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Russell E. Putt
Continental Shelf Associates, Inc.

David A. Gettleson
Continental Shelf Associates, Inc.

Neal W. Phillips
Continental Shelf Associates, Inc.

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FISH ASSEMBLAGES AND BENTHIC BIOTA ASSOCIATED WITH NATURAL HARD-BOTTOM AREAS IN THE NORTHWESTERN GULF OF MEXICO

Russell E. Putt, David A. Gettleson, and Neal W. Phillips
Continental Shelf Associates, Inc.
759 Parkway Street
Jupiter, FL 33458

ABSTRACT: We report new observations of fish and benthic invertebrate assemblages at shallow-water (<35 m depth), hard-bottom sites in the northwestern Gulf of Mexico. The biota of these previously unstudied areas and of three high-relief features in deeper water was observed during May 1980 using a combination of diver reconnaissance, videotape surveys, still-camera photography, and collection of invertebrates for identification. The six hard-bottom sites in shallow water typically comprised, small, often patchy, rock outcrops, and the associated sessile invertebrates included hydroids, bryozoans, sponges, octocorals, and ahermatypic stony corals. Sea urchins and arrow crabs were the most common motile epifauna. Fish assemblages were typified by red snapper, Atlantic spadefish, blue runner, gray triggerfish, sheepshead, and tomtate. Three deeper stations had many of the same fish and invertebrate species, but also possessed a more tropical assemblage including fire corals, antipatharians, spiny lobsters, and a variety of tropical fish species. Hermatypic corals characteristic of some large, offshore banks were not abundant at any of the sites.

Differences in the composition of fish assemblages between nearshore and deeper stations parallel those previously observed at petroleum platforms in the area. Shallow-water stations presumably experience a greater seasonal temperature range and lower absolute temperatures in winter and may be exposed to stresses such a lowered salinity and depleted oxygen levels due to their relative proximity to Mississippi River discharge. The fauna of these shallow hard-bottom sites has predominantly warm-temperate rather than tropical affinities.

Numerous hard-bottom areas or "natural reefs" are located in the northwestern Gulf of Mexico. The biota of large offshore reefs, snapper banks, and topographic highs in water depths greater than 60 m is well studied (Bright *et al.*, 1976; Sonnier *et al.*, 1976; Bright and Rezak, 1978a, b, 1981). The presence of small, hard-bottom features on the inner and middle shelf has been reported by local fishermen, and the locations of some of these features may have been recorded in the Sea Grant SNAG data (Graham, 1980), but most research concerning the biota of hard substrates in shallow waters has focused on oil production platforms (see review by Gallaway and Lewbel, 1982). A small reef in shallow water off South Padre Island, Texas, has been intensively investigated (Causey, 1969; McCarty, 1974; Felder and Chaney, 1979), but there have been no studies of reefs near the Louisiana coast. This paper presents qualitative observations of fish and invertebrate assemblages associated with previously unstudied, natural hard-bottom areas of the middle shelf off the Louisiana coast.

METHODS

Study Sites and Field Procedures

Nine hard-bottom sites were selected following discussions with commercial fishermen, dive-boat captains, and scientists knowledgeable of fish and epifaunal communities in the northwestern Gulf of Mexico. Of the nine sites, six (Stations A through F) were low-relief areas in shallow water (<35 m depth) and the remaining three (Stations G, H, and I) were high-relief features

in deeper water (Figure 1). Two of the deep-water sites had been surveyed previously. Station G, known locally as Jackaman's Hole, was studied by Sonnier *et al.* (1976; their Station A). Station I, or Sonnier Bank, was investigated by Sonnier *et al.* (1976) and Bright and Rezak (1978b).

