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# Decapod Crustaceans of the Flower Gardens Banks National Marine Sanctuary

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# Decapod Crustaceans of the Flower Gardens Banks National Marine Sanctuary

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**Since 1985, new sampling and reexamination of existing specimens have resulted in the finding of more than 25 additional decapod crustacean species at the Flower Gardens Banks National Marine Sanctuary. Of the 106 species of decapods that inhabit the Sanctuary, the predominant groups are the families Alpheidae, Palaemonidae, Paguridae, Diogenidae, Mithracidae, and Panopeidae. The West Flower Gardens Bank has the most diverse fauna of the areas sampled (60 species). Stetson Bank has 14 species that have not been found on the Flower Gardens Banks proper. Three species are typically found on mooring lines and oil platforms. Differences in bottom type and sampling effort may account for species differences at each bank. The majority of the species have tropical distributions.**

Marine invertebrates have been identified and collected from the Flower Gardens Banks National Marine Sanctuary (FGBNMS), since the 1950s. From 1970 to 1990, biologists at Texas A&M University (TAMU), especially Thomas Bright and Linda Pequegnat of the Department of Oceanography, collected and identified species taken on the Banks. Results of these studies were summarized in Bright and Pequegnat (1974), Kennedy et al. (1980), and Rezak et al. (1985).

The earliest report on decapods at the Banks was a doctoral dissertation by Ray (1974). Pequegnat and Ray (1974, in Bright and Pequegnat) summarized collections of crustaceans and other arthropods at West Flower Gardens Bank and listed 48 decapod species taken or photographed there. Kennedy et al. (1980) and Rezak et al. (1985) listed new records of decapods taken by the submersible vehicle *Diaphus* and box cores. Pequegnat and Heard (1979) described a new species of snapping shrimp, *Synalpheus agelas*, from the Banks. Wicksten and McClure (2003) described another new species of snapping shrimp, *Alpheus hortensis*, on the basis of newly collected material and existing specimens of a previously undescribed species.

Specimens from the FGBNMS taken in 1970–1990 were collected by hand or using rotenone while SCUBA diving, from the submersible vehicle *Diaphus*, and by box core or rock dredge. Since 1990, additional specimens, especially from Stetson Bank, have been collected by SCUBA. In 2003–2004, collections were made on deep reefs of the FGBNMS using a remote operated vehicle (ROV) from the National Oceanic and Atmospheric Administration research vessels *Ronald H. Brown* and *Nancy Foster*. The majority of the specimens were deposited in the collections of the Department of Oceanography, TAMU. Data originally were recorded in handwritten catalogs. In 1999, these specimens formally were incorporated into the Marine Invertebrates Collection, Texas Cooperative Wildlife Collection (TCWC) at TAMU.

During remodeling and updating of the collections at TCWC, much previously uncataloged material was located, identified, and cataloged. From 2000 to present, students from the Departments of Wildlife and Fisheries Science and Biology, TAMU, have assisted me in sorting and cataloging specimens from the TCWC, including more than 175 specimens from the FGBNMS. The personnel of the FGBNMS office started a photo bank containing both digital and film images of the biota of the Banks, including many images of crustaceans. The account that follows provides records and information on natural history of species collected or photographed at the Banks and natural gas production platform High Island A389-A, located within the sanctuary.

## MATERIALS AND METHODS

For purposes of this study, I included records only of decapods taken at 90 m or less. Bright and Pequegnat (1974) noted that the hard-bottom fauna rarely extended below 280 feet (85 m). Records of species came from published records in Pequegnat and Ray (1974), Rezak et al. (1985), and Kennedy et al. (1980) if the species came from 90 m or less. I did not include records that were not identified to species unless the record represented

the only report of a genus or a family. Except as noted in Table 1, specimens of these species are present in the TCWC. All catalog numbers are from the TCWC. Most of the species reported in these works were identified by Linda Pequegnat and James Ray of TAMU. (See Ray, 1974, for further information on use of material for comparison and identifications verified by other biologists.) Patsy McLaughlin, Western Washington University, identified *Catapagurus sharreri* and *Paguristes oxyophthalmus,* and Darryl Felder, University of Louisiana, Lafayette, identified *Pilumnus floridanus.*

For species representing first records for the FGBNMS, I have provided data for the specimens or photographs on which the record is based. Unless otherwise noted, only one specimen is present in a particular lot. Unless otherwise noted, identifications are made by me or were verified by me.

Since 1990, I have collected and identified decapods taken by SCUBA diving at 20–35 m at the FGBNMS. I took care to collect in what I believed to be previously understudied habitats: shale rubble, mooring lines, and octopus middens. I also identified 10 specimens taken from coral rubble during ROV operations.

