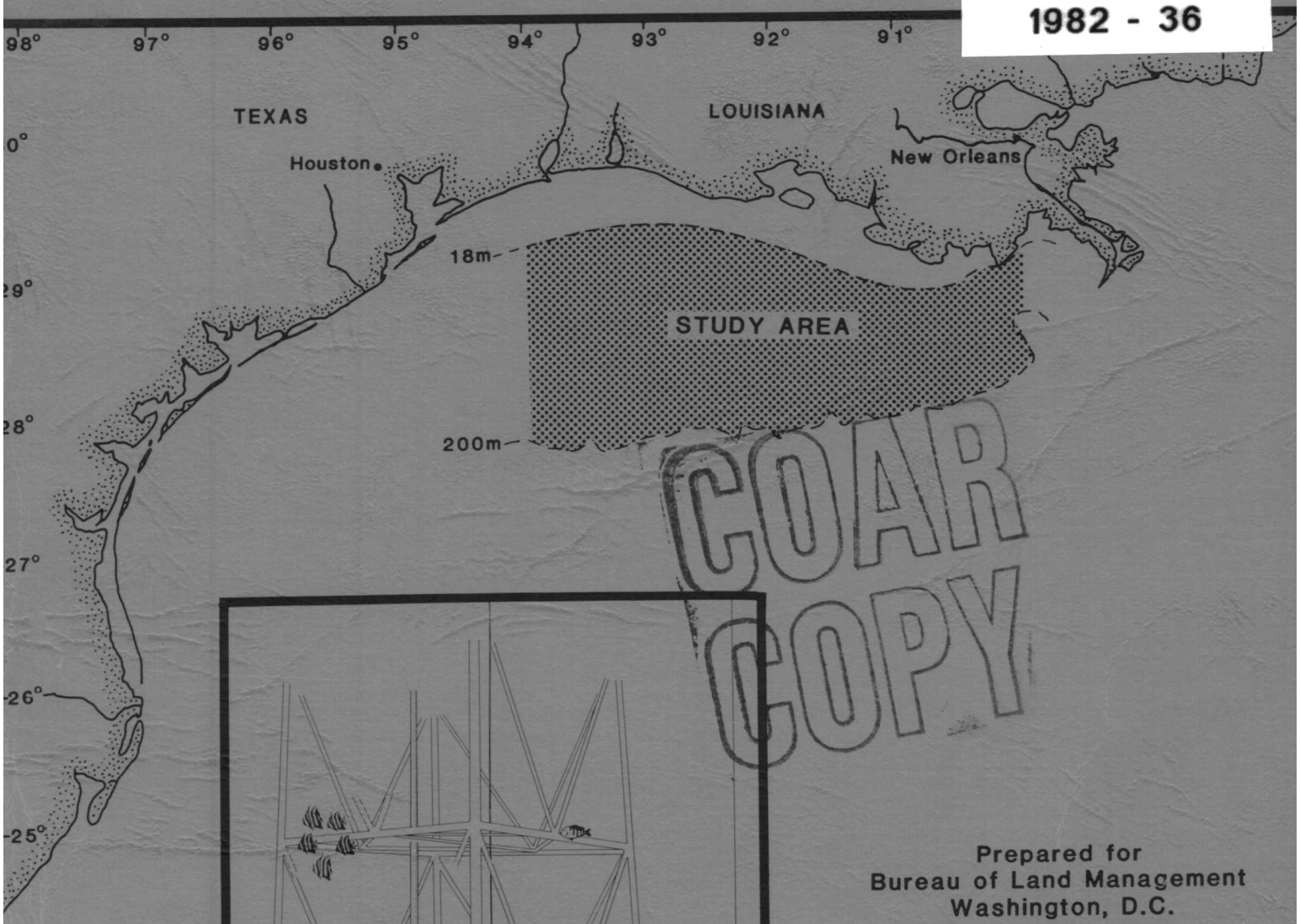
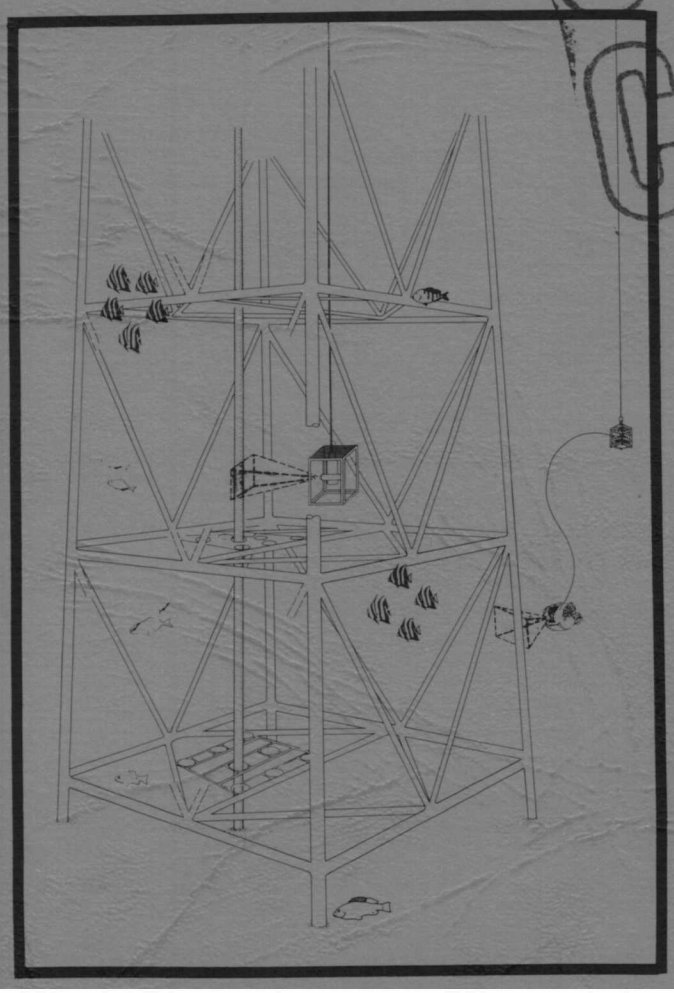
STUDY OF THE EFFECT OF OIL AND GAS ACTIVITIES ON REEF FISH POPULATIONS IN THE GULF OF MEXICO OCS AREA