The sites were surveyed during May 1980, using a combination of scuba-diver

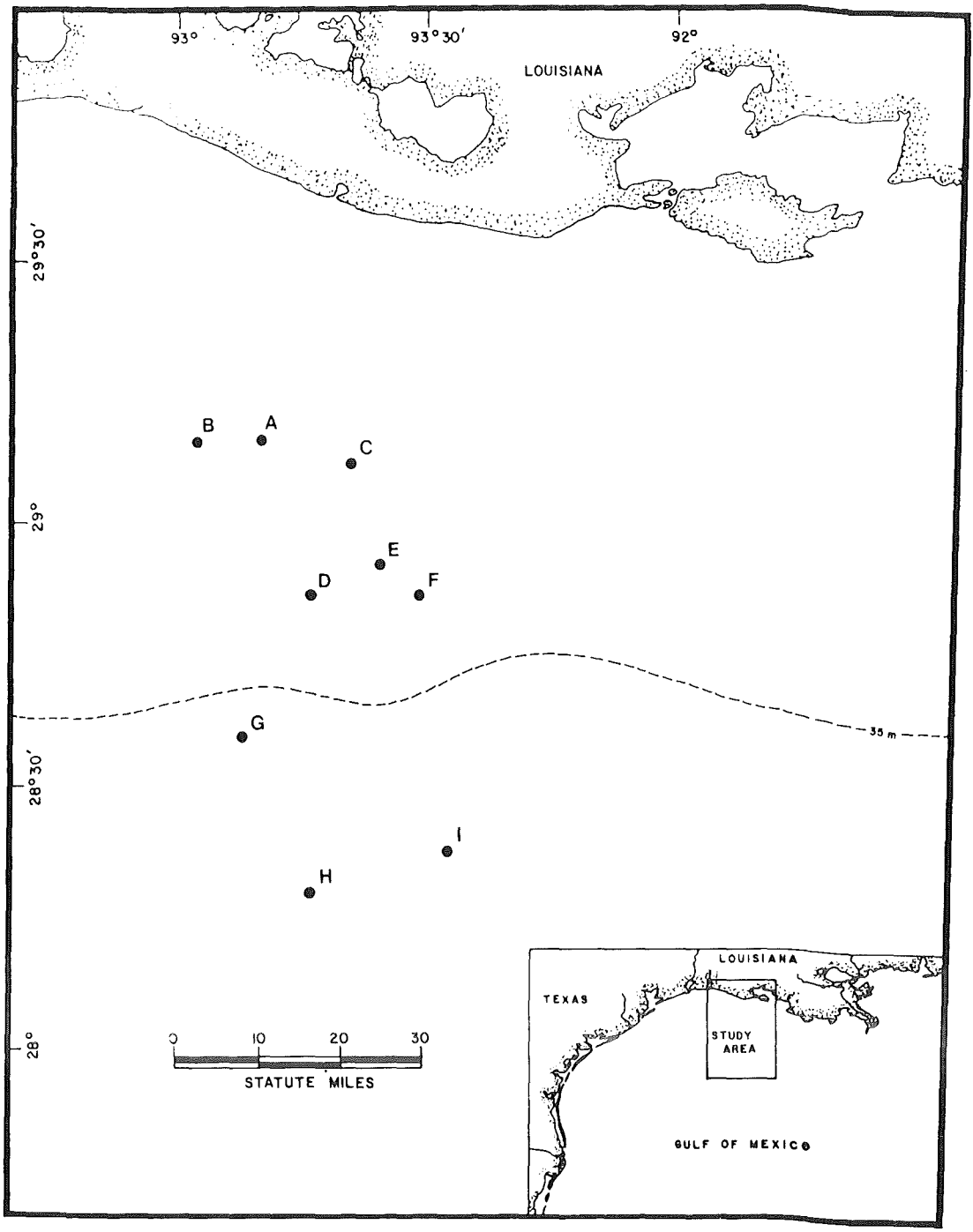

Figure 1. Chart of the study area showing station locations in the northwestern Gulf of Mexico.

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reconnaissance, underwater television, and still-camera photography. One station (G) was revisited in June 1980. Observations (one 15- to 30-min dive per station) were confined to depths of <30 m to avoid the need for decompression; thus, only the crests of the high-relief features in deeper water were studied. At each station, two divers recorded videotape observations using a Hydro Products Model TC-125 black and white underwater television camera coupled with a Model SC-303 television system control unit and a Sony Model AV-3650 videotape recorder. Observations were made while swimming along two perpendicular transects crossing each feature or station. Site characteristics were further documented using Nikonos II and III underwater 35-mm cameras with Subsea 100 and Sea-and-Sea 50 underwater strobes. While the other divers were completing videotape observations, two divers took close-up and wide-angle photographs of the epibenthos and fish populations and collected samples of the epibenthos at some stations for positive identification. At some stations, fishes were also collected by hook-and-line sampling. All samples were placed in glass jars with identification labels and preserved in either 10% buffered formalin or 70% ethanol, depending on the taxon collected. All observations concerning hydrographic (e.g., water clarity, temperature), structural (e.g., depth, size, area, relief), and biotic characteristics of the sites were recorded on audiotape and in field notebooks during debriefing sessions that followed each dive. These recorded observations were reviewed later to construct station descriptions.