Collections made before 1992, when the FGBNMS was established, could be made by destructive means such as breaking coral heads and sponges. Today, use of such techniques is discouraged, as is the use of rotenone or other poisons or narcotics. Some fast-moving carideans (such as *Cinetorhynchus manningi*) have been photographed but not yet collected. Other species either seem to be very rare (such as *Lysmata grabhami*) or belong to edible species (such as *Panulirus argus*) that may be recovering from constant collecting before establishment of the Sanctuary. I am hesitant to collect specimens of such species. I sight-identified species in the field while SCUBA diving if, on the basis of my experience, the species had characteristic color marks or was so large (as in the case of *P. argus*) that there was no chance of misidentification. In Table 1, I indicated that a species was sight-identified by the abbreviation "Obs."

When possible, I documented species that were not collected with photographs taken with a Nikonos V underwater camera. Copies of these photographs are on file at the FGBNMS office. I also identified species from photographs in the files of the FGBNMS office by ROV or volunteer divers. Species identified from photographs are given the notation "Ph" in Table 1, whether I also sight-identified them underwater or not. Also included are records of species and their natural history reported in my diving logbooks and among my personal photographs.

The estimated number of species should be regarded as conservative. Many species have not been identified or are known only from pieces, larval stages, or badly preserved material. Comparisons between banks are hindered by sampling bias. At least two species of snapping shrimp (*Alpheus* spp.) and a large, brown *Pagurus* sp. have yet to be collected or photographed. The East Flower Gardens Bank has received the least attention in collecting.

In the text that follows and in Table 1, the following abbreviations are used: WFG = West Flower Garden Bank, EFG = East Flower Garden Bank, and STB = Stetson Bank; FGB proper = East and West Banks, excluding the production platform (High Island A389-A = PLA) and STB. Species taken or photographed only at more than 40 m are so noted because this is the practical depth limit for most SCUBA diving. Depth and community zonation follow Bright and Pequegnat, 1974: High Diversity Coral Reef, at 36 m or less; Leafy Algal/*Madracis* Zones, at 27 to 46 m; Low Diversity Reef and Algal-Sponge Zones, 36–88 m; and Transition Zone and Drowned Reefs, at 50–90 m. Classification to family follows Martin and Davis (2001). Common names follow Williams et al. (1989).

## Results

A total of 106 species of decapods have been recorded at FGBNMS. A species list is given in Table 1. The most species-rich groups are the Alpheidae, Palaemonidae, Diogenidae, Paguridae, Mithracidae, and the four families of the superfamily Xanthoidea (Carpiliidae, Panopeidae, Pilumnidae, Xanthidae s.s., and Trapeziidae, previously all placed in the family Xanthidae). The WFG has the greatest number of recorded species (60), followed by EFG (46), STB (45 species, 14 of which have not been reported elsewhere in the FGBNMS), and PLA (7).

Penaeoid shrimp for the most part are absent from samples taken in the FGBNMS. Photographs of a penaeoid, *Metapenaopsis goodei,* were taken near a sand patch at EFG. Species of *Lucifer* are planktonic and were caught accidentally in a benthic sampling device.

The banded coral shrimp *Stenopus hispidus* lives in cracks and holes at all three banks. It may cohabit holes of the purplemouth moray, *Gymnothorax vicinus,* and the spotted moray, *G. moringa. Stenopus scutellatus* is common under


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TABLE 1. Annotated species list of decapod crustaceans of the Flower Gardens Banks National Marine Sanctuary.