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BUREAU OF LAND MANAGEMENT

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CSA

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STUDY OF THE EFFECT OF OIL AND GAS
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IN THE GULF OF MEXICO OCS AREA

EXECUTIVE SUMMARY

April, 1982

PREPARED FOR
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IN FULFILLMENT OF CONTRACT AA551-CT9-36

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Disclaimer

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EXECUTIVE SUMMARY

The primary purposes of this study were 1) to collect quantitative data for comparison of reef fish populations associated with natural hard bottom areas and offshore oil and gas structures and 2) to develop fish population sampling methods which can be applied in deep areas that exclude or limit direct observations. The study was designed as a three-phase effort, each phase with specific objectives: 1) Phase I - evaluation of potential study sites; 2) Phase II - evaluation of equipment and methods; and 3) Phase III - generation and evaluation of standing stock estimates for fish species. Planning for each subsequent phase was dependent upon the results of the prior phase.

The study area was the northern Gulf of Mexico outer continental shelf (OCS) between 90° and 94°W longitude and the 18 and 200-m isobaths (Figure 1). There are numerous hard bottom areas described as "natural reefs" within this area. Extensive OCS oil and gas activities have taken place near the natural reefs.

During Phase I, 25 sites (Figure 2) were surveyed, described, and classified into shallow water (inshore of the 35-m isobath) and deep water (offshore of the 35-m isobath) hard bottom features and platforms. The shallow water hard bottom sites consisted of relatively small, low-relief, outcrop features. Naturally occurring gas seeps were frequently observed. Hard substrate was normally covered by