Laboratory Procedures

Videotapes and photographs were reviewed in conjunction with audiotapes and field logs from debriefings to facilitate identification of fishes and epibenthos. Often the epibiota could not be identified to the species level, but the major taxa were noted and subjective assessments of biomass were recorded.

All samples were sorted to major taxa, stored in 70% ethanol (if not originally preserved in this solution), and subsequently identified to the lowest practicable taxonomic level. Common names for fish species cited in the text are those of Robins *et al.* (1980).

RESULTS

Physical characteristics of all sites are summarized in Table 1. Descriptions of sites and associated biota are given in the following sections, and phylogenetic lists of the invertebrate and fish taxa identified at each site are provided in Tables 2 and 3, respectively.

Shallow-Water Sites

The six shallow-water (<35m) hard-bottom sites consisted of small areas of low-relief (<1 to several meters) that were generally enveloped in a dense nepheloid layer (Table 1). The associated sessile epibiota included hydroids, bryozoans, ascidians, encrusting sponges, and some ahermatypic stony corals. Common fish species included Atlantic spadefish (*Chaetodipterus faber*), red snapper (*Lutjanus campechanus*), sheepshead (*Archosargus probatocephalus*), gray triggerfish (*Balistes capriscus*), and tomtate (*Haemulon aurolineatum*).

Station A: The hard substrate at this site consisted of a small area (about 20 m^2) of sheer rock outcrops rising 2 to 3 m from the seafloor and enveloped in a turbid nepheloid layer. Much of the bottom was covered by ascidians (*Distaplia bermudensis*) and colonial anemones. In addition, arrow crabs

Table 1. Summary of characteristics of hard-bottom areas surveyed.

Station	Location	Depth (m)	Approximate Relief (m)	Visibility (m)	Comments
Shallow					
A	29°09′24″N 92°50′20″W	21	2-3	1-2	Thermocline noted at 10 m depth.
B	29°08′02″N 92°58′48″W	20	3	3	Thermocline noted at 11 m depth. Gas seeps noted.
C	29°06′11″N 92°40′27″W	22	2-3	1-2	—
D	28°50′40″N 92°44′33″W	27	1-1.5	1-2	Gas seeps noted.
E	28°55′00″N 92°35′47″W	28	3.5	1-2	Thermocline noted at 15 m. Gas seeps noted.
F	28°52′39″N 92°30′08″W	29	2.5	1-2	Gas seep noted. White film present (sulfur bacteria)
Deep					
G (Jackaman's Hole)	28°36′26″N 92°53′52″W	43	25	10	—
H	28°19′48″N 92°43′16″W	61	30	20	Feature not previosly shown on MMS topographic maps.
I (Sonnier Bank)	28°20′47″N 92°27′15″W	58+	40	20	—

(*Stenorhynchus seticornus*), bryozoans (*Eschanira pesaneris*, Smittinidae sp.), hydroids (*Eudendrium carneum*), unidentified encrusting sponges, hard corals (*Oculina* cf. *diffusa*; possibly a branching form of *Astrangia*), octocorals [*Carejoa riisei* (Duchassaing and Michelotti, 1860); formerly *Telesto riisei*], and scattered gorgonians (*Leptogorgia virgulata*) were typical residents (Table 2).

Seven fish species were identified (Table 3): Atlantic spadefish, belted sandfish (*Serranus subligarius*), blue runner (*Caranx crysos*), gray triggerfish, red snapper, sheepshead, and tomtate. Red snapper was the most abundant.

Station B: This site consisted of a narrow (<3 m wide) band of silt-covered rock outcrops, up to 3 m in relief, running east-west for a distance of at least 76 m. Several gas seeps were observed bubbling from the seafloor. The epibiota included arrow crabs, ascidians, bryozoans, hard corals, bushy hydroids, and unidentified encrusting sponges (Table 2). Fishes observed near the rock outcrops included Atlantic spadefish, cocoa damselfish (*Pomacentrus variabilis*), gray snapper (*Lutjanus griseus*), red snapper, and sheepshead (Table 3).