Infraorder Penaeoidea
Family Penaeidae
*Metapenaeopsis goodei* (Smith, 1885)?: EFG (Ph) (1)
Family Solenoceridae
*Mesopenaeus tropicalis* (Bouvier, 1905): EFG, 40+
Family Luciferidae
*Lucifer* sp.: EFG
Infraorder Stenopodidea
Family Stenopodidae
*Stenopus hispidus* (Olivier, 1811): STB, EFG, WFG
*Stenopus scutellatus* Rankin, 1898: STB, WFG (2)
Infraorder Caridea
Family Alpheidae
*Alpheopsis labis* Chace, 1972: WFG, 40+
*Alpheus amblyonyx* Chace, 1972: EFG, WFG, 40+
*Alpheus beanii* Verrill, 1922: EFG, 40+
*Alpheus belli* Coutiere, 1898: WFG, 40+
*Alpheus cristulifrons* Rathbun, 1900: WFG
*Alpheus cylindricus* Kingsley, 1878: WFG
*Alpheus hortensis* Wicksten and McClure, 2003: STB, EFG, WFG (3)
*Alpheus paracrinitus* Miers, 1881: WFG
*Automate evermanni* Rathbun, 1901: STB, EFG, WFG, 40+
*Salmoneus ortmanni* (Rankin, 1898): EFG, 40+
*Synalpheus agelas* Pequegnat and Heard, 1979: WFG
*Synalpheus apioceros* Coutiere, 1909: STB, WFG* (4)
*Synalpheus bousfieldi* Chace, 1972: WFG (5)
*Synalpheus fritzmuelleri* Coutiere, 1909: EFG
*Synalpheus herricki* Coutiere, 1909: EFG
*Synalpheus minus* (Say, 1818): STB
*Synalpheus pandionis* Coutiere, 1909: WFG
*Synalpheus townsendi* Coutiere, 1909: STB, EFG, WFG (6)
Family Disciadidae
*Discias* sp.: WFG
Family Hippolytidae
*Latreutes fucorum* (Fabricius, 1798): STB, WFG
*Lysmata grabhami* (Gordon, 1935): STB, WFG(Ph)* (7)
*Thor amboinensis* (De Man, 1888): STB (Ph)* (8)
*Thor floridanus* Kingsley, 1878: WFG (9)
Family Palaemonidae
*Brachycarpus biunguiculatus* (Lucas, 1849): STB, EFG, WFG, PLA
*Leander tenuicornis* (Say, 1818): STB, WFG
*Periclimenaeus bredini* Chace, 1972: EFG, WFG, 40+
*Periclimenaeus* cf. *perlatus* (Boone): EFG (10)
*Periclimenes americanus* (Kinglsey, 1878): WFG
*Periclimenes harringtoni* Lebour, 1949: WFG, 40+
*Periclimenes pandionis* Holthuis, 1951: WFG, 40+
*Periclimenes pedersoni* Chace, 1958: EFG, WFG (Ph, Obs)* (11)
*Pontonia miserabilis* Holthuis, 1951 STB* (12)
*Tuleariocaris neglecta* Chace, 1969: WFG
Family Pasiphaeidae
*Leptochela bermudensis* Gurney, 1939: STB, EFG, 40+
Family Processidae:
*Processa fimbriata* Manning and Chace, 1971: WFG
*Processa hemphilli* Manning and Chace, 1971: EFG, 40+
Family Rhynchocinetidae
*Cinetorhynchus manningi* Okuno, 1996: WFG (Ph)* (13)
*Cinetorhynchus rigens* (Gordon, 1935): EFG, WFG
Infraorder Palinura
Family Palinuridae
*Panulirus argus* (Latreille, 1804): STB, WFG (Ph, Obs) (14)
*Panulirus guttatus* (Latreille, 1804): EFG (Ph, Obs)* (15)
Family Scyllaridae
*Parribacus antarcticus* (Lund, 1793): EFG, WFG* (Ph, Obs) (16)
*Scyllarides aequinoctialis* (Lund, 1793): EFG, WFG
*Scyllarides nodifer* (Stimpson, 1866): STB* (17)
Family Synaxidae
*Palinurellus grundlachi* (Von Martens, 1878): EFG
Infraorder Thalassinidea
Family Axiidae
*Coralaxius* sp.: EFG, WFG (18)
Family Callianassidae, unidentified: STB
Infraorder Anomura
Family Diogenidae
*Calcinus tibicen* (Herbst, 1791): STB, EFG, WFG
*Dardanus fucosus* Biffar and Provenzano, 1972: STB, EFG, WFG (19)
*Paguristes cadenati* Forest, 1954: EFG, WFG
*Paguristes grayi* Benedict, 1901: WFG
*Paguristes oxyophthalmus* Holthuis, 1959: WFG, 40+
*Paguristes sericeus* A. Milne-Edwards, 1880: STB, WFG
*Paguristes tortugae* Schmitt, 1933: WFG (20)
*Petrochirus diogenes* (Linnaeus, 1758): STB (Ph)* (21)
Family Paguridae
*Catapagurus sharreri* A. Milne-Edwards, 1880: EFG, 40+
*Iridopagurus caribbensis* (A. Milne-Edwards and Bouvier, 1893): WFG* (22)
*Pagurus annulipes* (Stimpson, 1860): WFG
*Pagurus brevidactylus* (Stimpson, 1859): STB, EFG, WFG (23)
*Phimochirus holthuisi* (Provenzano, 1961): STB*(24)
*Phimochirus operculatus* (Stimpson, 1859): WFG
*Phimochirus randalli* Provenznao, 1961: WFG (25)
Family Galatheidae
*Galathea rostrata* A. Milne-Edwards, 1880: STB, 40+
*Munida angulata* Benedict, 1902: WFG, 40+
*Munida pusilla* Benedict, 1902: WFG, STB, PLA*(26)
*Munida simplex* Benedict, 1902: EFG, 40+
Infraorder Brachyura
Family Homolidae
*Homola barbata* (Fabricius, 1793): EFG, 40+

TABLE 1. Continued.

