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A Systematic Review of Parasites Found Within Selected Teleost Fishes of the South Florida Hermatypic Coral Reef Tract

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NOVA SOUTHEASTERN UNIVERSITY

HALMOS COLLEGE OF ARTS AND SCIENCES

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Abstract

This report is a synthetic survey of published accounts of 43 reef-associated fish species and their parasites from the east coast of North America, the Caribbean Sea, Gulf of Mexico, and regions adjacent to the south Florida reef tract. To date, no comprehensive host-parasite list is available for this region, although comparable reviews from other regions have played a vital role in the fields of parasitology and fish ecology, providing valuable guidance on sampling locations, available host fishes inhabiting the region, and inventories of parasites likely to be found infecting these host species. This systematic review of teleost host fish species and their parasites represents the first host-parasite database for major fish taxa commonly sampled from the south Florida coral reef tract during field surveys, specifically within Monroe, Miami-Dade, Broward, and Palm Beach counties. It includes data on 43 host species, with records of 341 parasite taxa compiled from 150 published studies, organized into host-parasite and parasite-host lists. The database also revealed major knowledge gaps in the literature. For example, while some host taxa are well-represented by many studies (e.g., Gray Snapper *Lutjanus griseus*), those of lesser economic or recreational importance have largely been neglected. This effort bias has likely led to an underestimation of the parasite species richness in less-studied host fishes; it also makes it difficult to derive any major conclusions regarding differences in parasite community composition or structure among these fishes. Thus, while univariate and multivariate analyses suggested (for example) that phylogenetically related hosts tended to have compositionally similar parasite communities, these results were likely driven by differences in the extent to which the different host taxa have been studied. A major outcome of this report is the identification of relatively underexamined fish host taxa that require further study and should be targeted by future parasite surveys.

Key Words: Helminths, Metazoan, Acanthocephala, Arthropod, Annelida, Cestode, Digenea, Monogenea, Nematoda, Trematoda, Host, Parasite, List

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Introduction

Parasitism is an interspecific symbiotic relationship in which one species- the parasite- benefits at the expense of another species- the host. This is unlike mutualistic symbioses in which both organisms benefit from their interaction (Olano et al., 2011). Endoparasites are typically found within the tissues and hollow organs of their host organism, whereas ectoparasites are found on the hosts exterior. The term *parasite* is often reserved for eukaryotic organisms and excludes taxa such as viruses and bacteria. However, some eukaryotic groups such as plants and fungi are excluded as well, even though they include many clearly parasitic taxa (Press & Phoenix, 2005, Vilcinskas & Götz, 1999). For the purposes of this study, the focus is on that component of the parasite community consisting of animals, such as flatworms and roundworms.

Parasitism is the most common and one of the most successful modes of life. Parasites are extremely diverse: almost all animal taxa include parasitic members, and almost all organisms are subject to at least some degree of parasitism. Hosts often harbor a wide variety of parasitic species (Bordes & Morand, 2009, Poulin & Morand, 2000). Unfortunately, parasites are often overlooked and/or incorrectly classified. For this reason, the quantification of diversity among this mode of living is unknown, as many parasites are often grouped or classified improperly into poly- or paraphyletic groups, and different taxa are sometimes misidentified as the same organism (Poulin & Morand, 2000). Some parasite taxa are generalists, able to infect a variety of possible host species. Conversely, many parasites are also host specific, meaning they are found within one distinct host (Dunn et al., 2009). This can put these parasites at risk of co-extinction in situations where host populations are threatened by overexploitation or habitat loss; such extinctions often go unnoticed and unrecorded, due to decreased support for qualitative parasite surveys (and synthetic reviews such as this report).

Parasites play a variety of ecologically vital roles, most notably in regulating host populations. Parasites can alter the host's behavior or physiology, which can cause direct or indirect mortality of the host. For example, the parasitic trematode *Ribeiroia* sp. causes limb deformities as cercariae encyst in tadpoles, causing tadpole mortality as well as increased mortality in deformed frogs after metamorphosis (Johnson, 1999). The ciliate parasite *Lambornella clarki* directly affects mortality in their mosquito hosts. These parasites were shown

to alter mortality rates based on availability of food resources. When food was abundant, there was high mortality, whereas when food was scarce the mortality rate was still high but was attributed to insufficient food levels. When suitable food levels were available, mortality rates were lower, with higher fitness among host mosquitos (Washburn et al., 1991). *Batrachochytrium dendrobatidis* is another parasite that has caused major shifts in host populations. This fungal parasite infects many species of frogs and causes chytridiomycosis, a disease that has been associated with worldwide population declines and extinction of frog species (Rollins-Smith, 2020). These extinctions may coincide with the co-extinctions of other parasites found within these frog species (Rollins-Smith, 2020). Parasites also regulate host populations indirectly, for example by increasing host susceptibility to predation. Killifish infected with the brain-dwelling trematode *Euhaplorchis* sp. are more susceptible to predation by fish-eating birds (Lafferty et al., 1996). For many hosts, particularly those at higher trophic levels such as predators, parasitism may be the primary (or only) process regulating their populations (Sures et al., 2017).

Although parasites by definition cause harm to their host species, they can be beneficial to the larger ecological community. Some parasites are considered essential ecosystem engineers that can directly affect ecosystem structure (Marcogliese, 2005), often by altering host phenotypes and/or behavior (Hatcher et al., 2012). *Curtuteria australis* is a parasite that directly manipulates the behavior of the ecosystem engineering cockle *Austrovenus stutchburyi* from the intertidal zone of New Zealand. When infecting the cockle, *C. australis* directly manipulates its burrowing actions, forcing it to lie on top of the substrate instead of digging. This manipulation allows invertebrates like anemones and limpets to attach and colonize habitats that would otherwise be dominated by cockles (Thomas et al., 1998; Thomas et al., 1999; Dairain et al., 2019). However, although the parasite's actions increase local diversity, they negatively affect primary production because bioturbation or the cycling of nutrients by the cockles is reduced (Dairain et al., 2019), highlighting the complexity of parasite effects on ecosystems. Parasites play important structuring roles in terrestrial ecosystems as well: in plants, the ectoparasite dwarf mistletoe *Arceuthobium* sp. causes the growth of large bundles of twig-like structures termed "witches' brooms" that are used as nesting material by many bird species (Hatcher et al., 2012).

Parasites outnumber free-living organisms and play key ecological roles, yet information on their taxonomy and phylogeny are lacking. We lack parasitological data for many host taxa, habitats, and geographical areas. This problem has been exacerbated by ongoing decreases in funding support for descriptive surveys; furthermore, many parasitological journals have become increasingly reticent to publish surveys and host-parasite lists. This situation is unfortunate, as biodiversity surveys are the foundation of biological research, driving hypothesis generation, guiding ecological research, and informing efforts to conserve species and preserve ecosystems (e.g., Balmford & Gaston, 1999; Poulin & Leung, 2010). Identifying parasites to species can be time consuming and requires specialized training. It can also be expensive: parasite larvae often lack the adult structures necessary for morphological identification, making it necessary in some cases to use costly molecular techniques (Locke et al., 2010). Consequently, it is not uncommon for publications in parasitology to be based on datasets where parasites have only been identified to genus level or higher. It is not always necessary (or possible) to identify all parasites in a study to species test ecological hypotheses about parasites (e.g., Blanar et al., 2016), and analyses at the genus level or higher may in many cases be more appropriate, depending on the scale of the hypothesis being tested (Kennedy & Bush, 1994; Dallas & Becker, 2021). However, species-level identification of parasites is required for accurate assessments of parasite diversity and species richness, as well as in host-parasite surveys such as the present study (Poulin & Leung, 2010; Littlewood, 2011).

In most ecosystems, host species richness is positively correlated with parasite species richness: diversity begets diversity. This explains why regions of high host richness (e.g., tropical zones, undisturbed areas, most hermatypic coral reef habitats) have been better studied than less speciose regions, and many geographic regions remain poorly surveyed (Poulin et al., 2020). For marine fishes, diversity of metazoan parasites is well studied in areas of high host species richness (Poulin & Morand, 2000), with fewer studies being conducted outside of these biological hotspots. Furthermore, it has been estimated that 85-90% of helminth parasites of vertebrates remain undiscovered (Jorge & Poulin, 2018). This can be attributed in part to the intense focus on areas of high host richness and the lack of sampling effort in others. Targeted surveys in areas of lower host richness (say, in migratory corridors or near the edges of host ranges; see Warburton & Blanar, 2021) are likely to yield novel parasites and new host records, and ultimately more complete host parasite surveys for these hosts (Jorge & Poulin, 2018;

Gumbleton et al., 2020). Another mitigating strategy might be to synthesize published and unpublished host-parasite information from as wide a geographic region as possible, preferably encompassing as much of the hosts' natural range (Poulin et al., 2020; Poulin & Jorge, 2018). This approach has been successfully used to establish host-parasite databases for fishes (such as sticklebacks and killifishes) that have then been used to study the structure and composition of their parasite communities (Thieltges et al., 2013; Poulin et al., 2012). It is also the approach used to establish the reef-associated fishes host-parasite checklist that is the focus of this study.

Host-parasite checklists are a summary of host species and the parasites associated with them (Fletcher, 1998; Klimpel, 2001). They are often accompanied by a reciprocal checklist of parasites and their respective hosts. These checklists are assembled by compiling surveys from a host species and documenting accounts of the parasites found infecting them and vice versa. They play fundamental roles in the field of parasitology in two ways. First, these checklists are useful as a reference for those who study parasites in a host species: they can guide study design and help anticipate what parasite taxa are likely be found infecting a host species (Klimpel, 2001). They serve a complementary role to systematic keys, which are necessary for the morphological identification of parasites. Host-parasite lists (and associated parasite-host lists) typically include the geographic location of sampling, which can be beneficial in determining where to sample those organisms or what species might be expected in a specific location (Poulin, 2003). Second, checklists are important because they provide information on parasite species richness and community composition by host. Such data might, for example, be used to assess variation in host specificity among parasite taxa (Poulin et al., 2015). Studies can use metadata from geographic location, feeding habits of host, size, etc. to explore how these factors affect the assemblage of parasites in hosts and assess which may have the greatest effect on how these assemblages are formed (Price & Clancy, 1983; Klimpel, 2001; Thieltges et al., 2013; Poulin et al., 2012). Such checklists have been completed for various regions worldwide: excellent examples focused on fishes are available for systems ranging from monogeneans of freshwater fishes in Australia (Fletcher et al., 1998) or the metazoan parasites of Czech fishes (Moravec, 2001) to the parasites of deep-sea fishes (Klimpel et al., 2001).

Most published parasite surveys target a single host species or closely related species, frequently from one geographic area (e.g., Brooks & Amato, 1992, Williams & Bunkley-

Williams, 1994). As stated above, these checklists tend to come from hotspots of host diversity (and, it must be said, hotspots of parasitologists!), and some locations remain poorly studied (Carlson et al., 2020). One such region is the Florida hermatypic coral reef tract, where surprisingly little work has been conducted documenting parasites in hosts (Overstreet, 1969, Manter, 1942). The few available studies almost exclusively focus on fish of commercial or recreational importance, and often exclude or neglect fishes of ecological importance. For instance, scarid parrotfishes clean algae from coral beds and have an overall positive action on coral reef health, thereby enhancing reef biodiversity (Bonaldo et al., 2011). Unfortunately, despite their ecological importance, parrotfishes are understudied in parasitological research. As will be shown below, there are major differences in the extent to which different species of reef-associated fishes are represented in the parasitological literature (Levsen et al., 2018).

The intent of this study was to establish the first comprehensive checklist of published accounts of parasites identified from commonly observed teleost fish hosts of the Florida hermatypic coral reef tract. However, given the lack of published data on the Florida reef tract hosts and their parasites, studies outside of Florida including the Gulf of Mexico, the Caribbean, and the western Atlantic were included as proxy datasets for this region. The fish hosts incorporated in this list were chosen based on specific criteria. For the purposes of our research, the study needed to encompass several trophic guilds and common fish families in the south Florida reef tract of Monroe, Miami-Dade, Broward, and Palm Beach Counties.

The fish species included in this study were selected for their commercial and recreational importance, as well as their local abundance. Taking these criteria into consideration, several fishes were selected after a thorough evaluation of published studies on the fisheries of this region. For the recreational fishery, *Caranx crysos* (Blue Runner), *Caranx hippos* (Crevalle Jack), and *Lutjanus griseus* (Gray Snapper) accounted for 13%, 9%, and 5% of recreational landings respectively from 1990-2000 (Johnson et al., 2007). For the commercial fishery in the same region, *Caranx hippos (*Crevalle Jack), “miscellaneous reef fish” (a composite category), *Ocyurus chrysurus* (Yellowtail Snapper), and *Caranx crysos* (Blue Runner) comprised 13%, 12%, 11%, and 4% of commercial landings respectively during the same time period (Johnson et al., 2007). Others of low to no recreational and commercial importance were also selected for their ecological role in the Florida reef tract, such as *Labrisomus nuchipinnis*

(Hairy Blenny) and *Sphoeroides testudineus* (Checkered Pufferfish). Therefore, the species that were included in this study encompass a range of taxa of differing commercial and recreational importance. For example, many haemulid grunts were included in this study, as much of the literature cites them as being highly abundant in this region, accounting for up to 80% of the sampled fishes (e.g., Baron et al., 2004; Jordan et al., 2005). Taxa of lower abundance (based on the REEF database; Reef Environmental Education Foundation; https://www.reef.org/database-reports) were included as well, yielding a widely representative a host species list.

1. Conduct a comprehensive literature search for surveys of parasites identified from a subset of fishes commonly observed on the south Florida reef tract.
2. Resolve any synonymies and issues with incorrect or outdated taxonomy.
3. Compile the data from these surveys into host-parasite and parasite-host checklists for these fishes.
4. Evaluate the information in the resulting database and identify host taxa that require further parasitological investigation.

Table 1: Forty most commonly observed fish species in the Florida reef tract region of study according to diver visual surveys listed by increasing abundance (REEF Database). Species in bold represent those that were included in this study.