Station C: A small (30 m diameter) area of sediment-covered rock outcrops rising 2 to 3 m out of a soft mud-silt bottom at 22 m depth comprised the hard

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bottom at this site. Epibiota included colonial anemones, ascidians, bryozoans, corals, scattered gorgonians, and hydroids (Table 2). Numerous arrow crabs and urchins (*Arbacia punctulata*) were also present. Fishes observed near the outcrops were Atlantic spadefish, remora (*Remora remora*), cubbyu (*Equetus umbrosus*), gray triggerfish, vermilion snapper (*Rhomboplites aurorubens*) and red snapper (Table 3). Extremely turbid water hampered visual assessment of the fish populations.

Station D: Low-relief (1 to 1.5 m) rock outcrops on a sandy bottom at 27 m depth were identified over an area of several hundred square meters at this station. Several gas seeps were observed in the area. The scattered rocky patches supported a relatively large number of hard corals (*Oculina* cf. *diffusa* and *Phyllangia americana*), sea whips (*Leptogorgia setacea* and *L. hebes*), and sponges (*Ircinia* sp.). Low visibility and the scattered nature of the hard substrate prevented divers from identifying any predominant reef feature. Nine species of fishes were identified. Blue runner, red snapper, rock hind (*Epinephelus adscensionis*), and tomtate appeared to be the most abundant, but belted sandfish, cubbyu, whitespotted soapfish (*Rypticus maculatus*), grouper (*Mycteroperca* sp.), and cocoa damselfish were also present.

Station E: The hard bottom at this site was a series of rock outcrops rising from a soft, muddy seafloor at 28 m depth. Numerous gas seeps were observed bubbling intermittently from fissures in the outcrops. The rock substrate was covered by a thick mat of bryozoans (*Hippopetraliella marginata*) and hydroids. Small colonies of corals (*Oculina* cf. *diffusa*), numerous arrow crabs, and gastropods (*Vermicularia knorri*) were also observed (Table 2).

Only six species of fishes [Atlantic spadefish, gray triggerfish, red snapper, tomtate, squirrelfish (*Holocentrus ascensionis*), and southern stingray (*Dasyatis americana*)] were identified at the site. Red snapper was the most abundant.

Station F: An area of broken bottom with rock outcrops of up to 2.5 m relief was noted running east-west at this station. Rock outcrops were similar to those observed at Station E and were entirely enveloped by the nepheloid layer that extended from about 21 m depth to the bottom (29 m).

The rocks at this site were laced with cracks and fissures, and numerous gas seeps were observed. Rocks surrounding the point of gas escape were covered by an unidentified white material (possibly a filamentous green alga, or sulfur bacteria). Other hard surfaces were covered by bryozoans, scattered hard corals (*Oculina* cf. *diffusa* and *Phyllangia americana*), and thick growths of hydroids (*Sertularella* sp.). The epibenthic community also included numerous arrow crabs, gorgonians, octocorals, and urchins (Table 2). Fishes observed included belted sandfish, gray triggerfish, red snapper, tomtate, and cubbyu (Table 3).

Deep-Water Sites

The deeper-water sites generally consisted of high-relief features whose crests extended into clear water and were colonized by more tropical assemblages of invertebrates and fishes.

Station G: This site, known as Jackaman's Hole, consisted of a large rock outcrop and a depression on an otherwise flat bottom at 37 m depth. Water depth within the "hole" was about

Table 2. Phylogenetic list of invertebrate taxa found at hard-bottom study sites. Symbols: (x) denotes a collected specimen, (*) denotes identification by visual observation.