Family Dromiidae
*Dromia erythropus* (Edwards, 1771): STB, EFG
*Hypoconcha parasitica* (Linnaeus, 1763): STB* (27)
Family Calappidae
*Calappa* spp.: STB, EFG (Ph) (28)
Family Leucosiidae
*Callidactylus asper* Stimpson, 1871: STB
*Lithadia* cf. *L. cumingi* Bell, 1855: EFG, 40+
Family Inachidae
*Stenorhynchus seticornis* (Herbst, 1788): STB, EFG, WFG, PLA
Family Mithracidae
*Hemus cristulipes* A. Milne-Edwards, 1875: STB* (29)
*Macrocoeloma trispinosum*, (Latreille, 1825): STB, EFG
*Microphrys antillensis* Rathbun, 1920: STB* (30)
*Nemausa acuticornis* (Stimpson, 1870): STB* (31)
*Mithraculus forceps* (A. Milne-Edwards, 1875): EFG, WFG
*Mithrax hispidus* (Herbst, 1790): STB, EFG, WFG
*Mithrax verrucosus* H. Milne-Edwards, 1832: STB (Ph)* (32)
*Stenocionops furcata coelata* (A. Milne-Edwards, 1878): STB* (33)
*Teleophrys pococki* Rathbun, 1924?: STB, EFG, PLA* (34)
Family Parthenopidae
*Cryptopodia concava* Stimpson, 1871: STB, 40+
Family Portunidae
*Portunus anceps* (Saussure, 1858): STB* (35)
*Portunus sebae* (H. Milne-Edwards, 1834): EFG (Ph)* (36)
Family Carpiliidae
*Carpilius corallinus* (Herbst, 1783): WFG
Family Panopeidae
*Actaea acantha* (H. Milne-Edwards, 1834): EFG* (37)
*Actaea bifrons* Rathbun, 1898: WFG, 40+* (38)
*Melybia thalamita* Stimpson, 1871: WFG
*Micropanope spinipes* A. Milne-Edwards, 1880: WFG
*Paractaea rufopunctata nodosa* Stimpson, 1860: STB, WFG, PLA
*Platyactaea setigera* H. Milne-Edwards, 1834: STB
*Pseudomedaeus agassizii* (A. Milne-Edwards, 1880): STB, PLA
Family Xanthidae
*Hexapanopeus lobipes* (A. Milne-Edwards, 1880): EFG, WFG* (39)
*Hexapanopeus paulensis* Rathbun, 1930: STB
Family Pilumnidae
*Lobopilumnus agassizii* (Stimpson, 1871): STB
*Pilumnus floridanus* Strimpson, 1871: STB, EFG, WFG, PLA
*Pilumnus sayi* Rathbun, 1897?: EFG (40)
Family Trapeziidae
*Domecia hispida* Eydoux and Souleyet, 1842: EFG, WFG
Family Pseudorhombilidae
*Nanoplax* sp.?: WFG (41)
Family Pinnotheridae
*Parapinnixa bouvieri* (Rathbun, 1891): WFG, 40+ (42)

[a] Key: 40+ indicates that the species only has been taken deeper than 40 m; Ph, identified from photograph without specimen; Obs, identified by observation by author while diving; and *, first record from FGBNMS.

[b] Notes: 1. This is a tentative identification from a photograph taken at night in 2001 by Frank and Joyce Burek. This species has been collected at 28-Fathom Bank on 10 Oct. 1978, 54 m, #2–6836. It has been observed by divers in a similar habitat elsewhere in the greater Caribbean region (Humann and DeLoach, 2002).

2. The golden coral shrimp was collected at WFG on 26 March 1972, 26 m, sta. 72-0324-VI, #2–2738. I observed it at STB on the following dates: 7–8 June 1998, 10 Sept. 1999, 29 Feb. 2000, 30 July 2002, 2–4 Sept. 2003, and 14 June 2004. It was photographed at STB by Frank and Joyce Burek in 2002.

3. This species previously was identified as *Alpheus* sp. by Pequegnat (1974, p. 247).

4. This specimen was collected on 26 June 2001 (#2–7759).

5. This species previously was identified as *S. tanneri*; however, considerable confusion remains over the differences between *S. tanneri* and *S. bousfieldi*. The material from FGBNMS may contain both species.

6. Ray (1974) reported *Synalpheus townsendi scaphoceris* and typical *S. townsendi* from FGBNMS. I reexamined these specimens. The shape of the blade of the scaphocerite and its length relative to the end of the antennular peduncle do not match the description of *S. townsendi scaphoceris*. All are typical *S. townsendi*.