Species	Family
Porkfish, *Anisotremus virginicus*	**Grunt, Haemulidae**
Bluehead, *Thalassoma bifasciatum*	Wrasse, Labridae
Sergeant Major, *Abudefduf saxatilis*	**Damselfish, Pomacentridae**
French Grunt, *Haemulon flavolineatum*	**Grunt, Haemulidae**
Doctorfish, *Acanthurus chirurgus*	**Surgeonfish, Acanthuridae**
Blue Tang, *Acanthurus coeruleus*	Tang, Acanthuridae
Ocean Surgeonfish, *Acanthurus tractus*	Surgeonfish, Acanthuridae
Redband Parrotfish, *Sparisoma aurofrenatum*	**Parrotfish, Scaridae**
Sharpnose Puffer, *Canthigaster rostrata*	Puffer, Tetraodontidae
Stoplight Parrotfish, *Sparisoma viride*	**Parrotfish, Scaridae**
Bicolor Damselfish, *Stegastes partitus*	Damselfish, Pomacentridae
Tomtate, *Haemulon aurolineatum*	**Grunt, Haemulidae**
White Grunt, *Haemulon plumieri*	**Grunt, Haemulidae**
Bluestriped Grunt, *Haemulon sciurus*	**Grunt, Haemulidae**
Bar Jack, *Caranx ruber*	Jack, Carangidae
Gray Angelfish, *Pomacanthus arcuatus*	Angelfish, Pomacanthidae
French Angelfish, *Pomacanthus paru*	Angelfish, Pomacanthidae
Spanish Hogfish, *Bodianus rufus*	**Wrasse, Labridae**
Spotted Goatfish,*Pseudupeneus maculatus*	**Goatfish, Mullidae**
Slippery Dick, *Halichoeres bivittatus*	**Wrasse, Labridae**
Cocoa Damselfish, *Stegastes xanthurus*	Damselfish, Pomacentridae
Yellowtail Snapper, *Ocyurus chrysurus*	**Snapper, Lutjanidae**
Highhat, *Pareques acuminatus*	Drum, Sciaenidae
Gray Snapper, *Lutjanus griseus*	**Snapper, Lutjanidae**
Reef Butterflyfish, *Chaetodon sedentarius*	**Butterflyfish, Chaetodontidae**
Yellowhead Wrasse, *Halichoeres garnoti*	Wrasse, Labridae

Queen Angelfish, *Holacanthus ciliaris*	**Angelfish, Pomacanthidae**
Sailors Choice, *Haemulon parra*	**Grunt, Haemulidae**
Striped Parrotfish, *Scarus iseri*	Parrotfish, Scaridae
Spotfin Butterflyfish, *Chaetodon ocellatus*	Butterflyfish, Chaetodontidae
Princess Parrotfish, *Scarus taeniopterus*	Parrotfish, Scaridae
Bermuda Chub/Gray Chub, *Kyphosus sectatrix / K. bigibbus*	Chub, Kyphosidae
Butter Hamlet, *Hypoplectrus unicolor*	Sea Bass, Serranidae
Harlequin Bass, *Serranus tigrinus*	Sea Bass, Serranidae
Bridled Goby Complex (Bridled/Sand-Canyon/Patch-Reef), *Coryphopterus. glaucofraenum/ C. bol /C. tortugae*	Goby, Gobiidae
Graysby, *Cephalopholis cruentata*	**Grouper, Serranidae**
Rock Beauty, *Holacanthus tricolor*	Angelfish, Pomacanthidae
Lane Snapper, *Lutjanus synagris*	**Snapper, Lutjanidae**
Smallmouth Grunt, *Haemulon chrysargyreum*	Grunt, Haemulidae
Clown Wrasse, *Halichoeres maculipinna*	Wrasse, Labridae

Methods

A comprehensive literature search was conducted for parasitological surveys of 43 fish species (Table 2) from the Western Atlantic Ocean, including the Caribbean Sea and Gulf of Mexico. Two databases were used: *Web of Science* and *Zoological Record*, providing coverage of articles published since 1975 and 1864 respectively. A Boolean approach was used which included the common or scientific name of the host and a sub-search of the term "*parasit**". Articles not directly accessible via these databases were obtained via Google Scholar or interlibrary loan. Presence/absence data were extracted for all metazoan parasites, along with data on the survey location(s) where provided by the author(s) (if provided). These data were compiled into a host-parasite and parasite-host checklists, then used to calculate parasite species richness for each host. The number of studies obtained for each host was recorded as well.

Taxonomy issues

Several of the published accounts included invalid, revised, or synonymized parasite identifications. These were resolved using *WoRMS*: *World Register of Marine Species* (https://www.marinespecies.org/) for the sake of consistency. This was done by searching each host species to see the accepted species name if synonymous names were present. *WoRMS* was also used to extract taxonomic information (phylum, class, order, family, genus, and species) for all parasite taxa.

Analysis

Although the primary focus of this study is the host-parasite data, some basic analyses of the resulting dataset were conducted. To explore publication bias in the literature, parasite species richness was regressed against the number of studies retained for each host. ANOVA was used to test for differences in parasite species richness among host genus and family. These univariate analyses were conducted in JMP 15.2 (JMP®, Version *15.2* SAS Institute Inc., Cary, NC, 1989–2021.). To test for relative differences in parasite community composition among host species, families, and orders, pairwise Sorensen community similarity indices for all hosts were calculated in PRIMER-e 7.0.2 (www.primer-e.com), and used PERMANOVA to test for differences among species, families, and orders; Non-metric MultiDimensional Scaling (NMDS) was used to graphically explore these differences.

Table 2: List of surveyed host species, with common name per FishBase, along with the number of studies that provided parasitological information for that species. Each host species is also labeled as to whether they are exploited commercially or recreationally, and/or both (E=exploited, NE=non-exploited)

Family	Scientific name	Common name	# of studies	Importance
Acanthuridae	*Acanthurus bahianus*	Ocean surgeon	7	NE
Acanthuridae	*Acanthurus chirurgus*	Doctorfish	5	E
Balistidae	*Balistes capriscus*	Gray triggerfish	5	E
Belonidae	*Strongylura marina*	Atlantic needlefish	10	E
Carangidae	*Caranx crysos*	Blue runner	7	E
Carangidae	*Caranx hippos*	Crevalle jack	13	E
Carangidae	*Oligoplites saurus*	Leatherjack	11	E
Carangidae	*Selene vomer*	Lookdown	7	E
Carangidae	*Trachinotus falcatus*	Permit	3	E
Chaetodontidae	*Chaetodon sedentarius*	Reef butterflyfish	1	NE
Ephippidae	*Chaetodipterus faber*	Atlantic spadefish	10	E
Haemulidae	*Anisotremus surinamensis*	Black margate	1	NE
Haemulidae	*Anisotremus virginicus*	Porkfish	6	E
Haemulidae	*Haemulon aurolineatum*	Tomtate grunt	3	NE
Haemulidae	*Haemulon carbonarium*	Caesar grunt	1	NE
Haemulidae	*Haemulon flavolineatum*	French grunt	15	E
Haemulidae	*Haemulon parra*	Sailors choice	2	NE
Haemulidae	*Haemulon plumierii*	White grunt	2	E

Haemulidae	*Haemulon sciurus*	Bluestriped grunt	17	NE
Holocentridae	*Holocentrus rufus*	Longspine squirrelfish	1	E
Labridae	*Bodianus rufus*	Spanish hogfish	1	E
Labridae	*Clepticus parrae*	Creole wrasse	1	E
Labridae	*Halichoeres bivittatus*	Slippery dick	3	NE
Labridae	*Lachnolaimus maximus*	Hogfish	5	E
Labrisomidae	*Labrisomus nuchipinnis*	Hairy blenny	1	NE
Lutjanidae	*Lutjanus griseus*	Gray snapper	18	E
Lutjanidae	*Lutjanus synagris*	Lane snapper	15	E
Lutjanidae	*Ocyurus chrysurus*	Yellowtail snapper	8	E
Malacanthidae	*Malacanthus plumieri*	Sand tilefish	1	E
Mullidae	*Mulloidichthys martinicus*	Yellow goatfish	5	E
Mullidae	*Pseudupeneus maculatus*	Spotted goatfish	6	E
Pomacanthidae	*Holacanthus ciliaris*	Queen angelfish	2	E
Pomacentridae	*Abudefduf saxatilis*	Sergeant major	3	E
Scaridae	*Sparisoma viride*	Stoplight parrotfish	2	E
Scaridae	*Sparisoma aurofrenatum*	Redband parrotfish	1	E
Serranidae	*Cephalopholis cruentata*	Graysby	3	E
Serranidae	*Diplectrum formosum*	Sand perch	1	E
Serranidae	*Epinephelus morio*	Red grouper	16	E
Sparidae	*Calamus calamus*	Saucereye porgy	6	E
Sparidae	*Diplodus argenteus*	Silver porgy	2	E

Sparidae	*Lagodon rhomboides*	Pinfish	6	E
Synodontidae	*Synodus foetens*	Inshore Lizardfish	8	E
Tetradontidae	*Sphoeroides testudineus*	Checkered Puffer	5	NE

Results

A total of 151 published studies were obtained from the databases used for this study. Of these, 21 originated in Florida, while 130 were conducted in Atlantic regions adjacent to Florida including Mexico and Brazil. Not all studies conducted in Florida originated within the south Florida reef tract region, but rather within the Gulf of Mexico or Atlantic Ocean. Within the host-parasite checklists, "Locality" indicates the location in which host fish with those respective parasites were sampled. There were major differences in the number of studies available for each host species (Table 2; Figures 1-2, below). The 151 studies yielded presence-absence data for a total of 341 parasite taxa.

A total of 55 synonymous names were identified within the studies and resolved to their currently accepted name. One synonymy (*Helicometrina varia*) could not be resolved or found within WoRMS and was removed from the analysis. Furthermore, not all parasites were identified to species level: 5 of 341 parasites were identified only to family, and 52 of 341 only to genus; some other parasites were only identified by life stage (e.g., "metacercariae"). Two identifications were sufficiently suspect that they were excluded, as they were almost certainly incorrect: *Cucullanus cumanensis* from Tomtate *Haemulon aurolineatum* (Bashirullah & Diaz., 2015) and *Ascaris* sp. from Crevalle Jack *Caranx hippos* (Linton, 1905).

Analyses

Parasite species richness differed among hosts, ranging from 1-66 parasite taxa found within a host species (mean: 12.1±13.7), and was significantly positively correlated with the number of studies conducted on each host (linear regression; R^2=0.77, $F_{1,42}$=135.7, $p<0.001$; Figure 1). This positive relationship was even more pronounced when the analysis was repeated at the host family (linear regression; R^2=0.96, $F_{1,18}$=556.7, $p<0.001$; Figure 2) and host order levels (linear regression; R^2=0.98, $F_{1,9}$=1156.2, $p<0.001$). However, ANOVA failed to detect

significant differences in parasite species richness among host families or orders (ANOVA; R^2=0.66, $F_{20,42} \leq 1.417$, $p \geq 0.115$).

Given the strong publication bias revealed by these analyses, multivariate analyses were limited to a PERMANOVA test for parasite community compositional differences among host orders and host families; significant differences were detected for host family (pseudo-F=1.384, p=0.003; Figure 3) but not host order (pseudo-F=0.970, p=0.566). This was reflected in the ordination in Figure 3, which revealed clear clustering by family, indicating that host fishes from the same family had compositionally similar parasite communities.

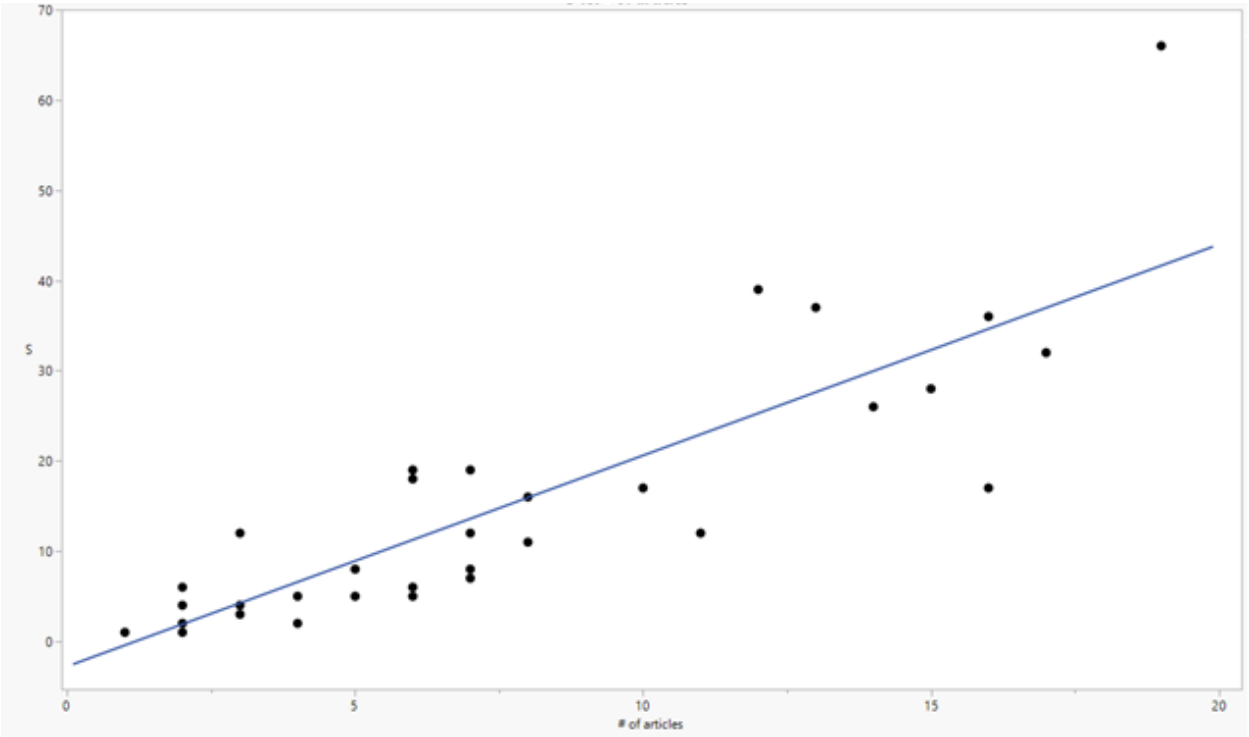

Figure 1. Scatterplot of parasite species richness (S) in each host against the number of articles available for that host, with the line of best fit indicating their significant positive relationship.