Taxon	Stations								
	Shallow						Deep		
	A	B	C	D	E	F	G	H	I
PORIFERA									
Agelas clathrodes	-	-	-	-	-	-	-	-	X
Agelas sp.	-	-	-	-	-	-	-	*	-
Bubaris mastophora	-	-	-	-	-	-	-	X	-
Ircinia sp.	-	-	-	*	-	-	-	*	*
Neofibularia nolitangere	-	-	-	-	-	-	-	*	*
Strongylophora sp.	-	-	-	-	-	-	-	-	X
CNIDARIA									
HYDROZOA									
Aglaophenia elongata	-	*	X	X	-	-	-	-	-
Eudendrium carneum	X	*	X	-	-	-	-	-	-
Millepora sp.	-	-	-	-	-	-	-	*	*
Sertularella sp.	-	-	-	-	-	X	-	-	-
ANTHOZOA									
Carejoa (Telesto) riisei	*	-	-	-	-	*	*	-	-
Cirrhipathes sp.	-	-	-	-	-	-	-	*	-
Colonial Zoanthid	X	-	*	-	-	-	-	-	-
Leptogorgia setacea	-	-	-	X	-	-	-	-	-
Leptogorgia sp.	-	-	*	-	-	*	-	-	-
Leptogorgia virgulata	*	-	-	-	-	-	-	-	-
Lophogorgia hebes	-	-	-	X	-	-	-	-	-
Oculina cf. *diffusa*	*	*	*	*	*	*	X	-	-
Phyllangia americana	-	-	-	*	-	X	-	-	-
Porites sp.	-	-	-	-	-	-	-	*	-
Siderastrea radians	-	-	-	-	-	-	X	-	-
Stephanocoenia sp.	-	-	-	-	-	-	-	-	*
ANNELIDA									
POLYCHAETA									
Filograna sp.	-	-	-	-	*	-	*	-	-
Hermodice carunculata	-	-	-	-	-	-	-	-	*
Spirobranchus giganteus	-	-	-	-	-	-	-	-	*
MOLLUSCA									
GASTROPODA									
Astrea tecta tecta	-	-	-	-	-	-	-	-	X
Cerithium litteratum	-	-	-	-	-	-	-	-	X
Conus ermineus	-	-	-	-	-	-	X	-	-
Diodora cayenensis	-	-	-	X	-	-	-	-	-
Muricanthus fulvescens	-	X	-	-	-	-	-	-	-
Vermicularia knorri	-	-	-	-	X	-	-	-	-
BIVALVIA (PELECYPODA)									
Lima scabra	-	-	-	-	-	-	-	-	X
Ostrea equestris	-	-	-	X	-	-	-	-	-
Pinna carnea	-	-	-	-	-	-	-	-	X
Pododesmus rudis	-	-	-	X	-	-	-	-	X
Pteria colymbus	-	-	-	X	-	-	-	-	-
Spondylus americanus	-	-	-	-	-	-	-	-	*
ARTHROPODA									
CRUSTACEA									
Panulirus argus	-	-	-	-	-	-	-	*	X
Stenorhynchus seticornis	*	*	*	-	*	*	-	-	-

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Table 2 (Continued)

BRYOZOA									
Celleporaria cf. *albirostris*	-	-	-	x	-	-	-	-	-
Cleidochasma contractum	-	-	-	x	-	-	-	-	-
Eschanira pesaneris	x	-	-	x	-	-	-	-	-
Hippopetraliella marginata	-	-	-	-	x	-	-	-	-
Microporella tractabilis	-	-	-	x	-	-	-	-	-
Smittinidae sp.	x	-	-	-	-	-	-	-	-
ECHINODERMATA									
Arbacia punctulata	-	*	*	*	-	*	*	-	*
Diadema antillarum	-	-	-	-	-	-	*	-	-
Echinaster sp.	-	-	x	x	-	-	-	-	-
Isostichopus sp.	-	-	-	-	-	-	*	*	-
UROCHORDATA									
ASCIDIACEA									
Distaplia bermudensis	x	x	-	-	-	-	-	-	-

43 m, and the peak of the hard-bottom feature was within 18 m of the surface. Rock outcrops in the form of ridges and hummocks were observed atop this feature, with reliefs ranging from 3 to 5 m. In contrast to the observations at shallow stations, visibility was excellent (>10 m).

Epibiota included bryozoans, hard corals (*Oculina* cf. *diffusa* and *Siderastrea radians*), octocorals, gastropods (*Conus ermineius*), hydroids, and urchins (*Diadema antillarum* and *Arbacia punctulata*) (Table 2).

Although 22 species of fishes were identified at this site (Table 3), their abundance appeared to be low. Many species such as blue angelfish (*Holacanthus bermudensis*), French angelfish (*Pomacanthus paru*), queen angelfish (*H. ciliaris*), spotfin butterflyfish (*Chaetodon ocellatus*), and Spanish hogfish (*Bodianus rufus*) are considered tropical forms. Vermilion snapper, the only commercially exploited fish species observed, was present at low densities.