7. The cleaner shrimp (*Lysmata grabhami*) has an unmistakable color pattern. (See Humann and DeLoach, 2002, p. 171, for a photograph.) It was photographed by ROV at WFG, 83 m, on 19 Feb. 2001, and by Frank and Joyce Burek at STB in 2004. Rezak et al. (1985) reported this species (as *Hippolysmata grabhami*) from the "mid-shelf claystone/siltstone banks" but did not deposit a specimen in the TCWC. Dardeau et al. (1980, as *L. amboinensis*) reported this species from near the Florida Middle Ground. The FGBNMS office also has photos of this species taken by ROV at Diaphus Bank, 92 m, 29 Sept. 2003 and Geyer Bank, 73 m, 6 Sept. 2004.

8. *Thor amboinensis* has an unmistakable color pattern. (See Humann and DeLoach, 2002, p. 173, for a photograph.) A single individual was photographed by Frank and Joyce Burek on 10 Aug. 2004. At present, this species is considered to live in both the Caribbean and the Indo-Pacific regions, but there may be distinct but similar species in the two areas.

9. This species previously was identified as *Thor* sp. (near *T. amboinensis*) by Pequegnat (1974, p. 251). I reexamined the specimen (#2–6822). The supraorbital spine does not match that of *T. amboinensis*.

10. There are seven specimens of this species from EFG, 31 Sept. 1978, 16–120 m, #2–6560. Linda Pequegnat noted on the specimen label that the major second chela was "more inflated and textured" than illustrated for *Periclimenaeus perlatus*. The shape of the rostrum also is similar to that of *P. bermudensis*, but the shape of the tooth on the fixed finger of the major chela is very different in that species.

11. Pederson's cleaner shrimp was photographed by ROV at EFG on 5 Aug. 2003, 90 m and then seen by me at WFG on 6 Aug. 2004, 22 m. This species also was photographed by ROV on McGrail Bank, 30 July 2003, and Bright Bank, 4 Aug. 2003, 51 m. (See Humann and DeLoach, 2002, p. 177 ,for a photograph.)

12. The specimen (#2–7010) was taken from an ascidian on a mooring line near the surface on 23 June 1998.

13. I follow the generic placement established by Okuno (1997) for rhynchocinetid shrimp. *Cinetorhynchus manningi* was identified from a photograph taken by Frank and Joyce Burek in 2001. This species has a distinctive color pattern of red bands and white spots. (See Humann and DeLoach, 2002, p. 185, for a photograph.)

14. Pequegnat and Ray 1974, p. 239, fig. 29, (as *?Panulirus argus*) gave records and a photograph of the Caribbean spiny lobster. They noted that "the specimens were not brought back to the laboratory for detailed examination." There are no specimens of this species from FGBNMS


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rocks and in holes at Stetson Bank, but there is only one report of this species from the FGB proper.

As is typical on tropical and subtropical reefs, the two most common families of the infraorder Caridea are the Alpheidae, especially species of *Alpheus* and *Synalpheus* spp., and the Palaemonidae. Members of both families are particularly common among rocks rubble and algal nodules; however, because of small size and cryptic habitat, they are rarely observed. The species of the Alpheidae at the FGBNMS have not been observed to form symbiotic associations with other organisms except for *S. agelas,* which lives among sponges. Three species of the Palaemonidae form symbiotic associations at the Banks: *Tuliareocaris neglecta,* with the sea urchins *Diadema antillensis* and *Astropyge magnifica; Periclimenes pedersoni,* with the sea anemones *Condylactis gigantea* and *Bartholomea annulata;* and *Pontonia miserabilis,* with an unidentified solitary ascidian. *Leander tenuicornis* lives among brown algae, *Sargassum* spp. Although no host was recorded for the single specimen taken, species of *Discias* often live within sponges.

Members of other caridean families are represented by four species or less. The night shrimps, *C. rigens* and *C. manningi,* live on the FGB proper. *Latreutes fucorum* lives among *Sargassum* spp. The scarlet-backed cleaner shrimp *L. grabhami* lives alone or in pairs in cracks in rocks. It was photographed when cleaning a purplemouth moray at STB. *Thor amboinensis* usually lives in association with corals or sea anemones, but the individual photographed at STB was living by itself. The other carideans at FGBNMS, listed in Table 1, were collected in dredges or box cores and have not been observed in life.

TABLE 1 Continued

in the TCWC. I observed and photographed this spiny lobster at Stetson Bank on 29–30 May 2003 and 14–15 June 2004. There is no other spiny lobster of this size or color pattern in the Gulf of Mexico. (See Humann and DeLoach, 2002, p. 189, for a photograph.)