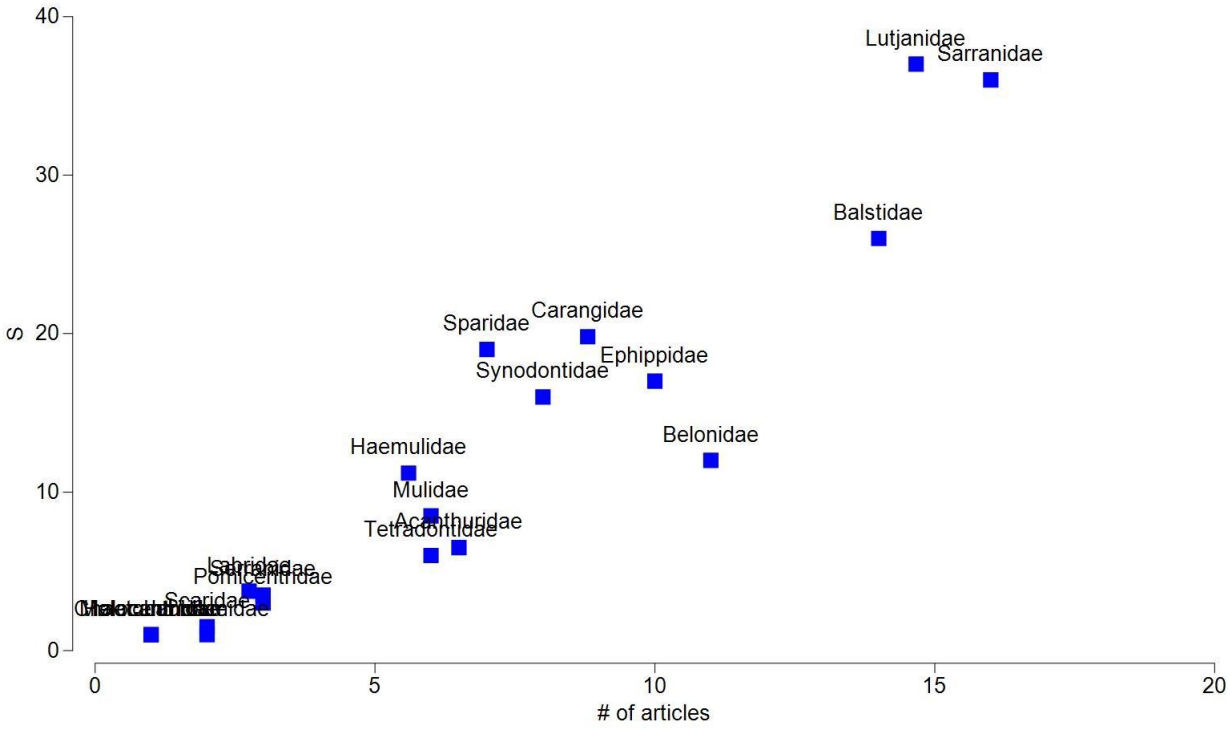

Figure 2. Scatterplot of parasite species richness (S) in each host family against the number of studies available for each family. The line indicating the positive relationship between these variables has been omitted for clarity.

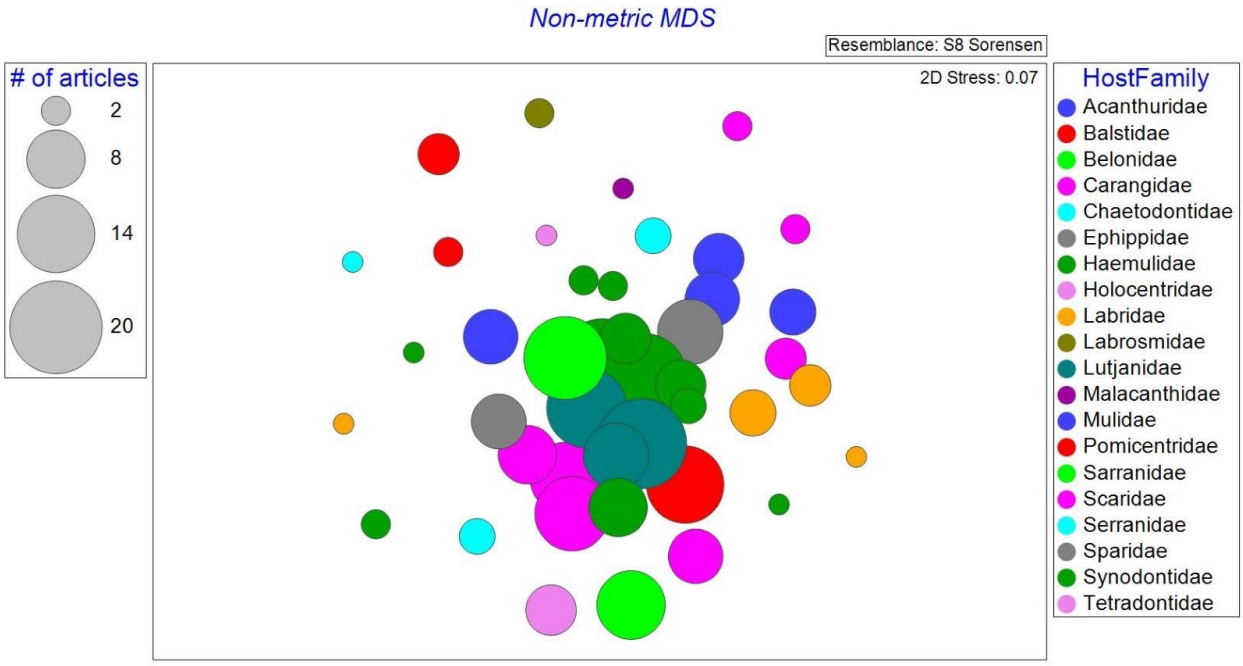

Figure 3. NMDS ordination of parasite community composition in relation to host family. Each bubble represents a host species; the size of the bubble is proportional to the number of studies available for that species, and its color indicates its taxonomic family. The distance among each pair of bubbles is inversely proportional to the (Sorensen) similarity of their parasite communities, i.e., bubbles that cluster together have compositionally similar parasite communities.

Host Parasite List: 43 host species found in the south Florida reef tract and their respective parasite taxa documented. Each parasite taxa are accompanied by the localities in which the hosts were sampled. The Localities are split into four subsections (South Florida Reef Tract, Gulf of Mexico, Caribbean Sea, and Atlantic Ocean) Accompanied by the exact locality in parentheses if noted. Few studies do not fit the four categories and are labeled in their Direct Locality and others are labeled just their locality as the exact location within that region was not available i.e. (Florida)

Host-Parasite List

Acanthuridae

Acanthurus bahianus

Common name: Ocean surgeon

Parasites:

Acanthocephala

Acanthogyrus acanthuri [102]

Locality: Caribbean Sea (Grand Cayman Island)

Arthropoda

Gnathia marleyi [32]

Locality: Caribbean Sea (U.S. Virgin Islands)

Trematoda

Hapladena varia [49]

Locality: Locality: Caribbean Sea (Belize)

Macradena perfecta[49]

Locality: Locality: Caribbean Sea (Belize)

Monorchimacradena-acanthuri[102]

Locality: Caribbean Sea (Grand Cayman Island)

Scaphanocephalus sp.[43]

Locality: Caribbean Sea (Saint Kitts West Indies)

Monogenea

Neobenedenia melleni [124]

Locality: Caribbean Sea

Acanthurus chirurgus

Common name: Doctorfish

Parasites:

Arthropoda

Anilocra acanthuri[150]

Locality: Caribbean Sea (Saint Kitts West Indies)

Monogenea

Neobenedenia melleni [124]

Locality: Caribbean Sea

Trematoda

Scaphanocephalus sp.[43]

Locality: Caribbean Sea (Saint Kitts West Indies)

Balistidae

Balistes capriscus

Common name: Gray triggerfish

Parasites:

Acanthocephala

Serrasentis sp.[5]

Locality: Atlantic Ocean (Brazil)

Arthropoda

Caligus ballistae[5]

Locality: Atlantic Ocean (Brazil)

Taeniacanthus ballistae[5]

Locality: Atlantic Ocean (Brazil)

Cestoda

Callitetrarhynchus gracilis[5]

Locality: Atlantic Ocean (Brazil)

Callitetrarhynchus sp.[5]

Locality: Atlantic Ocean (Brazil)

Callitetrarhynchus speciosus[5]

Locality: Atlantic Ocean (Brazil)

Nybelinia sp.[5]

Locality: Atlantic Ocean (Brazil)

Varelacreptotrema travassosi[5]

Locality: Atlantic Ocean (Brazil)

Nematoda

Contracaecum sp.[5]

Locality: Atlantic Ocean (Brazil)

Cucullanus brevicaudatus[113]

Locality: Atlantic Ocean (Brazil)

Dichelyne sp.[5]

Locality: Atlantic Ocean (Brazil)

Raphidascaris (Ichthyascaris) sp.[5]

Locality: Atlantic Ocean (Brazil)

Terranova sp.[5]

Locality: Atlantic Ocean (Brazil)

Trematoda

Aponurus laguncula[5]

Locality: Atlantic Ocean (Brazil)

Gonocercella sp.[5]

Locality: Atlantic Ocean (Brazil)

Homalometron annahoineffae[5]

Locality: Atlantic Ocean (Brazil)

Homalometron cryptum[106]

Locality: South Florida Reef Tract

Hypocreadium biminense[5]

Locality: Atlantic Ocean (Brazil)

Neoapocreadium coili[106]

Locality: South Florida Reef Tract

Opechona sp.[5]

Locality: Atlantic Ocean (Brazil)

Stephanostomum sp.[5]

Locality: Atlantic Ocean (Brazil)

Xystretrum pulchrum[5]

Locality: Atlantic Ocean (Brazil)

Xystretrum solidum[106]

Locality: South Florida Reef Tract

Belonidae

Strongylura marina

Common name: Atlantic needlefish

Parasites:

Acanthocephala

Pomphorhynchus lucyi[151]

Locality: Gulf of Mexico

Annelida

Cystobranchus vividus[121]

Locality: Gulf of Mexico

Arthropoda

Acusicola rogeri[39]

Locality: Caribbean Sea (Guatemala)

Mothocya xenobranchia[58]

Locality: Caribbean Sea

Monogenea

Ancyrocephalus cornutus[147]

Locality: Gulf of Mexico (Mexico), Gulf of Mexico (Florida)

Ancyrocephalus parvus[147]

Locality: Gulf of Mexico (Florida)

Nudaciraxine gracilis[76]

Locality: Massachusetts, USA

Nematoda

Philometra sp.[88]

Locality: Gulf of Mexico (Florida)

Trematoda

Prosorhynchoides strongylurae[62]

Locality: USA

Rhipidocotyle lintoni[62]

Locality: USA

Rhipidocotyle transversale[62]

Locality: USA

Schikhobalotrema acutum[67]

Locality: Atlantic Ocean (Brazil)

Carangidae

Oligoplites saurus

Common name: Leatherjack

Parasites:

Acanthocephala

Dollfusentis chandleri[1]

Locality: Gulf of Mexico (Mexico)

Neoechinorhynchus brentnickoli[119]

Locality: Gulf of Mexico (Mexico)

Rhadinorhynchus sp.[119]

Locality: Gulf of Mexico (Mexico)

Southwellina hispida[119]

Locality: Gulf of Mexico (Mexico)

Arthropoda

Argulus sp.[57]

Locality: Florida

Caligus sp.[57]

Locality: Florida

Caligus bonito bonito[133]

Locality: Atlantic Ocean (Brazil)

Caligus mutabilis[119]
Locality: Gulf of Mexico (Mexico)
Caligus robustus[132,133]
Locality: Atlantic Ocean (Brazil)
Cymothoa spinipalpa[135]
Locality: Atlantic Ocean (Brazil)
Lernanthropus giganteus[119]
Locality: Gulf of Mexico (Mexico)
Tuxophorus caligodes[132]
Locality: Atlantic Ocean (Brazil)

Cestoda

Callitetrarhynchus gracilis[133]
Locality: Atlantic Ocean (Brazil)
Pterobothrium crassicolle larvae[148]
Locality: Atlantic Ocean
Tetraphyllidea incertae sedis[119]
Locality: Atlantic Ocean (Brazil)

Monogenea

Ahpua piscicola[119]
Locality: Gulf of Mexico (Mexico)
Cichlidogyrus bychowskii[119]
Locality: Gulf of Mexico (Mexico)
Hargicola oligoplites[119,133]
Locality: Atlantic Ocean (Brazil), Mexico
Metacamopia oligoplites[134]
Locality: Atlantic Ocean (Brazil)
Probursata brasiliensis[133]
Locality: Atlantic Ocean (Brazil)
Probursata veraecrucis[1,119]
Locality: Gulf of Mexico (Mexico)

Nematoda

Capillaria sp.[1]
Locality: Gulf of Mexico (Mexico)
Contracaecum sp.[1, 119,133]
Locality: Atlantic Ocean (Brazil), Gulf of Mexico (Mexico)
Goezia sp. *Larvae*[1]
Locality: Gulf of Mexico (Mexico)
Hysterothylacium fortalezae[1]
Locality: Gulf of Mexico (Mexico)
Philometra sp.[1]
Locality: Gulf of Mexico (Mexico)
Procamallanus sp.[119]
Locality: Gulf of Mexico (Mexico)
Pseudoterranova sp.[1]
Locality: Gulf of Mexico (Mexico)

Trematoda

Bucephalus margaritae[133]
Locality: Atlantic Ocean (Brazil)
Ectenurus virgula[119]
Locality: Gulf of Mexico (Mexico)
Lecithochirium microstomum[106]
Locality: Atlantic Ocean (Brazil), Florida Coast
Manteria brachyderus[1,106,128,119]
Locality: Atlantic Ocean (Brazil), Florida Coast, Gulf of Mexico (Mexico)
Mecoderus oligoplitis[119]
Locality: Gulf of Mexico (Mexico)
Metadena sp.[119]
Locality: Gulf of Mexico (Mexico)
Metanematobothrium spinneri[119]
Locality: Gulf of Mexico (Mexico)
Parahemiurus merus[134]
Locality: Atlantic Ocean (Brazil)
Pseudoacanthostomum panamense[119]
Locality: Gulf of Mexico (Mexico)
Theledera pectinate [134]
Locality: Atlantic Ocean (Brazil)