When Station G was visited again one month later (June 1980), striking temporal variations in fish abundance were apparent. On 2-3 June, large schools of greater amberjack (*Seriola dumerili*), tomtate, and vermilion snapper were observed above the peak of the hard-bottom feature. These schools included hundreds of individuals of each species, in sharp contrast to the low numbers observed earlier. Small populations of demersal fishes including angelfishes, bigeye (*Priacanthus furcifer*), and yellowtail reeffish (*Chromis enchrysurus*) were present at the periphery of the bank. Numerous large rays (*Dasyatis* cf. *americana*) with wing spreads of >1 m were seen near the bottom on each of several dives. On 4 June, divers recorded a strong current (estimated at >1 kn) flowing across the bank, and fish populations were low. Only scattered groups of greater amberjack, tomtate, and vermilion snapper were observed, and these occurred off to the sides of the peak. The rays were absent, but demersal fish populations were similar to those observed on the previous day. A large school (30 to 50) of blue runner was observed near the surface. Although these observations were not quantitative, they indicate the potential for large short-term variations in the abundance and composition of fish assemblages in the area.

Station H: The hard-bottom feature at this site consisted of a rock outcrop

rising from a depth of 57 m to within 30 m of the surface. The feature is not presently included in bathymetric maps of the area or within lists of Minerals Management Service (MMS-OCS) topographic highs. The crest of the feature was about 23 m in diameter and consisted of very rugged rock surfaces and a pinnacle (2 to 4 m diameter) rising from 36 to 30 m depth. Our observations were restricted to the crest area.

Rock surfaces supported large areas of fire corals (*Millepora* sp.) and sponges (*Agelas* sp., *Ircinia* sp., and *Neofibularia nolitangere*). Spiral sea whips (*Cirrhipathes* sp.) and other antipatharians were also observed at a surprisingly shallow depth for these organisms in the northwestern Gulf. Warm-water fauna also included coral colonies (*Porites* sp.) and spiny lobsters (*Panulirus argus*) (Table 2). Twenty species of fishes were recorded during brief observations (Table 3), including large numbers (40 to 100) of creole-fish, greater amberjack, vermilion snapper, and yellowtail reef-fish. Other tropical species included blackbar soldierfish (*Myripristis jacobus*), queen angelfish, reef butterflyfish (*Chaetodon sedentarius*), Spanish hogfish, spotfin butterflyfish, and spotfin hogfish (*Bodianus pulchellus*).

Station I: Sonnier Bank, also known as "Three Hickey Rock," is a relatively large feature composed of siltstone outcrops extending from 17 m to at least 58 m depth. The shallowest of the five peaks that make up the bank was surveyed above 26 m depth. Visibility at the crest was excellent. Strong currents were noted flowing west at the surface and toward the east at the bottom.

The area surveyed was covered with encrusting fire corals (*Millepora* sp.) and sponges (*Ircinia* sp. and *Neofibularia nolitangere*). Thorny oysters (*Spondylus americanus*), flame scallops (*Lima scabra*), bristle worms (*Hermodice carunculata*), and serpulid worms (*Spirobranchus giganteus*) were common members of the bank crest community (Table 2). Several spiny lobsters were also observed.

Twenty-eight species of fishes were identified (Table 3). Large numbers of angelfishes, blue runner, creole-fish, and creole wrasse (*Clepticus parrai*) were present. The crest of the bank was marked by a large school of blue runner feeding at the surface. During calm conditions, the location of such schools is routinely used by fishermen and divers to pinpoint the shallowest point on the bank (F. Sonnier, 1980, personal communication).

DISCUSSION

Six shallow-water hard-bottom sites were surveyed during this study. Most consisted of small, low-relief (<1 to several meters) outcrops that were enveloped in the bottom nepheloid layer and covered by thick growths of hydroids, bryozoans, and ascidians. Observations of fish abundance, though limited because of low visibility in the nepheloid layer and admittedly non-quantitative, revealed associated populations of Atlantic spadefish, red snapper, sheepshead, gray triggerfish, and tomtate. The faunal assemblages associated with these shallow sites contrast with those noted at the deeper, high-relief features surveyed in this study. The deep-water sites surveyed are high-relief features that extend above the nepheloid layer into clear water, and the tops of these banks support a variety of tropical or warm-water species lacking at the inshore stations, including fire

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Table 3. List of fishes found at hard-bottom study sites. Symbols: (X) denotes a collected specimen (hook-and-line), and (*) denotes a visual identification.