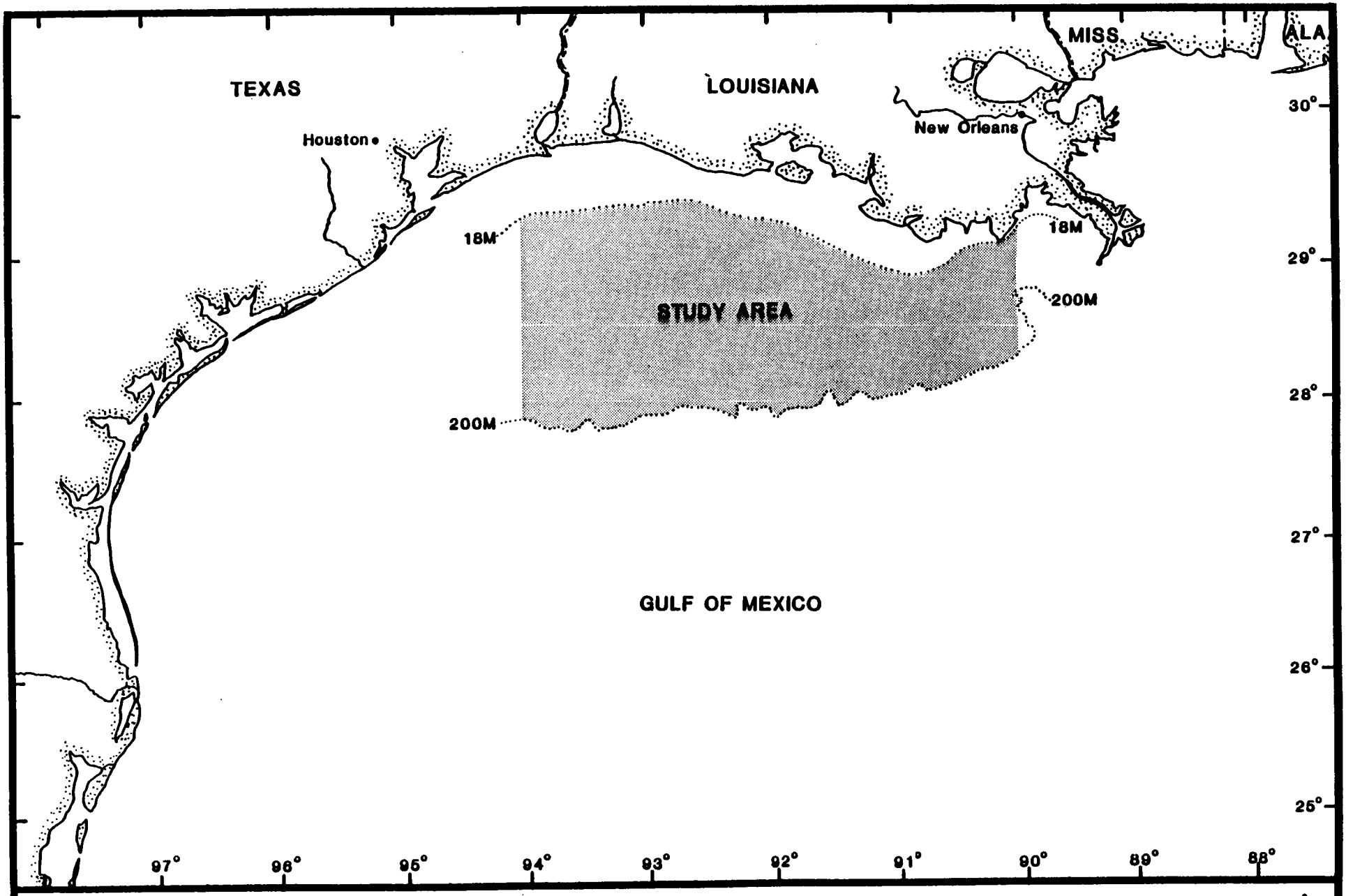


FIGURE 1. GEOGRAPHIC AREA OF STUDY.

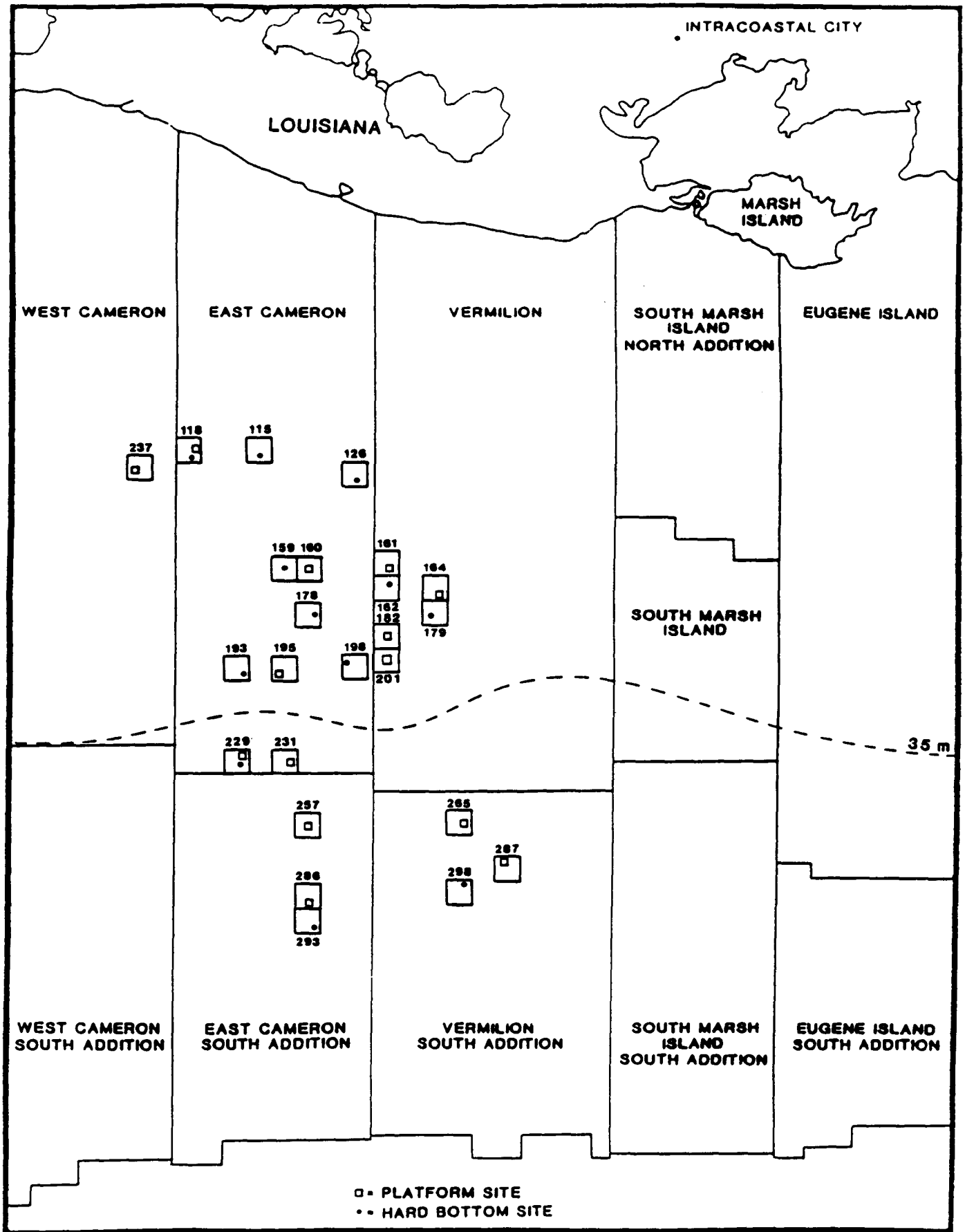


FIGURE 2. GEOGRAPHIC LOCATIONS OF SITES SURVEYED. ALL SITES WERE SURVEYED DURING PHASE I, EXCEPT FOR THE PLATFORM SITE IN VERMILION BLOCK 201. EAST CAMERON BLOCK 229 WAS THE ONLY SITE SURVEYED DURING PHASE II. EAST CAMERON BLOCK 195 AND VERMILION BLOCKS 161, 164, 201, AND 298 WERE SURVEYED DURING PHASE III.