Caranx crysos

Common name: Blue runner

Parasites:

Arthropoda

Cymothoa spinipalpa[40]
Locality: Atlantic Ocean (Brazil)
Tuxophorus caligodes[106,110]
Locality: South Florida Reef Tract, Gulf of Mexico (Florida)
Rocinela signata[40]
Locality: Atlantic Ocean (Brazil)

Trematoda

Alcicornis carangis[45]
Locality: Caribbean Sea (Puerto Rico)
Brachyphallus parvus[106]
Locality: South Florida Reef Tract
Bucephalus margaritae[106]
Locality: South Florida Reef Tract
Ectenurus virgula[106]
Locality: South Florida Reef Tract
Parahemiurus merus[106]
Locality: South Florida Reef Tract
Stephanostomum ditrematis[106]
Locality: South Florida Reef Tract
Theledera pectinata[106,128]
Locality: South Florida Reef Tract ,Gulf of Mexico (Florida)

Caranx hippos

Common name: Crevalle jack

Parasites:

Arthropoda

Acantholochus crevalleus[36]

Locality: Gulf of Mexico (Florida)

Caligus robustus[77]

Locality: Atlantic Ocean (Brazil)

Caligus tenax[111]

Locality: Caribbean Sea (Bahamas)

Lernanthropus giganteus[77]

Locality: Atlantic Ocean (Brazil)

Lernaeolophus striatus[2]

Locality: Caribbean Sea (Columbia)

Cestoda

Callitetrarhynchus gracilis[77]

Locality: Atlantic Ocean (Brazil)

Nybelinia sp.[77]

Locality: Atlantic Ocean (Brazil)

Monogenea

Abortipedia indica[73]

Locality: South Florida Reef Tract

Ahpua piscicola[73]

Locality: South Florida Reef Tract

Allopyragraphorus hippos[73,77]

Locality: South Florida Reef Tract, Atlantic Ocean (Brazil)

Allopyragraphorus incomparabilis[73]

Locality: South Florida Reef Tract

Allopyragraphorus sp.[77]

Locality: Atlantic Ocean (Brazil)

Allopyragraphorus winteri[73]

Locality: South Florida Reef Tract

Cemocotyle carangis[73]

Locality: South Florida Reef Tract

Cemocotyle noveboracensis[14,73,77]

Locality: South Florida Reef Tract Coast, Atlantic Ocean (Brazil), Gulf of Mexico (Mexico)

Cemocotylella elongata[73,77]

Locality: South Florida Reef Tract, Atlantic Ocean (Brazil)

Dionchus remorae[73]

Locality: South Florida Reef Tract

Neomicrocotyle pacifica[64]

Locality: Gulf of Mexico (Mexico)

Protomicrocotyle ivoriensis[73]

Locality: South Florida Reef Tract

Protomicrocotyle manteri[73]

Locality: South Florida Reef Tract

Protomicrocotyle mirabilis[73,77]

Locality: South Florida Reef Tract, Atlantic Ocean (Brazil)

Pseudomazocraes selene[73]

Locality: South Florida Reef Tract

Nematoda

Caranginema americanum[88]

Locality: Gulf of Mexico (Florida)

Contracaecum sp.[77]

Locality: Atlantic Ocean (Brazil)

Philometra sp.[77]

Locality: Atlantic Ocean (Brazil)

Philometroides grandipapillotus[87]

Locality: South Florida Reef Tract

Pseudoterranova sp.[77]

Locality: Atlantic Ocean (Brazil)

Raphidascaris (Ichthyascaris) sp.[77]

Locality: Atlantic Ocean (Brazil)

Trematoda

Bucephalus margaritae[15,77,106]

Locality: Gulf of Mexico (Mexico), Florida, Atlantic Ocean (Brazil)

Ectenurus virgula[106]

Locality: South Florida Reef Tract

Lecithochirium monticellii[76]

Locality: Massachusetts

Lecithochirium musculus[106]

Locality: South Florida Reef Tract

Lecithochirium microstomum[77]

Locality: Atlantic Ocean (Brazil)

Manteria brachyderus[77]

Locality: Atlantic Ocean (Brazil)

Parahemiurus merus[106]

Locality: South Florida Reef Tract

Stephanostomum ditrematis[106,128]

Locality: South Florida Reef Tract, Gulf of Mexico (Florida)

Stephanostomum ghanense[77]

Locality: Atlantic Ocean (Brazil)

Stephanostomum megacephalum[106]

Locality: South Florida Reef Tract

Selene vomer

Common name: Lookdown

Parasites:

Acanthocephala

Gorgorhynchoides bullocki[86]

Locality: Gulf of Mexico (Mexico)

Arthropoda

Excorallana tricornis[145]

Locality: Caribbean Sea (Columbia)

Metacaligus rufus[44]

Locality: Atlantic Ocean (Brazil)

Monogenea

Pseudomazocraes selene[68]

Locality: Atlantic Ocean (Brazil)

Trematoda

Hurleytrema shorti[106]

Locality: South Florida Reef Tract

Theledera sp.[106]

Locality: South Florida Reef Tract

Trachinotus falcatus

Common name: Permit

Parasites:

Trematoda

Cotylogaster basiri[59]

Locality: Gulf of Mexico

Helicometrina executa[106]

Locality: South Florida Reef Tract

Parahurleytrema pyriforme[106]

Locality: South Florida Reef Tract

Stephanostomum tenue[106]

Locality: South Florida Reef Tract

Chaetodontidae

Chaetodon sedentarius

Common name: Reef butterflyfish

Parasites:

Arthropoda

Anilocra chaetodontis[48]

Locality: Caribbean Sea (Cuba)

Ephippidae

Chaetodipterus faber

Common name: Atlantic spadefish

Parasites:

Arthropoda

Anuretes heckelii[28]

Locality: Atlantic Ocean (Brazil)

Caligus haemulonis[12,28]

Locality: Gulf of Mexico, Atlantic Ocean (Brazil)

Caligus mutabilis[28]

Locality: Atlantic Ocean (Brazil)

Lernanthropus pupa[12,28]

Locality: Gulf of Mexico, Atlantic Ocean (Brazil)

Monogenea

Parancyclodiscoides sp.[28]

Locality: Atlantic Ocean (Brazil)

Parancylodiscoides longiphallus [12,29,72,127]

Locality: Atlantic Ocean (Brazil), Gulf of Mexico

Sprostoniella micrancyra[29]

Locality: Atlantic Ocean (Brazil)

Sprostoniella sp.[28]

Locality: Atlantic Ocean (Brazil)

Nematoda

Goezia pelagia[41]

Locality: Gulf of Mexico

Trematoda

Aponurus laguncula[106]

Locality: South Florida Reef Tract

Lecithocladium chaetodipteris[28]

Locality: Atlantic Ocean (Brazil)

Multitestis inconstans [28,106,112]

Locality: Atlantic Ocean (Brazil), Florida Coast

Multitestoides brasiliensis[28]

Locality: Atlantic Ocean (Brazil)

Prosogonotrema bilabiatum[28]

Locality: Atlantic Ocean (Brazil)

Vitellibaculum spinosum[106]

Locality: South Florida Reef Tract

Haemulidae

Anisotremus surinamensis

Common name: Black margate

Parasites:

Trematoda

Genolopa minuscula[109]

Locality: Florida

Haemulon sciurus

Common name: Bluestriped Grunt

Parasites:

Acanthocephala

Dollfusentis chandleri[69]

Locality: Atlantic Ocean (Brazil)

Arthropoda

Caligus haemulonis[131]

Locality: Caribbean Sea

Gnathia marleyi[32]

Locality: Caribbean Sea (Virgin Islands)

Hatschekia linearis[111]

Locality: Caribbean Sea (Bahamas)

Hatschekia sp.[131]
Locality: Caribbean Sea
Lernanthropus chacchi[131]
Locality: Caribbean Sea
Parashiinoa bakeri[38]
Locality: Caribbean Sea (Panama)
Pseudoeucanthus uniseriatus[36]
Locality: Gulf of Mexico (Florida)

Monogenea

Benedenia sp.[34]
Locality: Bermuda
Haliotrematoides striatohamus[85]
Locality: Gulf of Mexico (Mexico)

Trematoda

Alloinfundibuirctus beauforti[49,70]
Locality: Locality: Caribbean Sea (Belize), Atlantic Ocean (Rio de Janeiro)
Alloinfundibuirctus haemuli[106]
Locality: South Florida Reef Tract
Alloinfundibuirctus sparisomae[49]
Locality: Locality: Caribbean Sea (Belize)
Aponurus pyriformis[46, 70]
Locality: Atlantic Ocean (Rio de Janeiro)
Cainocreadium consuetum[49]
Locality: Locality: Caribbean Sea (Belize)
Cainocreadium oscitans[102]
Locality: Caribbean Sea (Cayman Islands)
Didymozoidae sp.[49]
Locality: Locality: Caribbean Sea (Belize)
Diphterostomum brusinae[106]
Locality: South Florida Reef Tract
Diplangus parvus[106]
Locality: South Florida Reef Tract
Diplangus paxillus [70,106]
Locality: South Florida Reef Tract, Atlantic Ocean (Rio de Janeiro)
Diplomonorchis leiostomi[70]
Locality: Atlantic Ocean (Rio de Janeiro)
Genolopa ampulacea [70,106,109]
Locality: South Florida Reef Tract, Florida Atlantic Ocean (Rio de Janeiro)
Genolopa vesca[109]
Locality: Florida
Helicometrina nimia[115]
Locality: Atlantic Ocean (Brazil)
Infundibulostomum spinatum[106]

Locality: South Florida Reef Tract

Infundibirictus longovatus[106]

Locality: South Florida Reef Tract

Infundibirictus truncates[49,106]

Locality: South Florida Reef Tract, Atlantic Ocean (Belize)

Parahemiurus merus[70]

Locality: Atlantic Ocean (Rio de Janeiro)

Postmonorchis orthopristis[49,106]

Locality: South Florida Reef Tract, Atlantic Ocean (Belize)

Stephanostomum sentum[102]

Locality: Caribbean Sea (Cayman Islands)

Haemulon carbonarium

Common name: Caesar grunt

Parasites:

Trematoda

Aponurus pyriformis[106]

Locality: South Florida Reef Tract

Diplangus parvus[106]

Locality: South Florida Reef Tract

Diplangus paxillus[106]

Locality: South Florida Reef Tract

Homalometron foliatum[106]

Locality: South Florida Reef Tract

Stephanostomum sentum[106]

Locality: South Florida Reef Tract

Haemulon flavolineatum

Common name: French grunt

Parasites:

Arthropoda

Anilocra Haemuli [42,141,142,143]

Locality: Caribbean Sea (Virgin islands)

Gnathia marleyi[32,42,63]

Locality: Caribbean Sea (Virgin Islands)

Monogenea

Choricotyle hysteroncha[53]

Locality: South Florida Reef Tract

Haliotrema sp.[120]

Locality: Caribbean Sea (Virgin Islands)

Trematoda

Alloinfundibirictus asymmetricus[49]

Locality: Locality: Caribbean Sea (Belize)

Aponurus pyriformis[102]

Locality: Caribbean Sea (Cayman Islands)

Brachyphallus parvus[106]

Locality: South Florida Reef Tract

Diplangus parvus[79]

Locality: South Florida Reef Tract

Diplangus paxillus[79]

Locality: South Florida Reef Tract

Genitocotyle atlantica[79]

Locality: South Florida Reef Tract

Genolopa ampullacea [78,79,106]

Locality: South Florida Reef Tract

Homalometron dowgialloi[102]

Locality: Caribbean Sea (Saint Kitts West Indies)

Infundiburictus truncates [78,79,106]

Locality: South Florida Reef Tract

Leurodera decora[79]

Locality: South Florida Reef Tract

Paralasiotocus parvus [78,79]

Locality: South Florida Reef Tract

Postmonorchis orthopristis[79]

Locality: South Florida Reef Tract

Siphodera vinaledwardsii [107]

Locality: Caribbean Sea

Anisotremus virginicus

Common name: Porkfish

Parasites:

Arthropoda

Excorallana tricornis[146]

Locality: Caribbean Sea (Columbia)

Lernathropus amplitergum[111]

Locality: Caribbean Sea (Bahamas)

Trematoda

Alloinfundiburictus longicaecum [78,79,106]

Locality: South Florida Reef Tract

Aponurus pyriformis[79,106]

Locality: South Florida Reef Tract

Cainocreadium oscitans[79,106]

Locality: South Florida Reef Tract

Diphterostomum brusinae[106]

Locality: South Florida Reef Tract

Diplangus parvus[106]

Locality: South Florida Reef Tract

Diplangus paxillus[79,106]

Locality: South Florida Reef Tract

Genolopa ampullacea[106]

Locality: South Florida Reef Tract

Hamacreadium mutabile[79]

Locality: South Florida Reef Tract

Helicometrina executa[106]

Locality: South Florida Reef Tract

Homalometron cryptum[79,106]
Locality: South Florida Reef Tract
Homalometron foliatum[45]
Locality: Caribbean Sea (Puerto Rico)
Infundibuirctus longovatus[106]
Locality: South Florida Reef Tract
Lecithochirium musculus[106]
Locality: South Florida Reef Tract
Leurodera decora[79]
Locality: South Florida Reef Tract
Monorchis latus [78,79]
Locality: South Florida Reef Tract
Postmonorchis orthopristis[106]
Locality: South Florida Reef Tract

Haemulon parra
Common name: Sailors choice
Parasites:
Trematoda
Aponurus pyriformis[79]
Locality: South Florida Reef Tract
Diplangus miolecithus[79]
Locality: South Florida Reef Tract
Leurodera decora[79]
Locality: South Florida Reef Tract

