rosner, B.A. 2011. *Fundamentals of biostatistics*. Brooks/Cole, Boston, 859 pp.

Rudolphi, K.A. 1809. E*ntozoorum sive vermium intestinalium historia naturalis. volumen 2, parte 1.* Tabernae Librariae et Artium, Ámsterdam, 457 pp.

Samamé, M. & F. Fernández. 2000. Evaluación biológico pesquera del falso volador *Prionotus stephanophrys* Lockington, componente de la ictiofauna demersal del Perú. *Boletín Instituto del Mar del Perú* 126: 1–28.

Samamé, M., M. Sánchez, J. Castillo, A. Mendieta, & U. Damm. 1983. Evaluación de la población de merluza y otras especies demersales en el área Pto. Pizarro-Chimbote. *Boletín Instituto del Mar del Perú* 7(5): 115–191.

Sarmiento, L., M. Tantaleán, & A. Huiza. 1999. Nemátodos parásitos del hombre y de los animales en el Perú. *Revista peruana de parasitología* 14(1–2): 9–65.

Scheifler, M., E. Magnanou, S. Sanchez, & Y. Desdevises. 2022. Host specificity of monogenean ectoparasites on fish skin and gills assessed by a metabarcoding approach. *International Journal for Parasitology* 52(8): 559–567.

Schmitter, J.J. 1992. *Aspectos autoecológicos de los Triglidae (Pisces: Scorpaeniformes) en la costa occidental de Baja California Sur, México*. Tesis de maestría. Instituto Politécnico Nacional, Ciudad de México, México, 98 pp.

Schmitter, J.J. 1989. *Variación espacio-temporal en edad, talla y peso de Prionotus stephanophrys Lockington,* *1880 (Pisces: Triglidae), en la costa occidental de Baja California Sur, México.* Tesis de Licenciatura. Universidad Nacional Autónoma de México, Ciudad de México, 38 pp.

Siddiqi, A.H. & R.M. Cable. 1960. Digenetic trematodes of marine fishes of Puerto Rico. *Scientific Survey of Porto Rico and the Virgin Islands* 17(3): 257–369.

Shih, H.H., W. Liu, & Z.Z. Qiu. 2004. Digenean fauna in marine fishes from Taiwanese water with the description of a new species, *Lecithochirium tetraorchis* sp. nov. *Zoological Studies* 43(4): 671–676.

Shimazu, T. 2018. Adult digeneans (Trematoda) parasitic in *Hypomesus nipponensis* (Osteichthyes, Osmeridae) from brackish-water lakes of Japan. *Bulletin of the National Museum of Natural Sciences, Series A* 44(2): 57–68.

Simões, R.O., T.S. Cardoso, A.N. Pereira, F. Paschoal, & J.L. Luque. 2025. Parasite metacommunity structure of *Mullus argentinae* Hubbs & Marini, 1933 (Actinopterygii: Mullidae) off Rio de Janeiro, Southeastern Brazil. *Anais da Academia Brasileira de Ciências* 97(3): e20240830.

Sinclair, N.R., F.G. Smith, & J.J. Sullivan. 1972. The Stomachicola rubea: *Tubulovesicula pinguis Enigma*. *Proceedings of the Helminthological Society of Washington* 39: 253–258.

Steindachner, F. 1866. Fortsetzung der ichthyologischen Notizen. *Anzeiger der Kaiserlichen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftlichen Classe* 3: 19–20.

Steindachner, F. 1875. Ichthyologische Beiträge (II). I. Die Fische von Juan Fernandez in den Sammlungen des Wiener Museums. II. Über einige neue Fischarten von der Ost- und Westküste Süd-Amerikas. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe* 71: 443–480.

Tantaleán, M. & A. Huiza. 1994. Sinopsis de los parásitos de peces marinos de la costa peruana. *Biotempo* 1(1): 53–101.

Tantaleán, M., L. Sánchez, L. Gómez, & A. Huiza. 2005. Acantocéfalos del Perú. *Revista peruana de biología* 12(1): 83–92.

Tarazona, J., Gutiérrez, D., C. Paredes, & A. Indacochea. 2003. Overview and challenges of marine biodiversity research in Peru. *Gayana* 67(2): 206–231.

Tessema, W. 2020. Review on parasites of fish and their public health importance. ARC ARC *Journal of Animal and Veterinary Sciences* 6(2): 23–27.

Theisen, S., H.W. Palm, S.H. Al-Jufaili, & S. Kleinertz. 2017. *Pseudempleurosoma haywardi* sp. nov. (Monogenea: Ancyrocephalidae (sensu lato) Bychowsky & Nagibina, 1968): An endoparasite of croakers (Teleostei: Sciaenidae) from Indonesia. *PLoS One* 12(9): e0184376.

Timi, J.T. 2025. Parasites as Biological in Aquatic Hosts. N. J. Smit, & B. Sures (eds.), *Aquatic Parasitology: Ecological and Environmental Concepts and Implications of Marine and Freshwater Parasites*, pp. 445–470, Springer, Cham.

Timi, J.T. & K. Buchmann. 2023. A century of parasitology in fisheries and aquaculture. *Journal of Helminthology* 97: e4.

Timi, J.T. & A.L. Lanfranchi. 2009. The importance of the compound community on the parasite infracommunity structure in a small benthic fish. *Parasitology Research* 104(2): 295–302.

Timi, J.T. & K. Mackenzie. 2015. Parasites in fisheries and mariculture. *Parasitology* 142(1): 1–4.

Timi, J.T. & R. Poulin. 2020. Why ignoring parasites in fish ecology is a mistake. International *Journal for Parasitology* 50(10–11): 755–761.

Torres, P., M.I. Jercic, J.C. Weitz, E.K. Dobrew, & R.A. Mercado. 2007. *Human pseudoterranovosis*, an emerging infection in Chile. *Journal of Parasitology* 93(2): 440–443.

Tschudi, J.J. von. 1846. *Ichthyologie*. Untersuchungen *über* die Fauna Peruana. Scheitlin & Zollikofer, St. Gallen 1–693.

Vicente, J.J. & E. Dos Santos. 1974. Alguns helmintos de peixes do litoral norte fluminense-II. *Memórias do Instituto Oswaldo Cruz* 72(3–4): 173–180.

Vieira, E.G.M., E. Fischer, G. Graciolli, C. Ferreira, G. Camargo, M. Silveira, & A. Eriksson. 2019. Bat flies aggregation on *Artibeus planirostris* hosts in the Pantanal *Parasitology* 146(11): 1462–1466.

Yamaguti, S. 1965. New Monogenetic Trematodes from Hawaiian Fishes, I. *Pacific Science* 19: 55–95.

Zar, J.H. 2014. *Biostatistical Analysis*. Pearson Education International, London, 931 pp.

Zuur, A.F., E.N. Ieno, N. Walker, A.A. Saveliev, & G.M. Smith. 2009. *Mixed Effects Models and Extensions in Ecology with R*. Springer, New York, 563 pp.