thick growths of ascidians, bryozoans, and hydroids. Atlantic spadefish, gray triggerfish, red snapper, sheepshead, and tomtate were present. The deep water hard bottom sites consisted of large high-relief features rising above a nepheloid layer into clear water. The tops of these features supported warm water species of corals, crustaceans, fishes, and sponges. Shallow water platforms were covered by an epibiotal assemblage numerically dominated by barnacles, bryozoans, hydroids, and encrusting sponges. Deep water platforms supported larger numbers of bivalves and octocorals than did shallow water platforms. Both shallow and deep water platforms supported large populations of Atlantic spadefish, blue runner, greater amberjack, red snapper, and sheepshead. The principal faunal characteristic distinguishing both deep water hard bottom and platform sites from shallow water sites was the occurrence of large numbers of tropical reef fishes at the deep water sites. Angelfishes, butterflyfishes, creole-fish, and creole wrasse were common members of the deep water areas while common shallow water species such as the Atlantic spadefish and sheepshead were absent. Based upon the results of the site characterizations of Phase I, areas for study were selected to accomplish the objectives of Phases II and III.

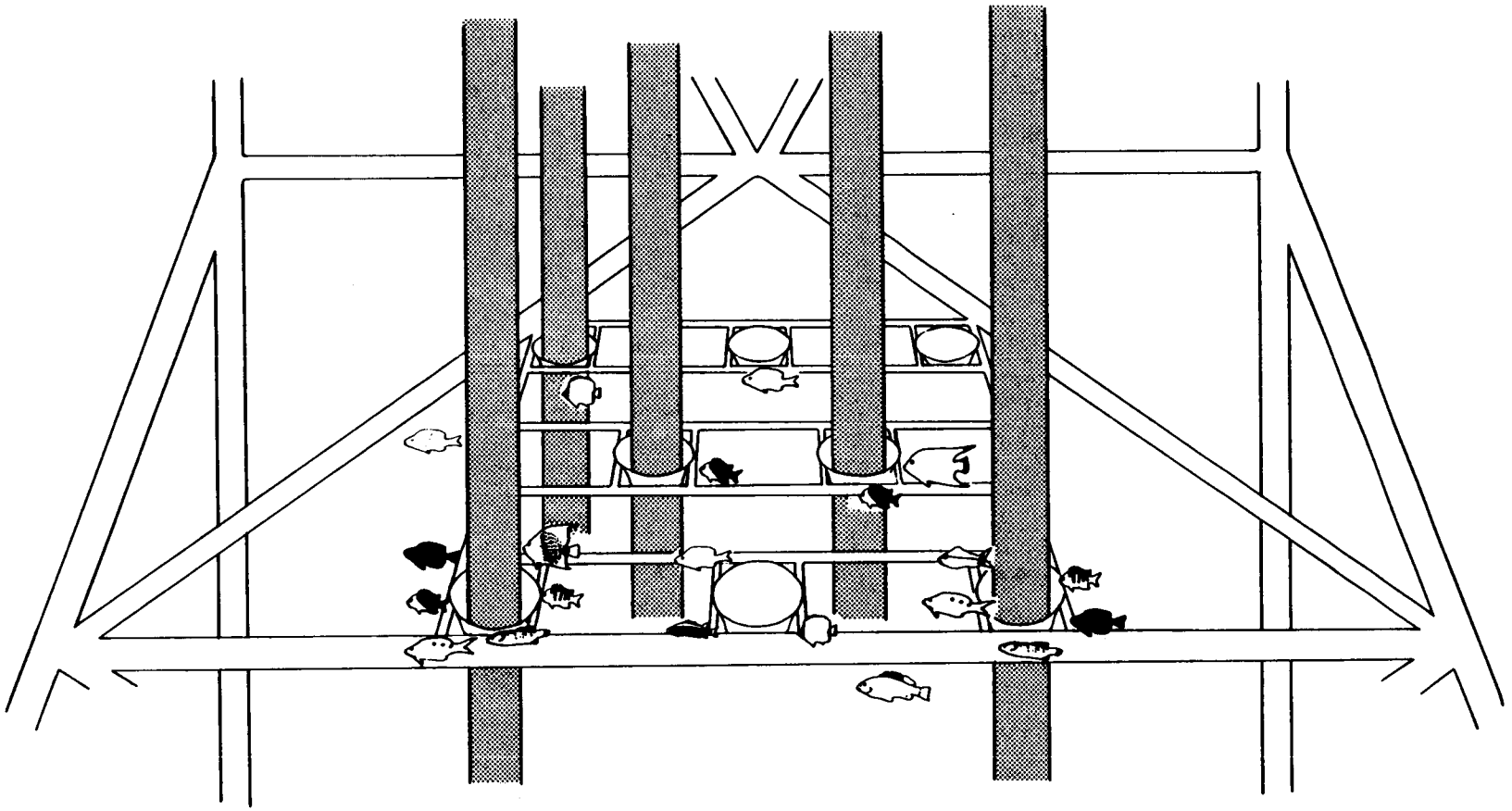
During Phase II, equipment and methods were evaluated at the deep water hard bottom area of Jackaman's Hole and at the deep water Platform "A", located 2.4 km from each other at the southern edge of East Cameron Area, Block 229 (Figure 2). The