Haemulon aurolineatum
Common name: Tomtate grunt
Parasites:
Cestoda
Callitetrarhynchus gracilis[108]
Locality: Atlantic Ocean (Brazil)
Monogenea
Choricotyle aspinachorda[10]
Locality: Caribbean Sea (Venezuela)
Haliotrema sp.[10]
Locality: Caribbean Sea (Venezuela)
Nematoda
Philometra haemulontis[98]
Locality: Gulf of Mexico (Florida)
Trematoda
Aponurus pyriformis[10]
Locality: Caribbean Sea (Venezuela)
Diplangus paxillus[10]
Locality: Caribbean Sea (Venezuela)
Genolopa ampullacea[10]

Locality: Caribbean Sea (Venezuela)

Hemiuridae sp.[10]

Locality: Caribbean Sea (Venezuela)

Homalometron foliatum[10]

Locality: Caribbean Sea (Venezuela)

Infundibuirctus longovatus[10]

Locality: Caribbean Sea (Venezuela)

Prolecithochirium sp.[10]

Locality: Caribbean Sea (Venezuela)

Haemulon plumierii

Common name: White grunt

Parasites:

Arthropoda

Caligus Haemulonis[131]

Locality: Gulf of Mexico (Mexico)

Gnatthid sp.[131]

Locality: Gulf of Mexico (Mexico)

Hatschekia sp.[131]

Locality: Gulf of Mexico (Mexico)

Lernanthropus chacchi[131]

Locality: Gulf of Mexico (Mexico)

Nematoda

Philometra haemulontis[98]

Locality: Gulf of Mexico (Florida)

Holocentridae

Holocentrus rufus

Common name: Longspine squirrelfish

Parasites:

Arthropoda

Gnatthid sp.[125]

Locality: Gulf of Mexico (Mexico)

Labridae

Lachnolaimus maximus

Common name: Hogfish

Parasites:

Annelida

Trachelobdella lubrica[144]

Locality: Caribbean Sea (Puerto Rico)

Arthropoda

Hatschekia parva[111]

Locality: Caribbean Sea (Bahamas)

Nerocila benrosei[21]

Locality: Caribbean Sea (Bahamas)

Trematoda

Helicometrina nimia[103]
Locality: Caribbean Sea (Jamaica)
Helicometrina execta[79]
Locality: South Florida Reef Tract
Lepocreadium bimarinum[79]
Locality: South Florida Reef Tract
Megalomyzon robustum[79]
Locality: South Florida Reef Tract
Myzoxenus lachnolaimi[79]
Locality: South Florida Reef Tract

Clepticus parrae
Common name: Creole wrasse
Parasites:
Arthropoda
Belizia brevicauda[35]
Locality: Caribbean Sea

Halichoeres bivittatus
Common name: Slippery dick
Parasites:
Acanthocephala
Acanthocephaloides spinicaudatus[22]
Locality: Caribbean Sea (Puerto Rico)
Nematoda
Hysterothylacium reliquens[104]
Locality: Gulf of Mexico
Trematoda
Helicometrina execta[106]
Locality: South Florida Reef Tract
Nicolla halichoeri[106]
Locality: South Florida Reef Tract

Bodianus rufus
Common name: Spanish hogfish
Parasites:
Arthropoda
Nerocila benrosei[21]
Locality: Caribbean Sea (Bahamas)

Labrisomidae
Labrisomus nuchipinnis
Common name: Hairy blenny
Parasites:
Acanthocephala
Dollfusentis heteracanthus[23]
Locality: Caribbean Sea (Jamaica)

Lutjanidae
Lutjanus synagris
Common name: Lane snapper

Parasites:

Arthropoda

Cymothoa excisa[145]

Locality: Caribbean Sea (Columbia)

Cymothoa spinipalpa[40]

Locality: Atlantic Ocean (Brazil)

Gnatthid sp.[140]

Locality: Caribbean Sea (Virgin Islands)

Gnathia marleyi[32]

Locality: Caribbean Sea (Virgin Islands)

Monogenea

Euryhaliotrema longibaculum[83]

Locality: Gulf of Mexico

Euryhaliotrema tubocirrus[83]

Locality: Gulf of Mexico

Haliotrematoides cornigerum[83]

Locality: Gulf of Mexico

Haliotrematoides heteracantha[83]

Locality: Gulf of Mexico

Haliotrematoides longihamus[83]

Locality: Gulf of Mexico

Haliotrematoides magnigastrohamus[83]

Locality: Gulf of Mexico

Nematoda

Anisakis sp.[3]

Locality: Atlantic Ocean (Brazil)

Raphidascaris (Ichthyascaris) sp.[3]

Locality: Atlantic Ocean (Brazil)

Philometra synagridis[89,140]

Locality: Gulf of Mexico (Florida), Gulf of Mexico

Terranova sp.[60]

Locality: Gulf of Mexico

Trematoda

Brachyphallus parvum[106]

Locality: South Florida Reef Tract

Ectenurus virgula[49]

Locality: Locality: Caribbean Sea (Belize)

Hamacreadium mutabile[49,106]

Locality: South Florida Reef Tract

Lecithochirium microstomum[106]

Locality: South Florida Reef Tract

Lecithochirium musculus[49]

Locality: Locality: Caribbean Sea (Belize)

Metadena adglobosa[49]

Locality: Locality: Caribbean Sea (Belize),

Siphodera vinaledwardsii[49,106]

Locality: Caribbean Sea (Virgin Islands), Florida Coast

Siphoderina americanus[47]

Locality: Locality: Caribbean Sea (Belize)

Stegopa globosa[49,51,106]

Locality: South Florida Reef Tract, Caribbean Sea (Belize), Caribbean Sea

Stephanostomum casum[49,106]

Locality: South Florida Reef Tract, Caribbean Sea (Belize)

Cestoda

Floriceps sp.[4]

Locality: Atlantic Ocean (Brazil)

Oncomegas sp.[4]

Locality: Atlantic Ocean (Brazil)

Pseudogrillotia sp.[4]

Locality: Atlantic Ocean (Brazil)

Lutjanus griseus

Common name: Gray snapper

Parasites:

Acanthocephala

Dollfusentis chandleri[8]

Locality: Gulf of Mexico

Dollfusentis sp.[8]

Locality: Gulf of Mexico

Gorgorhynchoides bullock [8,86]

Locality: Gulf of Mexico, Gulf of Mexico (Mexico)

Gorgorhynchus medius[8]

Locality: Gulf of Mexico

Serrasentis sp.[8]

Locality: Gulf of Mexico

Arthropoda

Argulus sp.[52]

Locality: Caribbean Sea (Venezuela)

Caligus bonito bonito[52]

Locality: Caribbean Sea (Venezuela)

Cymothoa excisa[149]

Locality: Caribbean Sea (Venezuela)

Lernanthropus rathbuni[52]

Locality: Caribbean Sea (Venezuela)

Raninoides lamarcki[145]

Locality: Caribbean Sea (Puerto Rico)

Cestoda

Callitetrarhynchus gracilis[8]

Locality: Gulf of Mexico

Tetrarhynchus sp.[8]

Locality: Gulf of Mexico

Monogenea

Ancyrocephalus sp.[126]
Locality: South Florida Reef Tract
Euryhaliotrema fajeravilae[83]
Locality: Gulf of Mexico
Euryhaliotrema fastigatum[83]
Locality: Gulf of Mexico
Euryhaliotrema longibaculum[83]
Locality: Gulf of Mexico
Euryhaliotrema paracanthi[83]
Locality: Gulf of Mexico
Euryhaliotrema sp.[52]
Locality: Caribbean Sea (Venezuela)
Euryhaliotrema tubocirrus[83]
Locality: Gulf of Mexico
Haliotrematoides gracilihamus[83]
Locality: Gulf of Mexico
Haliotrematoides heteracantha[83]
Locality: Gulf of Mexico

Nematoda

Acuariidae sp.[60]
Locality: Gulf of Mexico
Anisakis pegreffii[8]
Locality: Gulf of Mexico
Capillaria sp.[8]
Locality: Gulf of Mexico
Contracaecum sp.[60]
Locality: Gulf of Mexico
Cucullanus palmeri[8]
Locality: Gulf of Mexico
Cucullanus pargi [8,56,60]
Locality: Gulf of Mexico, Gulf of Mexico (Mexico)
Dentiphilometra lutjanid [54,56]
Locality: Gulf of Mexico (Mexico)
Dichelyne bonaci [8,55,60]
Locality: Gulf of Mexico
Dichelyne lintoni[8]
Locality: Gulf of Mexico
Echinocephalus sp.[60]
Locality: Gulf of Mexico
Hysterothylacium sp.[60]
Locality: Gulf of Mexico
Philometra brevispicula[87]
Locality: South Florida Reef Tract
Philometra latispicula[89]
Locality: Gulf of Mexico (Florida)
Philometra sp. [8,60]

Locality: Gulf of Mexico

Procamallanus sp.[60]

Locality: Gulf of Mexico

Spirocamallanus cricotus[8]

Locality: Gulf of Mexico

Terranova sp.[60]

Locality: Gulf of Mexico

Trematoda

Brachyphallus parvus[8]

Locality: Gulf of Mexico

Cainocreadium gulella[8]

Locality: Gulf of Mexico

Cainocreadium lintoni[8]

Locality: Gulf of Mexico

Cardicola euzeti[18]

Locality: Gulf of Mexico

Dollfustrema sp.[8]

Locality: Gulf of Mexico

Gonacanthella lutjani[8]

Locality: Gulf of Mexico

Hamacreadium mutabile [8,106]

Locality: South Florida Reef Tract, Gulf of Mexico

Helicometrina execta[8]

Locality: Gulf of Mexico

Helicometrina nimia [8,115]

Locality: Atlantic Ocean (Brazil), Gulf of Mexico

Helicometra torta[8]

Locality: Gulf of Mexico

Hemiuridae sp.[8]

Locality: Gulf of Mexico

Hypocreadium biminense[8]

Locality: Gulf of Mexico

Lecithochirium microstomum[8]

Locality: Gulf of Mexico

Lecithochirium monticellii[8]

Locality: Gulf of Mexico

Lecithochirium musculus[8]

Locality: Gulf of Mexico

Leurodera decora[8]

Locality: Gulf of Mexico

Metadena adglobosa [8,106]

Locality: South Florida Reef Tract, Gulf of Mexico

Metadena obscura[8]

Locality: Gulf of Mexico

Metadena sp.[106]

Locality: South Florida Reef Tract

Neoprosorhynchus sp.[8]
Locality: Gulf of Mexico
Preptetos trulla[8]
Locality: Gulf of Mexico
Siphodera vinaledwardsii [8,52]
Locality: Gulf of Mexico, Caribbean Sea (Venezuela)
Siphoderina americanus[8]
Locality: Gulf of Mexico
Stegopa globose [8,106]
Locality: South Florida Reef Tract, Gulf of Mexico
Stephanostomum casum [8,106]
Locality: South Florida Reef Tract, Gulf of Mexico

Ocyurus chrysurus

Common name: Yellowtail snapper

Parasites:

Arthropoda

Hatschekia oblonga[33]
Locality: South Florida Reef Tract

Monogenea

Euryhaliotrema torquecirrus[71]
Locality: Gulf of Mexico

Nematoda

Anisakis sp.[3]
Locality: Atlantic Ocean (Brazil)
Raphidascaris (Ichthyascaris) sp.[3]
Locality: Atlantic Ocean (Brazil)
Terranova sp.[3,60]
Locality: Atlantic Ocean (Brazil), Gulf of Mexico

Trematoda

Deretrema fusillus[79]
Locality: South Florida Reef Tract
Hamacreadium mutabile[79]
Locality: South Florida Reef Tract
Helicometrina nimia [3,79,106,115]
Locality: Atlantic Ocean (Brazil), Florida
Lepocreadium trulla[79,106]
Locality: South Florida Reef Tract
Parahemiurus merus[79]
Locality: South Florida Reef Tract
Paramanteriella confusum[106]
Locality: South Florida Reef Tract
Siphodera vinaledwardsii[79]
Locality: South Florida Reef Tract
Siphoderina americana[106]
Locality: South Florida Reef Tract
Stegopa globose [51,106]

Locality: South Florida Reef Tract, Caribbean Sea

Stephanostomum casum[79,106]

Locality: South Florida Reef Tract

Stephanostomum interruptum[129]

Locality: Gulf of Mexico

Malacanthidae

Malacanthus plumieri

Common name: Sand tilefish

Parasites:

Trematoda

Cainocreadium oscitans[116]

Locality: Caribbean Sea (Puerto Rico)

Mullidae

Mulloidichthys martinicus

Common name: Yellow goatfish

Parasites:

Acanthocephala

Dollfusentis ctenorhynchus[102]

Locality: Caribbean Sea (Saint Kitts West Indies)

Trematoda

Hirudinella ventricose[24]

Locality: Gulf of Mexico

Opecoeloides brachyteleus[79]

Locality: South Florida Reef Tract

Scaphanocephalus expansus[66]

Locality: Caribbean Sea

Pseudopeneus maculatus

Common name: Spotted goatfish

Parasites:

Arthropoda

Caligidae sp.[27]

Locality: Atlantic Ocean (Brazil)

Hamaticolax scutigerulus [26,27,37]

Locality: Atlantic Ocean (Brazil)

Rocinela signata [25,27]

Locality: Atlantic Ocean (Brazil)

Cestoda

Mixonybelinia edwinlintoni[108]

Locality: Atlantic Ocean (Brazil)

Nybelinia indica[27,108]

Locality: Atlantic Ocean (Brazil)

Nybelinia lingualis[108]

Locality: Atlantic Ocean (Brazil)

Pseudolacistorhynchus noodti[27,108]

Locality: Atlantic Ocean (Brazil)

Pseudotobothrium dipsacum[108]

Locality: Atlantic Ocean (Brazil)

Monogenea

Haliotrema caballeroi[27]

Locality: Atlantic Ocean (Brazil)

Haliotrema caraibense[27]

Locality: Atlantic Ocean (Brazil)

Haliotrema golvani[27]

Locality: Atlantic Ocean (Brazil)

Pomacanthidae

Holacanthus ciliaris

Common name: Queen angelfish

Parasites:

Trematoda

Antorchis urna[79]

Locality: South Florida Reef Tract

Megasolena mikra[7]

Locality: Florida

Pleurogonius candidulus[79]

Locality: South Florida Reef Tract

Pyelosomum erubescens[79]