15. I observed and photographed the spotted spiny lobster at night on 7 Aug. 2004. There is no other spiny lobster with this color pattern in the Gulf of Mexico. (See Humann and DeLoach, 2002, p. 191, for a photograph.)

16. I observed and Frank Burek photographed the sculptured slipper lobster at night on 6 Aug. 2004. Frank and Joyce Burek also photographed this species in 1999 and 2002. (See Humann and DeLoach, 2002, p.193, for a photograph.)

17. One specimen of the ridged slipper lobster was collected from STB, 3 Sept. 1976, 22–25 m, sta. 76G6-2, #2–3316. I observed and photographed the ridged slipper lobster on 30 May 2003 and 15 June 2004. (See Humann and DeLoach, 2002, p. 195, for a photograph.)

18. According to the crustacean catalog, six specimens of this axiid were sent to Brian Kensley, U.S. National Museum of Natural History (USNM) for identification. These have not been returned.

19. The specimens from WFG previously were identified as *Dardanus venosus* (Pequegnat, 1974, p. 240).

20. This species was identified by J. P. Ray (#2–6260). According to Rafael Lemaitre (USNM), there is considerable confusion regarding the identification of species of *Paguristes* in the Gulf of Mexico.

21. Identification is based on video footage obtained by Emma Hickerson, FGBNMS, on 30 May 2003 at a depth of approximately 21 m. There is no other hermit crab in the Gulf of Mexico that grows to such a large size.

22. This species was taken on 24 Feb. 2000 at 23 m (#2–7146).

23. This species previously was identified as *Pagurus miamiensis* by Pequegnat (1974, p. 243)

24. This specimen was taken on 8 June 1999, 22–25 m, #2–7000.

25. This species originally was identified as *Pylopagurus randalli.* The generic name has been changed (McLaughlin, 1981).

26. This species was taken at PLA on 16 July 1992, 15 m, #2–7015 and at STB on 17 May 2002, 23 m, #2–8153; 30 July 2002, 23–26 m, #2–84336, and 2 Sept. 2003, 27 m, #2–8866.

27. This species was taken on 29 May 2003, 24 m, #2–8764. The rough shellback crab previously was known as *Hypoconcha sabulosa* (Herbst, 1799), but that name has been found to be a junior synonym of *H. parasitica* (Holthuis and Manning, 1987).

28. Juvenile box crabs were photographed by Frank and Joyce Burek in 2002.

29. This species was taken on 29 May 2003, 24 m, #2–8765.

30. This species was taken on 15 July 1998, 27 m, #2–6999.

31. This species was taken on 9 June 1999, 22–25 m, #2–6996 and 1 March 2000, 23 m, #2–7152.

32. This species was photographed at night on 3 Sept. 2003, 24 m.

33. This species was taken on 8 June 1999, 24 m, #2–6995.

34. This species has not been reported previously from the Gulf of Mexico. Rathbun (1925) gave the range as Curacao and Brazil, and the related *T. ornatus* from northeast Yucatan, Puerto Rico, St. Croix, and Fernando de Noronha, Brazil. The specimens examined correspond to *T. pococki,* not *T. ornatus,* in having a carapace markedly broader than long. The posterior armature of the ambulatory legs differs from that illustrated for *T. ornatus* by Rathbun in lacking pronounced lobes and tubercles. There are three lots in the TCWC: EFG, 24 Feb. 2000, mooring line, 10 m, #2–7150, 7 specimens; STB, 7 June 1999, surface, #2–7009, 2 specimens; PLA, 9–13 June 1992, 27 m, 3 specimens. Darryl Felder also has examined material of this species and agrees on the identification.

35. This species was taken on 28 Aug. 2001, 21–24 m, #2–7817.

36. This species was photographed by Frank and Joyce Burek at EFG in 2001. It is the only portunid with the characteristic "eyespots" on the carapace. (See Humann and DeLoach, 2002, p. 215 for a photograph.)

37. This specimen was taken on 7 Sept. 2004, 23 m, from octopus midden, #2–8955.

38. This specimen was taken on 1 Dec. 1972, 55 m, #2–2847, identified by Linda Pequegnat.

39. This species originally was identified as *Micropanope nuttingi* (EFG, 16–120 m, submersible, sta. 78G9III-D-130, #2–7911), no record of identifier. The specimens do not match the illustrations and description of that species as given by Williams (1984). The carpus of the major chela bears pits, not spines. The merus of each ambulatory leg is markedly bilobed. Two more specimens were taken at STB, 26 June 2001, 22–24 m, #2–7769.