Species	Stations								
	Shallow						Deep		
	A	B	C	D	E	F	G	H	I
CHONDRICHTHYES									
CARCHARHINIDAE									
Negaprion brevirostris	-	-	-	-	-	-	*	-	-
DASYATIDAE									
Dasyatis cf. *americana*	-	-	-	-	*	-	*	-	-
OSTEICHTHYES									
HOLOCENTRIDAE									
Holocentrus ascensionis	-	-	-	-	*	-	*	*	*
Myripristis jacobus	-	-	-	-	-	-	-	*	*
SERRANIDAE									
Epinephelus adscensionis	-	-	-	*	-	-	-	-	-
Mycteroperca phenax	-	-	-	-	-	-	*	-	*
Mycteroperca sp.	-	-	-	*	-	-	-	*	*
Paranthias furcifer	-	-	-	-	-	-	-	*	*
Serranus subligarius	*	-	-	*	-	*	-	-	-
GRAMMISTIDAE									
Rypticus maculatus	-	-	-	*	-	-	X	-	-
PRIACANTHIDAE									
Priacanthus arenatus	-	-	-	-	-	-	*	-	-
ECHENEIDAE									
Remora remora	-	-	*	-	-	-	-	-	-
CARANGIDAE									
Caranx crysos	*	-	-	*	-	-	-	-	*
Caranx hippos	-	-	-	-	-	-	*	-	-
Seriola dumerili		-	-	-	-	*	-	*	*
LUTJANIDAE									
Lutjanus campechanus	*	X	*	*	*	*	-	*	-
Lutjanus griseus	-	*	-	-	-	-	-	-	-
Rhomboplites aurorubens	-	-	*	-	-	-	*	*	*
HAEMULIDAE									
Haemulon aurolineatum	*	-	-	*	*	*	X	*	*
SPARIDAE									
Archosargus probatocephalus	*	*	-	-	-	-	-	-	-
SCIAENIDAE									
Equetus umbrosus	-	-	*	*	-	*	X	-	-
MULLIDAE									
Mulloidichths martinicus	-	-	-	-	-	-	-	-	*
KYPHOSIDAE									
Kyphosus sectatrix	-	-	-	-	-	-	-	-	*
EPHIPPIDAE									
Chaetodipterus faber	*	*	*	-	*	-	*	-	-
CHAETODONTIDAE									
Chaetodon ocellatus	-	-	-	-	-	-	*	*	*
Chaetodon sedentarius	-	-	-	-	-	-	-	*	*
POMACANTHIDAE									
Holacanthus bermudensis	-	-	-	-	-	-	*	*	*
Holacanthus ciliaris		-	-	-	-	-	*	*	*
Holacanthus tricolor	-	-	-	-	-	-	-	*	*
Pomacanthus paru	-	-	-	-	-	-	*	*	*
POMACENTRIDAE									
Abudefduf saxatilis	-	-	-	-	-	-	-	-	*
Chromis cyaneus	-	-	-	-	-	-	-	-	*
Chromis multilineatus	-	-	-	-	-	-	-	*	-
Chromis enchrysurus	-	-	-	-	-	-	-	*	-

Table 3 (Continued)

Pomacentrus leucostictus	-	-	-	-	-	-	*	-	-
Pomacentrus variabilis	-	*	-	*	-	-	*	*	*
LABRIDAE									
Bodianus pulchellus	-	-	-	-	-	-	-	*	-
Bodianus rufus	-	-	-	-	-	-	*	*	*
Clepticus parrai	-	-	-	-	-	-	-	*	*
Halichoeres bivittatus	-	-	-	-	-	-	X	-	-
SPHYRAENIDAE									
Sphyraena barracuda	-	-	-	-	-	-	-	-	*
BLENNIIDAE									
Parablennius sp. A	-	-	-	-	-	-	-	-	*
ACANTHURIDAE									
Acanthurus chirurgus	-	-	-	-	-	-	*	-	*
BALISTIDAE									
Balistes capriscus	*	-	*	-	*	*	X	-	-
Cantherhines pullus	-	-	-	-	-	-	-	-	*
OSTRACIIDAE									
Lactophrys triqueter	-	-	-	-	-	-	-	-	*
TETRAODONTIDAE									
Canthigaster rostrata	-	-	-	-	-	-	-	-	*