Locality: South Florida Reef Tract

Pomacentridae

Abudefduf saxatilis

Common name: Sergeant major

Parasites:

Arthropoda

Anilocra abudefdufi[147,150]

Locality: Caribbean Sea (Saint Kitts West Indies), Gulf of Mexico (Florida)

Kuna insularis[148]

Locality: Caribbean Sea (Saint Kitts West Indies)

Scaridae

Sparisoma aurofrenatum

Common name: Redband parrotfish

Parasites:

Trematoda

Scaphanocephalus expansus[47]

Locality: Caribbean Sea

Sparisoma viride

Common name: Stoplight parrotfish

Parasites:

Arthropoda

Chondracanthus wilsoni[61]

Locality: Eastern North America

Trematoda

Primisanguis caribbeanensis[19]
Locality: Caribbean Sea

Serranidae

Cephalopholis cruentata
Common name: Graysby
Parasites:

Arthropoda
Gnatthid sp.[123]
Locality: Atlantic Ocean
Monogenea
Neobenedenia sp.[123]
Locality: Atlantic Ocean
Pseudorhabdosynochus meganmarieae[74]
Locality: Atlantic Ocean
Scaphanocephalus sp.[66]
Locality: Caribbean Sea

Diplectrum formosum
Common name: Sand perch
Parasites:
Nematoda
Philometra diplectri[100]
Locality: Gulf of Mexico

Epinephelus morio
Common name: Red grouper
Parasites:
Acanthocephala
Gorgorhynchus clavatus [93,94,139]
Locality: Gulf of Mexico (Mexico)
Arthropoda
Hatschekia insolita[139]
Locality: Gulf of Mexico (Mexico)
Cestoda
Callitetrarhynchus sp.[139]
Locality: Gulf of Mexico (Mexico)
Callitetrarhynchus sp *larvae*[94]
Locality: Gulf of Mexico (Mexico)
Eutetrarhynchus sp *larvae*[94]
Locality: Gulf of Mexico (Mexico)
Tetraphyliddea sp.[139]
Locality: Gulf of Mexico (Mexico)
Tylocephalum sp *larvae*[94]
Locality: Gulf of Mexico (Mexico)
Monogenea
Neobenedenia melleni[20]
Locality: Caribbean Sea (Saint Kitts West Indies)

Parancylodiscoides macrobaculum[84]
Locality: Gulf of Mexico (Mexico)
Pseudorhabdosynochus justinella[74,84]
Locality: Gulf of Mexico (Mexico), Atlantic Ocean
Pseudorhabdosynochus yucatanensis[84,94,139]
Locality: Gulf of Mexico (Mexico)

Nematoda

Anisakis typica [93,94,139]
Locality: Gulf of Mexico (Mexico)
Ascarophis Mexicana[91,94,139]
Locality: Gulf of Mexico (Mexico)
Capillaria sp.[93]
Locality: Gulf of Mexico (Mexico)
Hysterothylacium eurycheilum [93,94]
Locality: Gulf of Mexico (Mexico)
Hysterothylacium sp. [93,94]
Locality: Gulf of Mexico (Mexico)
Paracapillaria epinepheli[90,94]
Locality: Gulf of Mexico (Mexico)
Paracapillaria sp.[139]
Locality: Gulf of Mexico (Mexico)
Philometra margolisi [94,97,139]
Locality: Gulf of Mexico (Mexico)
Philometra morii[98,99]
Locality: Gulf of Mexico (Florida), Gulf of Mexico
Philometra salgadoi [94,95,96,137,139]
Locality: Gulf of Mexico, Gulf of Mexico (Mexico)
Pseudoterranova decipiens[94]
Locality: Gulf of Mexico (Mexico)

Trematoda

Allonematobothrium yucatanensis[94]
Locality: Gulf of Mexico (Mexico)
Bucephalus sp.[139]
Locality: Gulf of Mexico (Mexico)
Bucephalus sp. *metacercariae*[94]
Locality: Gulf of Mexico (Mexico)
Cardiocephaloides sp *metacercariae*[94]
Locality: Gulf of Mexico (Mexico)
Dollfustrema sp.[94]
Locality: Gulf of Mexico (Mexico)
Helicometra torta [79,94,139]
Locality: South Florida Reef Tract, Gulf of Mexico (Mexico)
Helicometrina nimia[94]
Locality: Gulf of Mexico (Mexico)
Lecithochirium floridense [94,139]
Locality: Gulf of Mexico (Mexico)

Lepidapedoides levenseni [79,94,139]
Locality: South Florida Reef Tract, Gulf of Mexico (Mexico)
Postporus epinepheli [79,94,139]
Locality: South Florida Reef Tract
Prosorhynchoides sp.[139]
Locality: Gulf of Mexico (Mexico)
Pyelosomum erubescens[94]
Locality: Gulf of Mexico (Mexico)
Rhipidocotyle sp. *metacercariae*[94]
Locality: Gulf of Mexico (Mexico)
Stephanostomum dentatum [79,94,139]
Locality: South Florida Reef Tract, Gulf of Mexico (Mexico)
Stephanostomum sp.[94]
Locality: Gulf of Mexico (Mexico)
Strigeidae sp.[139]
Locality: Gulf of Mexico (Mexico)

Sparidae

Calamus calamus

Common name: Saucereye porgy

Parasites:

Arthropoda

Lernanthropus longilamina[111]
Locality: Caribbean Sea (Bahamas)
Rocinela signata[111]
Locality: Caribbean Sea (Bahamas)

Monogenea

Neobenedenia melleni[101]
Locality: Caribbean Sea (Bahamas)

Trematoda

Aponurus pyriformis[79]
Locality: South Florida Reef Tract
Cotylogaster basiri[116]
Locality: Caribbean Sea (Puerto Rico)
Diplangus paxillus[79]
Locality: South Florida Reef Tract
Helicometrina nimia [79,115]
Locality: South Florida Reef Tract, Atlantic Ocean (Brazil)
Infundiburictus truncates[103]
Locality: Caribbean Sea (Jamaica)
Macvicaria crassigula[79]
Locality: South Florida Reef Tract
Myzoxenus vitellosus[79]
Locality: South Florida Reef Tract
Parahemiurus microcercus[79]
Locality: South Florida Reef Tract
Preptetos trulla[79]

Locality: South Florida Reef Tract

Proctoeces erythraeus[79]

Locality: South Florida Reef Tract

Proctoeces lintoni[116]

Locality: Caribbean Sea (Puerto Rico)

Pycnadena lata[79]

Locality: South Florida Reef Tract

Stephanostomum sentum[79]

Locality: South Florida Reef Tract

Diplodus argenteus

Common name: Silver porgy

Parasites:

Monogenea

Atriaster heterodus[117,118]

Locality: Atlantic Ocean (Brazil)

Polylabris tubicirrus[118]

Locality: Atlantic Ocean (Brazil)

Lagodon rhomboides

Common name: Pinfish

Parasites:

Acanthocephala

Rhadinorhynchus pristis[75]

Locality: North Carolina

Serrasentis sagittifer[75]

Locality: North Carolina

Arthropoda

Acanthocolax hystricosus[36]

Locality: Gulf of Mexico (Florida)

Cymothoa excisa[13]

Locality: Gulf of Mexico (Yucatan peninsula)

Nerocila acuminata[122]

Locality: Gulf of Mexico

Trematoda

Brachyphallus parvus[106]

Locality: South Florida Reef Tract

Diphterostomum Americanum [106,128]

Locality: South Florida Reef Tract, Gulf of Mexico (Florida)

Diplomonorchis leiostomi[106]

Locality: South Florida Reef Tract

Hemiurus appendiculatus[75]

Locality: North Carolina

Lecithochirium monticellii[75]

Locality: North Carolina

Lepocreadium floridanum[106]

Locality: South Florida Reef Tract

Opechona pyriformis[75]
Locality: North Carolina
Opecoeloides vitellosus[75]
Locality: North Carolina
Parahemiurus merus[106]
Locality: South Florida Reef Tract
Proctoeces lintoni[106]
Locality: South Florida Reef Tract
Steringotrema corpulentum [75,106]
Locality: South Florida Reef Tract, North Carolina

Cestoda

Otobothrium crenacolle[75]
Locality: North Carolina
Tetraphyllidea incertae sedis[75]
Locality: North Carolina

Synodontidae

Synodus foetens

Common name: Inshore lizardfish

Parasites:

Arthropoda

Elthusa alvaradoensis[17,30]
Locality: Gulf of Mexico (Mexico)

Cestoda

Tetraphyliddea sp.[105]
Locality: South Florida Reef Tract

Nematoda

Goezia minuta[105]
Locality: South Florida Reef Tract

Trematoda

Brachyphallus parvus[79,106]
Locality: South Florida Reef Tract
Ectenurus americanus[106]
Locality: South Florida Reef Tract
Genolopa ampullacea[79]
Locality: South Florida Reef Tract
Lecithochirium musculus[105]
Locality: South Florida Reef Tract
Lecithochirium mecosaccum[79,105]
Locality: South Florida Reef Tract
Lecithochirium synodi[79]
Locality: South Florida Reef Tract
Opecoeloides polyfimbriatus[114]
Locality: Gulf of Mexico
Opecoeloides sp.[101]
Locality: Caribbean Sea (Bahamas)
Opegaster synodi[79]

Locality: South Florida Reef Tract

Parahemiurus merus[79]

Locality: South Florida Reef Tract

Stomachicola muraenesocis[101,130]

Locality: Caribbean Sea (Bahamas)

Tubulovesicula pinguis[130]

Locality: South Florida Reef Tract

Tetradontidae

Sphoeroides testudineus

Common name: Checkered puffer

Parasites:

Monogenea

Heterobothrium lamothei[136]

Locality: Gulf of Mexico (Mexico)

Pseudempleurosoma carangis[82]

Locality: Gulf of Mexico (Mexico)

Nematoda

Capillaria carioca[92]

Locality: Gulf of Mexico (Mexico)

Cucullanus dodsworthi[81]

Locality: Atlantic Ocean (Brazil)

Trematoda

Xystretrum solidum[80]

Locality: Gulf of Mexico (Mexico)

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Parasite-Host list

Acanthocephala

Acanthocephaloides spinicaudatus

Halichoeres bivittatus[22]

Acanthogyrus acanthuri

Acanthurus bahianus[102]

Dollfusentis chandleri

Haemulon Sciurus[69]

Lutjanus griseus[8]

Oligoplites saurus[1]

Dollfusentis ctenorhynchus

Mulloidichthys martinicus[102]

Dollfusentis heteracanthus

Labrisomus nuchipinnis[23]

Dollfusentis sp.

Lutjanus griseus[8]

Gorgorhynchoides bullocki

Lutjanus griseus[8,86]
Selene vomer[86]
Gorgorhynchus clavatus
Epinephelus morio[93,94,139]
Gorgorhynchus medius
Lutjanus griseus[8]
Neoechinorhynchus brentnickoli
Oligoplites saurus[119]
Pomphorhynchus lucyi
Strongylura marina[151]
Rhadinorhynchus pristis
Lagodon rhomboides[75]
Rhadinorhynchus sp.
Oligoplites saurus[119]
Serrasentis sagittifer
Lagodon rhomboides[75]
Serrasentis sp.
Balistes capriscus[5]
Lutjanus griseus[8]
Southwellina hispida
Oligoplites saurus[119]

Annelida

Cystobranchus vividus
Strongylura marina[121]
Trachelobdella lubrica
Lachnolaimus maximus[144]

Arthropoda

Acanthocolax hystricosus
Lagodon rhomboides[36]
Acantholochus crevalleus
Caranx hippos[36]
Acusicola rogeri
Strongylura marina[39]
Anilocra abudefdufi
Abudefduf saxatilis[147,150]
Anilocra acanthuri
Acanthurus chirurgus[150]
Anilocra chaetodontis
Chaetodon sedentarius[48]
Anilocra haemuli
Haemulon flavolineatum[42,141,142,143]
Anuretes heckelii
Chaetodipterus faber[28]
Argulus sp.
Lutjanus griseus[52]
Oligoplites saurus[57]

Belizia brevicauda
    Clepticus parrae[35]
Caligus sp.
    Oligoplites saurus[57]
    Pseudupeneus maculatus[27]
Caligus ballistae
    Balistes capriscus[5]
Caligus bonito bonito
    Lutjanus griseus[52]
    Oligoplites saurus[133]
Caligus haemulonis
    Chaetodipterus faber[12,28]
    Haemulon plumierii[131]
    Haemulon sciurus[131]
Caligus mutabilis
    Chaetodipterus faber[28]
    Oligoplites saurus[119]
Caligus robustus
    Caranx hippos[77]
    Oligoplites saurus[132,133]
Caligus tenax
    Caranx hippos[111]
Chondracanthus wilsoni
    Sparisoma viride[61]
Cymothoa excisa
    Lagodon rhomboides[13]
    Lutjanus griseus[149]
    Lutjanus synagris[145]
Cymothoa spinipalpa
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    Lutjanus synagris[40]
    Oligoplites saurus[135]
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    Acanthurus bahianus[32]
    Haemulon flavolineatum[32,42,63]
    Haemulon sciurus[32]
    Lutjanus synagris[32]
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    Cephalopholis cruentata[123]
    Haemulon plumierii[131]
    Holocentrus rufus[125]
    Lutjanus synagris[140]
Hamaticolax scutigerulus
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Hatschekia insolita
    Epinephelus morio[139]

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    Haemulon sciurus[111]
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Hatschekia sp.
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    Haemulon sciurus[131]
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    Haemulon plumierii[131]
    Haemulon sciurus[131]
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    Calamus calamus[111]
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    Chaetodipterus faber[12,28]
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    Lutjanus griseus[52]
Metacaligus rufus
    Selene vomer[44]
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    Lagodon rhomboides[122]
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    Bodianus rufus[21]
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    Haemulon sciurus[38]
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    Haemulon sciurus[36]
Raninoides lamarcki
    Lutjanus griseus[145]
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    Calamus calamus[111]
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Oligoplites saurus[132]
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Callitetrarhynchus gracilis
Balistes capriscus[5]
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Lutjanus griseus[8]
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Nybelinia lingualis
Pseudupeneus maculatus[108]
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Balistes capriscus[5]
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Oncomegas sp.
Lutjanus synagris[4]
Otobothrium crenacolle
Lagodon rhomboides[75]
Pseudogrillotia sp.
Lutjanus synagris[4]
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Pseudotobothrium dipsacum
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Caranx hippos[73]

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Caranx hippos[73]

Allopyragraphorus sp.