mobility offered by a remotely operated vehicle (ROV) was judged a distinct advantage over other visual assessment tools. Based upon the results of Phase II, the primary assessment equipment recommended for Phase III and future studies included a ROV with powerful thrusters, a wide-angle television camera, and a still photographic system. The suggested assessment method consisted of a three-dimensional sampling strategy with observations at fixed positions and along horizontal transects at several depths at each study platform. Deployments of reference targets of known size were recommended to determine the amount of water volume viewed for standing stock calculations at hard bottom sites and outside of platforms. Supplemental techniques included time-lapse movie observations at three depths to provide estimates of short-term (e.g., 1 to 12 hours), temporal variation of fish populations. Some fish trapping and hook-and-line fishing were recommended to provide length-weight data.

During Phase III, the standing stocks of reef fishes were quantitatively assessed and compared at one hard bottom area (Sonnier Bank) and at four platforms (Figure 2). The distributions and abundances of fishes were highly variable. Based on the types of fish species present and their relative abundances, the ichthyocommunity of Sonnier Bank was distinct from those of the platforms. At Sonnier Bank, virtually no fishes were in the water column at the surface and mid-water stations. Most species were directly associated with the hard

bottom habitat. The bank was a diversified habitat area, ranging from a high-relief (31 m) rock outcrop at the peak to flat mud bottom at the outer stations. Fish populations varied from platform to platform. The largest number of fishes was found at the platform in Vermilion Block 161, while the most species were encountered in Vermilion Block 164. Offshore structures were responsible for concentrating fish populations vertically in the water column. There appeared to be a direct relationship between the abundance of small sedentary reef fishes and schooling species that remained near the structure and the amount of available platform habitat. Some hard bottom fishes utilized the relief offered by the platform as a ladder to expand their vertical migratory range.

Quantitative comparisons of fish assemblages associated with hard bottom areas and offshore platforms were complicated by natural variability in the spatial and temporal distribution patterns of fishes. Certain species were closely associated with particular areas of platforms and occurred in patches, groups, or clusters (Figure 3). Other species exhibited a pronounced spatial relationship with depth and water clarity (Figure 4). If a slight water current was flowing past a platform, virtually the entire fish community was positioned up-current from the platform (Figure 5). The abundance and distribution of fishes at Jackaman's Hole (Figure 6) changed radically over a period of one month and



WARSAW GROUPER
CREOLE-FISH
VERMILION SNAPPER
COCOA DAMSELFISH
WHITESPOTTED SOAPFISH
FRENCH ANGELFISH
REEF BUTTERFLYFISH
TOMTATE
BLUE ANGELFISH
SERGEANT MAJOR
SQUIRRELFISH
BIGEYE

FIGURE 3. REEF FISHES CLUSTERING AROUND WELL GUIDES.