40. The crustacean catalog lists a specimen identified as *Pilumnus? sayi,* #2–6129, identified by T .W. Roberts. This specimen is missing. Other specimens identified by T. W. Roberts as "*Pilumnus ? sayi*" have since been identified as *P. caribaeus* Desbonne and Schramm, 1867.

41. This specimen was taken on 28 Feb. 2000, 23–24 m, #2–7147. Without a specimen of this genus for comparison, the identification remains uncertain.

42. Rezak et al. (1985) listed *Parapinnixa* sp. from the "Flower Gardens". A single specimen identified as *P. bouvieri* by L. Pequegnat, WFG, 55–57 m, #2–2845, is listed in the crustacean catalog but is missing. A checklist of species taken by box core at STB lists a broken specimen of *Pinnixa* sp., but this specimen also is missing.

The spiny lobster, *P. argus,* and the ridged slipper lobster, *Scyllarides nodifer,* have been seen and photographed repeatedly at WFG and STB. Other palinurans are known from one or two records. Lobster shrimps, family Axiidae, were taken in Van Veen grabs.

The most common anomurans are the hermit crabs. *Pagurus brevidactylus, Dardanus fucosus,* and *Calcinus tibicen* occur on all three banks. Other species live on the reefs or on adjacent sand flats. Galatheid crabs usually are taken at 40 m or more, but *Munida pusilla* has been collected by divers at STB and PLA.

Among the Brachyura, the most common are crabs of the superfamily Xanthoidea. The plumed hairy crab, *P. floridanus,* was found at all three banks. These crabs usually live under rocks or in coral rubble. The batwing coral crab, *Carpilius corallinus,* was reported by Pequegnat and Ray at WFG in 1974 and has been observed sporadically since then.

Spider crabs, families Mithracidae and Inachidae (formerly both considered to be subfamilies of the family Majidae), often are seen during night dives. Species of *Mithrax* are common under rocks or coral rubble. Arrow crabs (*Stenorhynchus seticornis*) are seen on almost every dive among cracks, in holes with morays, or near sea urchins. *Microphrys antillensis* and *Stenocionops furcata* are decorator crabs that cover themselves with pieces of algae and *Macrocoeloma trispinosum,* with sponges.

Brachyuran families that usually live in sand are more common at STB than on the FGB proper. One species each of the Leucosiidae and Parthenopiidae have been taken in box cores. Box crabs, *Calappa* spp., were photographed at EFG. Crabs of the families Homolidae and Dromiidae are found both on rocks and on sand. They often carry objects gripped by the dactyls of their posterior legs (Wicksten, 1986). *Homola barbata* has been photographed carrying a piece of a gorgonian. *Dromia erythropus* covers itself with a piece of sponge. *Hypoconcha parasitica* carries a single valve of a pelecypod over its dorsal surface.

## Discussion

The FGBNMS is limited in its species richness. The reefs are small, isolated from each other or other reefs, and topographically steep. Except for a small space on the supporting legs of PLA, there are no intertidal areas. On the FGB proper, the shallowest areas are at approximately 18 m. Stetson Bank, closer to shore and composed of soft sedimentary rock, lacks the High Diversity Reef zones observed on the FGB proper.

Water temperatures at the FGBNMS drop below 20 C every winter. Some tropical species do not range as far north as the FGBNMS: for example, *Mithrax spinosissimus,* the largest crab of the Caribbean region, has not been reported from the FGBNMS, although it lives at the Florida Keys. This crab, with a carapace width of up to 184 mm (Williams, 1984), would be difficult to overlook. Species may be absent because of cooler water temperatures that inhibit spawning or recruitment.

The two banks of the FGB proper both have coral caps interrupted by deep channels, overhangs, and patches of white sand. These constitute the High-Diversity Coral Reef. *Carpilius corallinus, P. pedersoni,* the two species of *Cinetorhynchus,* and *Domecia hispida,* reported at the FGB proper but not at STB, usually live on or near coral reefs. Just below the coral cap lies the Leafy Algae and *Madracis* zone, with small corals and dense growths of algae. At depths of 46 m, there are extensive fields of nodules of coralline algae in the Algal–Sponge zone. Many palaemonid and alpheid shrimp from WFG inhabit these zones. At 50 m or more are the transition zone and drowned reefs with a fauna containing comatulid crinoids, gorgonians, antipatharians, and sponges. Species present at these depths include *H. barbata* and *Munida* spp. Photographs and specimens taken by ROV at Diaphus Bank and by submersible vehicle or dredge at other banks suggest that at least 10 other decapod species may occur at 40 m or deeper at FGBNMS.

Much of the habitat at STB consists of high shale reefs, shale rubble, and coarse sand. The most common coral, *Madracis mirabilis,* is ahermatypic and does not form large mounds. There are many large sponges. Of the 14 species of decapods reported at STB but not at the FGB proper, six are either burrowers or inhabitants of sandy bottoms and four inhabit holes in shale.