Caranx hippos[77]

Allopyragraphorus winteri

Caranx hippos[73]

Ancyrocephalus cornutus

Strongylura marina[147]

Ancyrocephalus parvus

Strongylura marina[147]

Ancyrocephalus sp.

Lutjanus griseus[126]

Atriaster heterodus

Diplodus argenteus[117,118]

Benedenia sp.

Haemulon sciurus[34]

Cemocotyle carangis

Caranx hippos[73]

Cemocotyle noveboracensis

Caranx hippos[14,73,77]

Cemocotylella elongata

Caranx hippos[73,77]

Choricotyle aspinachorda

Haemulon aurolineatum[10]

Choricotyle hysteroncha

Haemulon flavolineatum[53]

Cichlidogyrus bychowskii

Oligoplites saurus[119]

Dionchus remorae
    Caranx hippos[73]
Euryhaliotrema fajeravilae
    Lutjanus griseus[83]
Euryhaliotrema fastigatum[83]
    Lutjanus griseus
Euryhaliotrema longibaculum
    Lutjanus griseus[83]
    Lutjanus synagris[83]
Euryhaliotrema paracanthi
    Lutjanus griseus[83]
Euryhaliotrema sp.
    Lutjanus griseus [52]
Euryhaliotrema torquecirrus
    Ocyurus chrysurus[71]
Euryhaliotrema tubocirrus
    Lutjanus griseus[83]
    Lutjanus synagris[83]
Haliotrema caballeroi
    Pseudupeneus maculatus[27]
Haliotrema caraibense
    Pseudupeneus maculatus[27]
Haliotrema golvani
    Pseudupeneus maculatus[27]
Haliotrema sp.
    Haemulon aurolineatum[10]
    Haemulon flavolineatum[120]
Haliotrematoides cornigerum
    Lutjanus synagris[83]
Haliotrematoides gracilihamus
    Lutjanus griseus[83]
Haliotrematoides heteracantha
    Lutjanus griseus[83]
    Lutjanus synagris[83]
Haliotrematoides longihamus
    Lutjanus synagris[83]
Haliotrematoides magnigastrohamus
    Lutjanus synagris[83]
Haliotrematoides striatohamus
    Haemulon sciurus[85]
Hargicola oligoplites
    Oligoplites saurus[119,133]
Heterobothrium lamothei
    Sphoeroides testudineus[136]
Metacamopia oligoplites
    Oligoplites saurus[134]

Neobenedenia melleni
Acanthurus chirurgus[124]
Acanthurus bahianus[124]
Calamus calamus[101]
Epinephelus morio[20]
Neobenedenia sp.
Cephalopholis cruentata[123]
Neomicrocotyle pacifica
Caranx hippos[64]
Nudaciraxine gracilis
Strongylura marina[76]
Parancyclodiscoides sp.
Chaetodipterus faber[28]
Parancylodiscoides longiphallus
Chaetodipterus faber[12,29,72,127]
Parancylodiscoides macrobaculum
Epinephelus morio[84]
Polylabris tubicirrus
Diplodus argenteus[118]
Probursata brasiliensis
Oligoplites saurus[133]
Probursata veraecrucis
Oligoplites saurus[1,119]
Protomicrocotyle ivoriensis
Caranx hippos[73]
Protomicrocotyle manteri
Caranx hippos[73]
Protomicrocotyle mirabilis
Caranx hippos[73,77]
Pseudempleurosoma carangis
Sphoeroides testudineus[82]
Pseudomazocraes selene
Caranx hippos[73]
Selene vomer[68]
Pseudorhabdosynochus justinella
Epinephelus morio[74,84]
Pseudorhabdosynochus meganmarieae
Cephalopholis cruentata[74]
Pseudorhabdosynochus yucatanensis
Epinephelus morio[84,94,139]
Sprostoniella micrancyra
Chaetodipterus faber[29]
Sprostoniella sp.
Chaetodipterus faber[28]

Nematoda

Acuariidae sp.

Lutjanus griseus[60]
Anisakis pegreffii
Lutjanus griseus[8]
Anisakis sp.
Lutjanus synagris[3]
Ocyurus chrysurus[3]
Anisakis typica
Epinephelus morio[93,94,139]
Ascarophis mexicana
Epinephelus morio[93,94,139]
Capillaria carioca
Sphoeroides testudineus[92]
Capillaria sp.
Epinephelus morio[93]
Lutjanus griseus[8]
Oligoplites saurus[1]
Caranginema americanum
Caranx hippos[88]
Contracaecum sp.
Balistes capriscus[5]
Caranx hippos[77]
Lutjanus griseus[60]
Oligoplites saurus[1,119,133]
Cucullanus brevicaudatus
Balistes capriscus[113]
Cucullanus dodsworthi
Sphoeroides testudineus[81]
Cucullanus palmeri
Lutjanus griseus[8]
Cucullanus pargi
Lutjanus griseus[8,56,60]
Dentiphilometra lutjani
Lutjanus griseus[54,56]
Dichelyne bonacii
Lutjanus griseus[8,55,60]
Dichelyne lintoni
Lutjanus griseus[8]
Dichelyne sp.
Balistes capriscus[5]
Echinocephalus sp.
Lutjanus griseus[60]
Goezia minuta
Synodus foetens[105]
Goezia pelagia
Chaetodipterus faber[41]
Goezia sp. *Larvae*

Oligoplites saurus[1]
Hysterothylacium eurycheilum
Epinephelus morio[93,94]
Hysterothylacium fortalezae
Oligoplites saurus[1]
Hysterothylacium reliquens
Halichoeres bivittatus[104]
Hysterothylacium sp.
Epinephelus morio[93,94]
Lutjanus griseus[60]
Paracapillaria epinepheli
Epinephelus morio[90,94]
Paracapillaria sp.
Epinephelus morio[139]
Philometra brevispicula
Lutjanus griseus[87]
Philometra diplectri
Diplectrum formosum[100]
Philometra haemulontis
Haemulon aurolineatum[98]
Haemulon plumierii[98]
Philometra latispicula
Lutjanus griseus[89]
Philometra margolisi
Epinephelus morio[94,97,139]
Philometra morii
Epinephelus morio[98,99]
Philometra salgadoi
Epinephelus morio[94,95,96,137,139]
Philometra sp.
Caranx hippos[77]
Lutjanus griseus[8,60]
Oligoplites saurus[1]
Strongylura marina[88]
Philometra synagridis
Lutjanus synagris[89,140]
Philometroides grandipapillatus
Caranx hippos[87]
Procamallanus sp.
Lutjanus griseus[60]
Oligoplites saurus[119]
Pseudoterranova decipiens
Epinephelus morio[94]
Pseudoterranova sp.
Caranx hippos[77]
Oligoplites saurus[1]

Raphidascaris (Ichthyascaris) sp.
Balistes capriscus[5]
Caranx hippos[77]
Lutjanus synagris[3]
Ocyurus chrysurus[3]
Spirocamallanus cricotus
Lutjanus griseus[8]
Terranova sp.
Balistes capriscus[5]
Lutjanus griseus[60]
Lutjanus synagris[60]
Ocyurus chrysurus[3,60]

Trematoda

Alcicornis carangis
Caranx crysos[45]
Alloinfundiburictus asymmetricus
Haemulon flavolineatum[49]
Alloinfundiburictus beauforti
Haemulon sciurus[49,70]
Alloinfundiburictus haemuli
Haemulon sciurus[106]
Alloinfundiburictus longicaecum
Anisotremus virginicus[78,79,106]
Alloinfundiburictus sparisomae
Haemulon sciurus[49]
Allonematobothrium yucatanense
Epinephelus morio[94]
Antorchis urna
Holacanthus ciliaris[79]
Aponurus laguncula
Balistes capriscus[5]
Chaetodipterus faber[106]
Aponurus pyriformis
Anisotremus virginicus[79,106]
Calamus calamus[79]
Haemulon aurolineatum[10]
Haemulon carbonarium[106]
Haemulon flavolineatum[102]
Haemulon parra[79]
Haemulon sciurus[46,70]
Brachyphallus parvus
Caranx crysos[106]
Haemulon flavolineatum[106]
Lagodon rhomboides[106]
Lutjanus griseus[8]
Lutjanus synagris[106]

Synodus foetens[79,106]
Bucephalus margaritae
Caranx crysos[106]
Caranx hippos[15,77,106]
Oligoplites saurus[133]
Bucephalus sp.
Epinephelus morio[139]
Cainocreadium consuetum
Haemulon sciurus[49]
Cainocreadium gulella
Lutjanus griseus[8]
Cainocreadium lintoni
Lutjanus griseus[8]
Cainocreadium oscitans
Anisotremus virginicus[79,106]
Haemulon sciurus[102]
Malacanthus plumieri[116]
Cardicola euzeti
Lutjanus griseus[18]
Cardiocephaloides sp.
Epinephelus morio[94]
Cotylogaster basiri
Calamus calamus[116]
Trachinotus falcatus[59]
Deretrema fusillus
Ocyurus chrysurus[79]
Didymozoidae sp.
Haemulon sciurus[49]
Diphterostomum americanum
Lagodon rhomboides[106,128]
Diphterostomum brusinae
Anisotremus virginicus[106]
Haemulon sciurus[106]
Diplangus miolecithus
Haemulon parra[79]
Diplangus parvus
Anisotremus virginicus[106]
Haemulon carbonarium[106]
Haemulon flavolineatum[79]
Haemulon sciurus[106]
Diplangus paxillus
Anisotremus virginicus[79,106]
Calamus calamus[79]
Haemulon aurolineatum[10]
Haemulon carbonarium[106]
Haemulon flavolineatum[79]

Haemulon sciurus[70,106]
Diplomonorchis leiostomi
Haemulon sciurus[70]
Lagodon rhomboides[106]
Dollfustrema sp.
Epinephelus morio[94]
Lutjanus griseus[8]
Ectenurus americanus
Synodus foetens[106]
Ectenurus virgula
Caranx crysos[106]
Caranx hippos[106]
Lutjanus synagris[49]
Oligoplites saurus[119]
Genitocotyle atlantica
Haemulon flavolineatum[79]
Genolopa ampullacea
Anisotremus virginicus[106]
Haemulon aurolineatum[10]
Haemulon flavolineatum [78,79,106]
Haemulon sciurus[70,106,109]
Synodus foetens[79]
Genolopa minuscula
Anisotremus surinamensis[109]
Genolopa vesca
Haemulon sciurus[109]
Gonacanthella lutjani
Lutjanus griseus[8]
Gonocercella sp.
Balistes capriscus[5]
Hamacreadium mutabile
Anisotremus virginicus[79]
Lutjanus synagris[49,106]
Lutjanus griseus[8,106]
Ocyurus chrysurus[79]
Hapladena varia
Acanthurus bahianus[49]
Balistes capriscus
Helicometra torta
Epinephelus morio[79,94,139]
Lutjanus griseus[8]
Helicometrina executa
Anisotremus virginicus[106]
Halichoeres bivittatus[106]
Lachnolaimus maximus[79]
Lutjanus griseus[8]

Trachinotus falcatus[106]
Helicometrina nimia
Calamus calamus[79,115]
Epinephelus morio[94]
Haemulon sciurus[115]
Lachnolaimus maximus[103]
Lutjanus griseus[8,115]
Ocyurus chrysurus[3,79,106,115]
Hemiuridae sp.
Haemulon aurolineatum[10]
Lutjanus griseus[8]
Hemiurus appendiculatus
Lagodon rhomboides[75]
Hirudinella ventricosa
Mulloidichthys martinicus[24]
Homalometron annahoineffae
Balistes capriscus[5]
Homalometron cryptum
Anisotremus virginicus[79,106]
Balistes capriscus[106]
Homalometron dowgialloi
Haemulon flavolineatum [102]
Homalometron foliatum
Anisotremus virginicus[45]
Haemulon aurolineatum[10]
Haemulon carbonarium[106]
Hurleytrema shorti
Selene vomer[106]
Hypocreadium biminense
Balistes capriscus[5]
Lutjanus griseus[8]
Infundibulostomum spinatum
Haemulon sciurus[106]
Infundiburictus longovatus
Anisotremus virginicus[106]
Haemulon aurolineatum[10]
Haemulon sciurus[106]
Infundiburictus truncatus
Calamus calamus[103]
Haemulon sciurus[49,106]
Haemulon flavolineatum[78,79,106]
Lecithochirium floridense
Epinephelus morio[94,139]
Lecithochirium mecosaccum
Synodus foetens[79,105]
Lecithochirium microstomum

Caranx hippos[77]
Lutjanus synagris[106]
Lutjanus griseus[8]
Oligoplites saurus[106]
Lecithochirium monticellii
Caranx hippos[76]
Lagodon rhomboides[75]
Lutjanus griseus[8]
Lecithochirium musculus
Anisotremus virginicus[106]
Caranx hippos[106]
Lutjanus griseus[8]
Lutjanus synagris[49]
Synodus foetens[105]
Lecithochirium synodi
Synodus foetens[79]
Lecithocladium chaetodipteri
Chaetodipterus faber[28]
Lepidapedoides levenseni
Epinephelus morio[79,94,139]
Leopcreadium bimarinum
Lachnolaimus maximus[79]
Lepocreadium floridanum
Lagodon rhomboides[106]
Lepocreadium trulla
Ocyurus chrysurus[79,106]
Leurodera decora
Anisotremus virginicus[79]
Haemulon flavolineatum[79]
Haemulon parra[79]
Haemulon plumierii
Lutjanus griseus[8]
Macradena perfecta
Acanthurus bahianus[49]
Macvicaria crassigula
Calamus calamus[79]
Manteria brachyderus
Caranx hippos[77]
Oligoplites saurus[1,106,119,128]
Mecoderus oligoplitis
Oligoplites saurus[119]
Megalomyzon robustum
Lachnolaimus maximus[79]
Megasolena mikra
Holacanthus ciliaris[7]
Metadena adglobosa