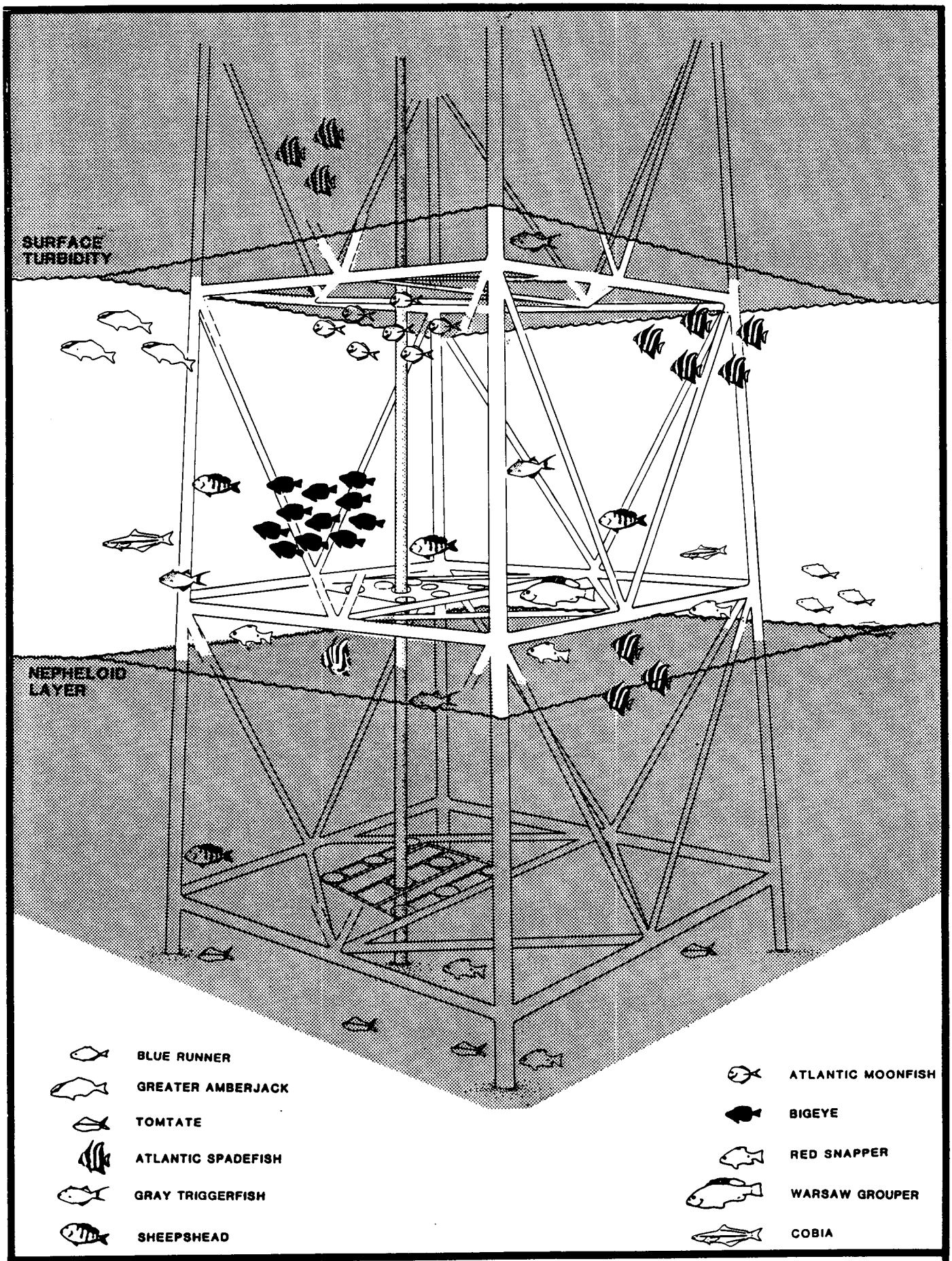


FIGURE 4. DIAGRAMMATIC REPRESENTATION OF FISH DISTRIBUTION RELATED TO NEPHELOID AND SURFACE TURBIDITY LAYERS.

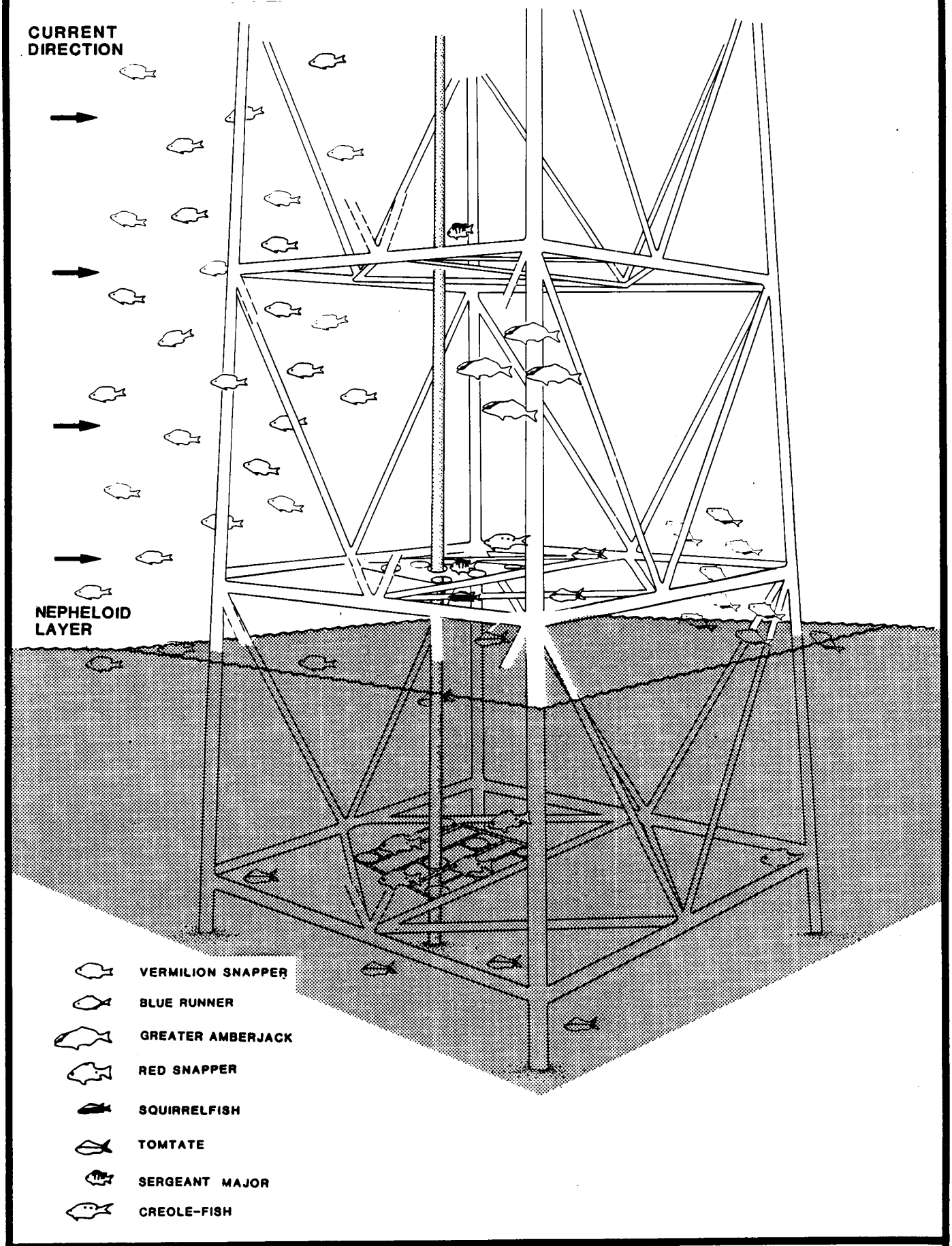


FIGURE 5. DIAGRAMMATIC REPRESENTATION OF FISH DISTRIBUTION RELATED TO CURRENT.