Felder and Chaney (1979) studied decapods from Seven and One-half Fathom Reef (26°49.0′N 97°19.3′W), a rocky reef covered by a mat of fouling organisms (especially tubes of the polychaete *Phyllochaetopterus* sp.) This reef is much closer to shore than the FGBNMS and rises to a depth of less than 10 m. Of the 66 species recorded there, only 19 also occur at the Banks. Seven and One-Half Fathom Reef has more species typical of soft bottoms, such as shrimp of the families Penaeidae and Sicyonidae, the crabs *Persephona mediterranea* and *Hepatus epheliticus,* and six species of the family


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Portunidae. It also has four species of the family Porcellanidae, absent at the Bank. *Mithrax hispidus, D. hispida,* and many other species typical of coral reefs are absent from this reef, as are deeper reef inhabitants such as *Munida* spp.

At PLA, located 1.5 km east of EFG, decapods live in association with sponges and giant barnacles (*Megabalanus antillensis*) attached to the support beams. Of the six species that occur there, *S. seticornis, M. pusilla,* and *Brachycarpus biunguiculatus* also occur regularly on the FGB proper and STB. *Synalpheus fritzmuelleri, Hexapaneopus paulensis,* and *Paractaea rufopunctata* also have been reported from the FGB proper and STB but in association with mooring buoys or their lines. On other platforms, *S. fritzmuelleri* and *H. paulensis* commonly live in spaces between *M. antillensis* (Fotheringham and Brunenmeister, 1989). The giant barnacle is uncommon on the Banks, usually living at the apex of rocks at STB or on mooring lines. Biological interactions, perhaps predation or overgrowth of the barnacle by corals or sponges, may render the Banks inhospitable to some of the crabs and shrimp usually found on the platform.

Pequegnat and Ray (1974) stated that the crustacean fauna of WFG was tropical "in nature and origin, with definite southern (i.e., Caribbean) affinities." This conclusion holds true today for the decapod fauna of the FGBNMS as a whole. Except for the fauna associated with *Sargassum,* almost none of the species found at FGBNMS occur along shore in the northern Gulf of Mexico. The arrow crab *S. seticornis* and the giant hermit crab *Petrochirus diogenes* have been collected in the ship channels of Brownsville and Corpus Christi (MKW, field notes). The crabs, *Pachygrapsus transversus, Menippe adina* (as *M. mercenaria*), and *Cronius ruber,* although found on oil and gas platforms closer to shore (Fotheringham and Brunenmeister, 1989), have not been reported on PLA.

As is common in isolated habitats, some of the species at the FGBNMS may arrive and settle but eventually die out without establishing a breeding population. For example, only a single giant hermit crab, *P. diogenes,* has been observed at Stetson Bank (E. Hickerson, pers. comm.). Other species may move on or between banks. At STB, I observed spiny lobsters (*P. argus*) repeatedly at the same dens during May 2003, but these lobsters were not observed in Sep. 2003 after Hurricane Claudette passed through the area. In June 2004, spiny lobsters were back in the same area but not in the same dens.

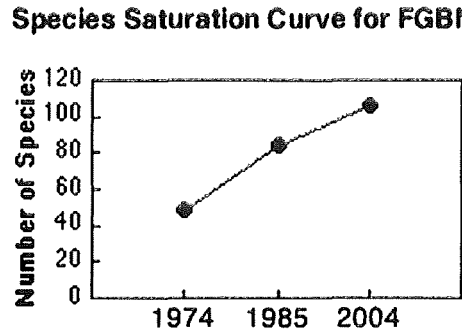


Fig. 1. Species saturation curve for FGBNMS. Number of species for 1974 is from Pequegnat and Ray (1974); number for 1985 includes species reported by Kennedy et al. (1980) and Rezak et al. (1985).

Figure 1 shows a species saturation curve starting with species numbers, as reported by Pequegnat and Ray (1974), adding species, reported by Kennedy et al. (1980) and Rezak et al. (1985), and ending with recent records including studies at Stetson Bank and by use of an ROV. The curve shows that addition of new species has decreased, suggesting that the rate of discovery of new species at the FGBNMS is slowing. It is likely that additional cryptic species live on the deeper reef slopes or may be carried in on drifting *Sargassum* spp.

Isolated by geology and distance from other coral reefs, the fauna of the FGBNMS offers opportunities for study of genetic isolation and species interactions. The reefs are too deep to be affected by all but the most severe weather and are far away from shore with its silt and multiple human-induced interactions. The decapod fauna is distinct from that of the nearest coastline in being of tropical affinities and inhabiting hard-bottom habitats.

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