corals, various antipatharians, warm-water sponge species, and spiny lobsters. Sonnier Bank, as previously noted by Bright and Rezak (1978b), was dominated at its crest by the hydrozoan coral *Millepora* and the sponges *Neofibularia nolitangere* and *Ircinia* sp.; a few small heads of the coral *Stephanocoenia* sp. were noted in both their study and ours. Our Station H appeared similar in the composition of its epibiotal community. The principal ichthyofaunal characteristic distinguishing between our shallow and deep-water sites was the presence at the latter of a large number of tropical reef fishes such as creole wrasse, creole-fish, and species of angelfish and butterflyfish; common shallow-water species such as the Atlantic spadefish and sheepshead were usually absent. It is premature to generalize concerning fish assemblages on the basis of a single set of diver observations, given the potential for extreme seasonal and other temporal variations in fish populations in the area (Continental Shelf Associates, Inc., 1982). However, Sonnier et al. (1976) previously noted an abundance of tropical fish species at Sonnier Bank (Station I) and Jackaman's Hole (Station G), and Bright and Rezak (1978b) noted an abundance of vermilion snapper and red snapper, as well as many tropical species, at Sonnier Bank. Our Station G (Jackaman's Hole), the shallowest of the three deep sites surveyed, appears intermediate in faunal characteristics between shallow and deep-water hard-bottom areas. A variety of tropical fish species were observed, but the presence of octocorals (*Carejoa riisei*), hard corals (*Oculina* cf. *diffusa*), Atlantic spadefish, and gray triggerfish, and the absence of spiny lobsters were more characteristic of inshore stations.

Our observations can be viewed in the context of known distribution patterns of hard-bottom communities in the northern Gulf of Mexico. In the northern Gulf, only a few deep-water, high-relief banks (East and West Flower Garden Banks, and portions of 18-Fathom Bank) support extensive active reef-building coral populations (*Montastrea*, *Diploria*, *Porites*) (Rezak and Bright, 1983). The area is at the northern limit of tropical reef develop-

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ment in the western Atlantic due to minimum winter temperatures of 18°C or less (Pulley, 1963; Bright, 1983); most bank communities in the northern Gulf (including the Florida Middle Ground) (Grimm and Hopkins, 1977) are, in contrast, characterized by relatively limited reef-building activity by hydrozoan corals (*Millepora*) and/or coralline algae (Rezak and Bright, 1983). The crests of the features we surveyed at Stations H and I (Sonnier Bank) fit the description of a *Millepora*-Sponge Zone as defined by Rezak and Bright (1983); the community associated with the feature at Station G, in shallower mid-shelf banks discussed by Rezak and Bright (1983), and low-relief hard-bottom areas in the northwestern and northeastern Gulf are characterized by mixed warm temperate/tropical assemblages of fouling biota more comparable to those observed at our shallow stations. The northern Gulf encompasses a transition zone between predominantly tropical vs. warm-temperate (Carolinean) provinces (Hedgpeth, 1953). Seven and One-Half Fathom Reef, a low-relief (2 to 3 m) outcropping located in 14 m depth off South Padre Island, Texas, supports a fouling community of mixed but predominantly Carolinean affinities as well as numerous tropical fish species (Felder and Chaney, 1979). However, the reef is distinctive in possessing a dense mat of polychaete tubes (McCarty, 1974), and specific epifaunal and ichthyofaunal comparisons to our findings are precluded by the limited and qualitative nature of our observations. Hard-bottom features in shallow water off the Louisiana coast can be expected to be depauperate in comparison to their counterparts in the extreme northwestern Gulf, because the former are likely to be more frequently exposed to stresses such as periodic salinity reductions (Gallaway, 1981), occasional depletion of benthic dissolved oxygen levels (Harper *et al.*, 1981), and high near-bottom turbidity (as observed in our study). All of these stresses can be related to proximity to the Mississippi River discharge, but occasional benthic hypoxia is also a significant feature of shallow benthic habitats off the Texas coast (Pavela *et al.*, 1983). Hard-bottom communities associated with granular limestone outcroppings at the extreme northern rim of the De Soto Canyon exhibit patches of impoverished biota apparently due to localized turbidity (Shipp and Hopkins, 1978), and the presence of a near-bottom nepheloid layer can determine the composition and lower depth limit of epibiotal assemblages on offshore, high-relief banks (Rezak and Bright, 1983).

Low-relief hard-bottom areas off the Louisiana coast thus support a hardy fouling biota that is exposed to chronic turbidity and (probably) other environmental stresses. These areas provide habitat and food for at least a limited number of fish species and are both deserving of, and accessible to, further ecological study.

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