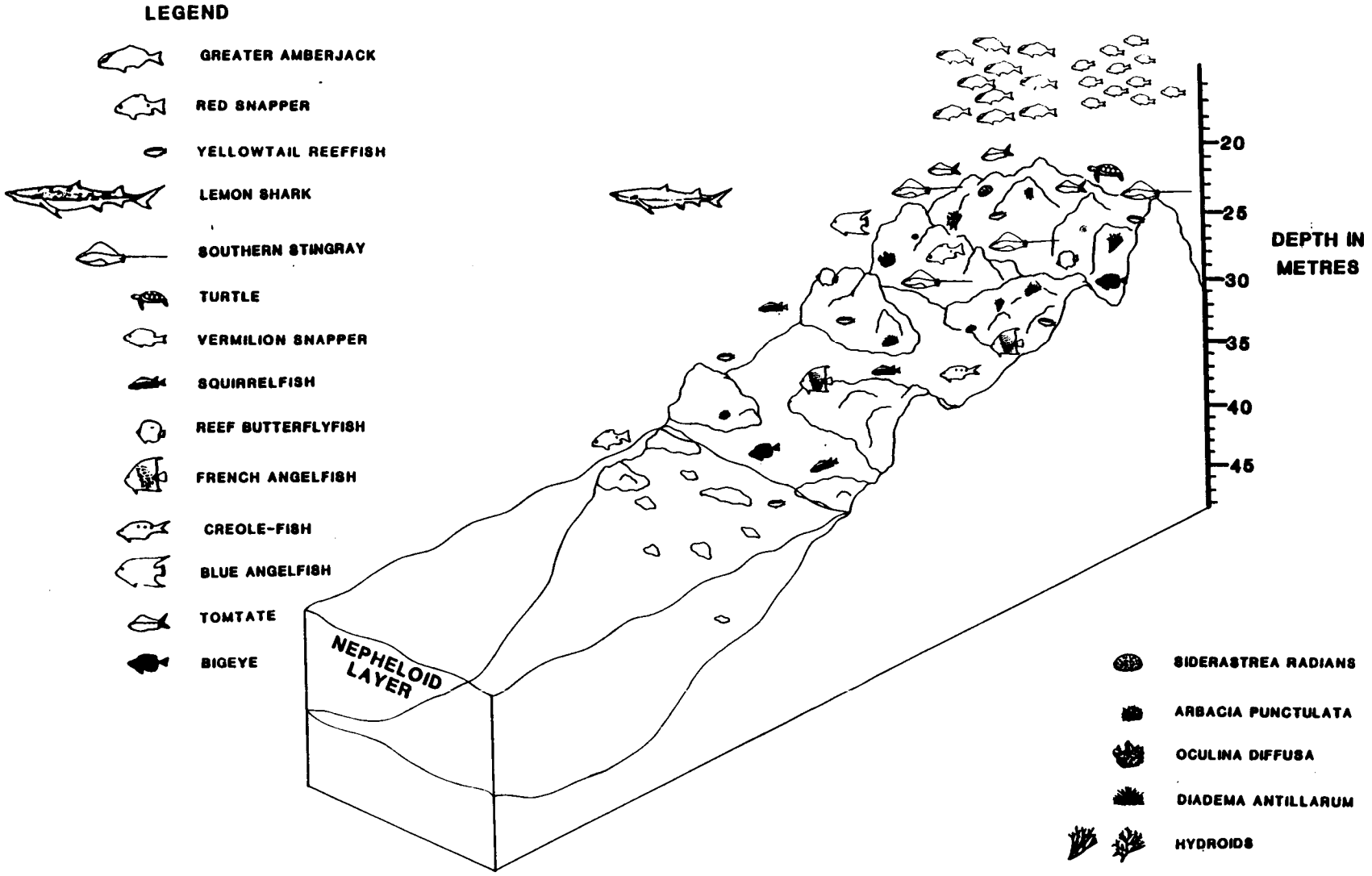


FIGURE 6. DIAGRAMMATIC REPRESENTATION OF EAST CAMERON AREA, BLOCK 229, HARD BOTTOM, JACKAMAN'S HOLE.

diurnal variation was noted in the behavior of several species. To evaluate the standing stock of fishes associated with hard bottom or platform areas using remote sampling equipment, such examples of spatial and temporal variations must be considered in the sampling methods.

Numerous low-relief, shallow water (<35 m), hard bottom areas were identified during this study (Figure 7). These areas support substantial reef fish populations and are important to local commercial and sports fishing interests (Sonnier, 1981). None of these low-relief fishing banks are currently protected under oil and gas biological lease stipulations.

One previously unidentified high-relief feature (East Cameron Area, Block 293, Hard Bottom, 29 Fathom Place) was described during this study. This rock outcrop feature, rising from a depth of 57 m to within 30 m of the surface, supports extensive invertebrate and fish communities which are typical of those associated with previously described topographic highs. This feature is not presently shown on any bathymetric charts, nor is it included on the BLM, OCS topographic features list.