Lutjanus griseus[8,106]
Lutjanus synagris[49]
Metadena obscura
Lutjanus griseus[8]
Metadena sp.
Lutjanus griseus[106]
Oligoplites saurus[119]
Metanematobothrium spinneri
Oligoplites saurus[119]
Monorchimacradena acanthuri
Acanthurus bahianus[102]
Monorchis latus
Anisotremus virginicus[78,79]
Multitestis inconstans
Chaetodipterus faber[28,106,112]
Multitestoides brasiliensis
Chaetodipterus faber[28]
Myzoxenus lachnolaimi
Lachnolaimus maximus[79]
Myzoxenus vitellosus
Calamus calamus[79]
Neoapocreadium coili
Balistes capriscus[106]
Neoprosorhynchus sp.
Lutjanus griseus[8]
Nicolla halichoeri
Halichoeres bivittatus[106]
Opechona pyriformis
Lagodon rhomboides[75]
Opechona sp.
Balistes capriscus[5]
Opecoeloides brachyteleus
Mulloidichthys martinicus[79]
Opecoeloides polyfimbriatus
Synodus foetens[114]
Opecoeloides sp.
Synodus foetens[101]
Opecoeloides vitellosus
Lagodon rhomboides[75]
Opegaster synodi
Synodus foetens[79]
Parahemiurus merus
Caranx crysos[106]
Caranx hippos[106]
Haemulon sciurus[70]
Lagodon rhomboides[106]

Ocyurus chrysurus[79]
Oligoplites saurus[134]
Synodus foetens[79]
Parahemiurus microcercus
Calamus calamus[79]
Parahurleytrema pyriforme
Trachinotus falcatus[106]
Paralasiotocus parvus
Haemulon flavolineatum[78,79]
Paramanteriella confusum
Ocyurus chrysurus[106]
Pleurogonius candidulus
Holacanthus ciliaris[79]
Postmonorchis orthopristis
Anisotremus virginicus[106]
Haemulon flavolineatum[79]
Haemulon sciurus[49,106]
Postporus epinepheli
Epinephelus morio[79,94,139]
Preptetos trulla
Calamus calamus[79]
Lutjanus griseus[8]
Primisanguis caribbeanensis
Sparisoma viride[19]
Proctoeces erythraeus
Calamus calamus[79]
Proctoeces lintoni
Calamus calamus[116]
Lagodon rhomboides[106]
Prolecithochirium sp.
Haemulon aurolineatum[10]
Prosogonotrema bilabiatum
Chaetodipterus faber[28]
Prosorhynchoides sp.
Epinephelus morio[139]
Prosorhynchoides strongylurae
Strongylura marina[62]
Pseudoacanthostomum panamense
Oligoplites saurus[119]
Pycnadena lata
Calamus calamus[79]
Pyelosomum erubescens
Epinephelus morio[94]
Holacanthus ciliaris[79]
Rhipidocotyle lintoni
Strongylura marina[62]

Rhipidocotyle sp. *Metacercariae*
    Epinephelus morio[94]
Rhipidocotyle transversale
    Strongylura marina[62]
Scaphanocephalus expansus
    Mulloidichthys martinicus[66]
    Sparisoma aurofrenatum[47]
Scaphanocephalus sp.
    Acanthurus bahianus[43]
    Acanthurus chirurgus[43]
    Cephalopholis cruentata[66]
Schikhobalotrema acutum
    Strongylura marina[67]
Siphodera vinaledwardsii
    Haemulon flavolineatum[107]
    Lutjanus griseus[8,52]
    Lutjanus synagris[49,106]
    Ocyurus chrysurus[79]
Siphoderina americanus
    Lutjanus griseus[8]
    Lutjanus synagris[104]
    Ocyurus chrysurus[106]
Stegopa globosa
    Lutjanus griseus[8,106]
    Lutjanus synagris[49,51,106]
    Ocyurus chrysurus[51,106]
Stephanostomum casum
    Lutjanus griseus[8,106]
    Lutjanus synagris[49,106]
    Ocyurus chrysurus[79,106]
Stephanostomum dentatum
    Epinephelus morio[79,94,139]
Stephanostomum ditrematis
    Caranx crysos[106]
    Caranx hippos[106,128]
Stephanostomum ghanense
    Caranx hippos[77]
Stephanostomum interruptum
    Ocyurus chrysurus[129]
Stephanostomum megacephalum
    Caranx hippos[106]
Stephanostomum sentum
    Calamus calamus[79]
    Haemulon carbonarium[106]
    Haemulon sciurus[102]
Stephanostomum sp.

Balistes capriscus[5]
Epinephelus morio[94]
Stephanostomum tenue
Trachinotus falcatus[106]
Steringotrema corpulentum
Lagodon rhomboides[75,106]
Stomachicola muraenesocis
Synodus foetens[101,130]
Strigeidae sp.
Epinephelus morio[139]
Theledera pectinata
Caranx crysos[106,128]
Oligoplites saurus[134]
Theledera sp.
Selene vomer[106]
Torticaecum fenestratum
Pseudupeneus maculatus
Tubulovesicula pinguis
Synodus foetens[130]
Varelacreptotrema travassosi
Balistes capriscus[5]
Vitellibaculum spinosum
Chaetodipterus faber[106]
Xystretrum pulchrum
Balistes capriscus[5]
Xystretrum solidum
Balistes capriscus[106]
Sphoeroides testudineus[80]

Discussion

The host-parasite checklist included herein is, to my knowledge, the first of its kind for the fishes of the south Florida hermatypic reef tract. It was based on a literature search that produced 151 published studies, yielding data on 341 parasite taxa infecting 43 reef-associated fish hosts. The above host-parasite and parasite-host lists should prove invaluable to future parasitological studies in this region, with several important caveats. First, the data were marked by significant publication bias, with the number of available studies being strongly predictive of the number of parasites recorded for each host. Second, as stated in the results, few of the studies (21of 151) were conducted in the Florida reef tract; this is surprising given its unique ecological and conservation status as the only hermatypic coral reef system in the continental USA. Consequently, the scope of the literature search was expanded to include data from the rest of the Atlantic Ocean, including the Caribbean Sea and the Gulf of Mexico. Lastly, this study focused on a limited subset of 43 fishes out of the hundreds that inhabit the Florida reef system (Banks et al., 2008). I briefly discuss the significance of each of these caveats below.

Publication bias occurs in parasitology (Møller & Jennions, 2001; Haddaway & Watson, 2016) and is a common problem in comprehensive review-style papers such as checklists and meta-analyses (Thornton & Lee, 2000; Lin & Chu, 2018). In the present study, some host species had been the object of more studies, i.e., there was bias of sampling effort; predictably, this resulted in more parasites being recorded for well-studied species such as *Lutjanus griseus* with 18 studies and *Haemulon Sciurus* with 17. Other species were less represented: of the 43 species studied, eight (*Chaetodon sedentarius, Labrisomus nuchipinnis, Anisotremus suinamensis, Haemulon carbonarium, Holocentrus rufus, Clepticus parrae,Bodainus rufus, Sparisoma aurofrenatum,* and *Malacanthus plumieri*) were only represented by a single study each. Table 2 shows the overall acquired number of sources for each species and shows great disparity in sampling efforts as few fish species are targeted heavily while others are rarely targeted. This effort bias is likely the product of strong interest in fishes of commercial and/or recreational importance and has almost certainly led to major underestimation of the true species richness and mischaracterization of parasite community composition in less-sampled fishes. This precludes making broad inferences about interspecific differences in parasitism among these fishes: no broad conclusions can be drawn from these data (for now).

That said, the data on compositional similarity (summarized in Figure 3) did reveal some interesting patterns. For example, host species that were phylogenetically related harbored similar parasite species and had comparable communities: a common pattern in parasite community ecology (Huang et al., 2013; Davies & Pedersen, 2008; Streicker et al., 2010). This can be seen as hosts of the same family are seen grouped together. This pattern is typically ascribed to co-evolution between hosts and parasites, so that as host lineages diversify, so do their parasites' (Poulin, 2004). A less expected pattern in Figure 3 is the clustering of hosts based on the number of studies featuring them: larger bubbles (representing well-studied species) are grouped in the center of the plot, suggesting that their parasite communities (when adequately sampled) share compositional similarities. This suggests a large degree of overlap in parasite community composition even among relatively unrelated taxa, and a preponderance of generalist parasite taxa that infect a wide range of host fishes. Even more intriguingly, this suggests that these parasite communities may be assembled to some degree via neutral model processes. Neutral theory models assume that unrelated parasite species with similar functional traits state may be functionally equivalent, so that two parasite assemblages may differ compositionally yet feature parasites filling equivalent roles. Indeed, some studies have noted parasite communities that, while diverse within a host, do not seem to differ between host species (Poulin, 2004). The use of functional trait approaches in the study of parasite communities is very promising (Llopis-Belenguer et al. 2019; Warburton & Blanar, in press). Further studies on this subject might assess the extent to which neutral processes (i.e., functional equivalence of parasites with shared traits) shape parasite assemblages in this system compared to niche-based processes (such as host specificity and co-evolution).

Another source of possible bias within this study is the regional differences in sampling effort. For example, most of the studies originated either in the Gulf of Mexico, Mexico, or in Brazil. Comparatively few studies originated specifically from the south Florida reef tract. None of the fish species chosen for the study are migratory yet hosts sampled from different regions appeared to have comparable parasite communities, and parasites in heavily studied host species were detected in multiple localities. A major goal of this study is to stimulate and facilitate further parasitological work on fishes from the Florida reef tract, particularly those for whom few data exist in the literature, and those that were excluded from this study.

Although all fish species sampled dwell within this region, host ranges may still be a complicating factor. Some of these species' ranges may end adjacently to, or on the edge of the Florida reef tract. For example, the Yellow goatfish has a FishBase-estimated range that starts in the south Florida reef tract and ranges through the Caribbean to southern Brazil. The Spotted goatfish has a range from New Jersey to southern Brazil therefore having the host range fully encompass the area of interest or the south Florida reef tract area, whereas the host range of the yellow goatfish just touches this region. This perhaps explains the lower presence of certain species, which would complicate sampling efforts of these species. This study looked at a wide range of localities near the Florida reef tract, therefore attempting to eliminate any host range bias. However, some bias may still exist as few studies using localities north of the south Florida reef tract were utilized for this review as very few exist on the target host species. Host ranges that are limited to a certain area affect the number of studies done within these hosts as they may not be readily available within the other areas that were included in this study or the hotspots that are regularly sampled. More studies within the reef tract are needed to ascertain if there is a systematic undersampling of certain host species of limited host range in these areas.

The species that were included in the study shared several traits. For example, all are readily sampled from the reef tract using straightforward techniques such as recreational rod-and-reel gear and/or spearfishing. This represents another potential source of bias in the data, as it resulted in the exclusion of cryptic species, or bottom-dwelling herbivores and invertivores. This is a common problem in studies that involve field sampling of fishes (e.g., see discussion in Blanar et al., 2021) that might be solved by using other sampling techniques such as passive traps or dipnetting by hand.

Our analyses initially intended to include meta-analytical parasite species accumulation curves, which would provide more precise guidance on sample size and study design. Unfortunately, many of the studies referenced in this systematic review failed to provide data on sample size. For example, of the ten published accounts of parasites detected in *Strongylura marina,* only one reported sample sizes. This further impairs our ability to compare parasite data among different studies. Sampling effort and/ or low sample size introduces bias into datasets. Under-sampling a host causes negative bias of species richness and causes outliers that skew the data (Coddington et al., 2009). Parasitology has an unfortunate history of studies that fail to report even the most basic design information and summary statistics (Morrisson, 2002). This

has consequences for the long term usefulness of their data; for example, Blanar et al. (2009) conducted a meta-analysis of the effect size of pollution on parasitism and noted that only 49 of more than 200 studies provided enough basic information to calculate effect size (such as sample sizes, standard deviations), while the rest had to be excluded. Thankfully, this situation has improved recently (Morrisson, 2002), and more recent studies are more likely to include this important information.

Host size may also play a role in parasite community richness and composition, as larger hosts provide a more habitat for parasitic species. Host size plays a role in parasite community richness in host species (Kamiya et al., 2013) including marine fishes (Sasal et al., 1997). Fish of larger size tend to have longer lifespans that may also play a role, as fish species that live longer theoretically have more time to be colonized by parasites. The link between parasite community structure and host longevity is likely to be complex; indeed, parasite species richness is often paradoxically negatively correlated with longevity in fishes (Morand & Harvey, 2000; Cooper et al., 2012). Feeding behavior or trophic ecology can also play a role in the makeup of parasite communities, as many parasites, such as helminth species, are transmitted through feeding behavior. Fishes occupying higher trophic levels may have a more diverse parasite community compared to those of lower trophic level or those host species who feed solely on non-animal prey (Poulin & Leung, 2011). Further research is necessary to investigate how parasite communities are formed and how these possible covariates affect the formation and species richness within a host's parasite community in the south Florida reef tract.

Lastly, many of the parasites in the publications used for this study were not identified to species, and some were only identified by life stage. Taxonomic resolution remains a persistent problem in parasitological literature (Poulin & Leung, 2010). Achieving species level identification of parasites is crucial to understand the entire parasite communities and their overall effects on the host and the surrounding ecosystem. Furthermore, we excluded some parasites that were clearly misidentified. Misidentification is another common problem in these studies (Bush et al., 2021; Nielsen et al., 2014). When this occurs, it can be confusing to other scientists studying those host species, their parasite communities, and their effects. It is vital to have adequate identification of all species to comprehend species richness in these communities, as overall species richness frequently coincides with ecosystem function. Proper identification is

necessary for correct conservation of organisms, control of pathogens, and effective management of wildlife (Bush et al., 2021).

Conclusion

The south Florida hermatypic coral reef tract is an understudied locality of interest of high host species richness. Relatively few studies have identified the parasites of several fish species within this region. This study attempts to shed light onto this historically overlooked locality by utilizing geographically adjacent regions as proxy locations for the Florida reef tract. Some fish within this study were heavily represented in the literature, while others were not, leading to a large sampling bias within the dataset. However, more research must be conducted to complete a more accurate host parasite checklist for the teleost fish host species of the Florida reef tract. Ultimately, the overall task of creating a host parasite checklist was successful using data from adjacent regions, but no real conclusions can be drawn from the current dataset and its analyses.

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