Based upon the results of this study, the following recommendations were made.

1) Further study of the newly identified, shallow water features and deep water, hard bottom feature should

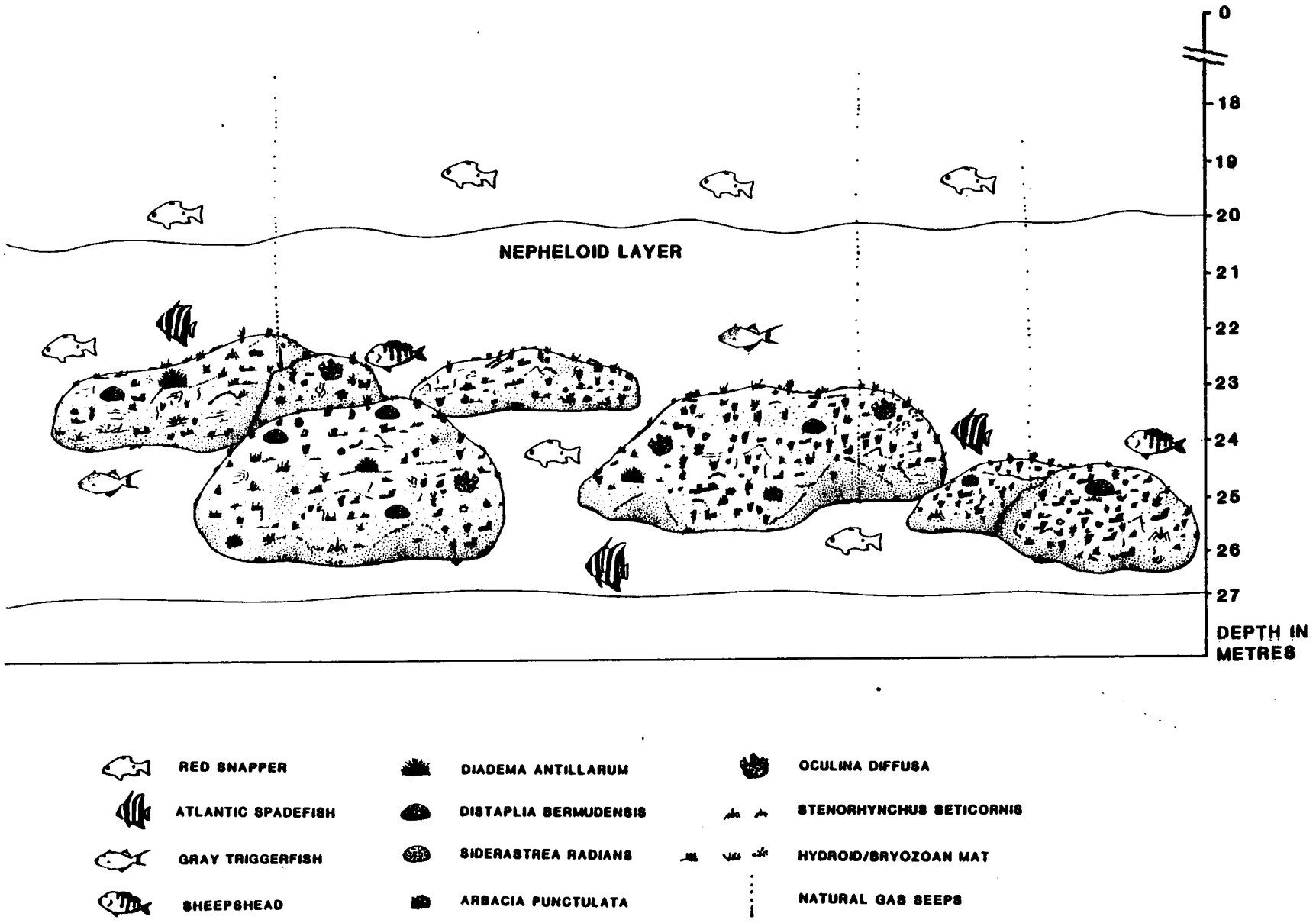


FIGURE 7. DIAGRAMMATIC REPRESENTATION OF A TYPICAL SHALLOW WATER HARD BOTTOM AREA.

be considered to determine if they should be included under biological lease stipulations.

2) Further quantitative evaluations of the natural spatial and temporal variations in fish assemblages associated with hard bottom and platform areas are required before accurate impact assessments are possible.

3) Movements of tagged fishes before and after platform placement should be studied to determine if placement and presence of an offshore structure reduces reef fish populations on neighboring hard bottom areas.

4) Future remote censusing studies of deep water fish populations along the outer continental shelf or continental slope should consider selection of vehicle, camera, and observation technique. The manufacturer, the vehicle, the operator (pilot), and the manufacturer's support and maintenance capabilities must all be evaluated in the vehicle selection. Camera selection depends on both the objectives of the study and the physical conditions likely to be encountered at the study site. The selection of operating technique will depend upon the objectives of the survey, the environmental conditions anticipated at the study area (e.g., currents, relief, size of structure, and water

clarity). Techniques range from those yielding only a qualitative species list to those yielding specific standing stock or biomass estimates.

Once these initial decisions have been made, an extensive period of shallow water (within scuba range) field testing should be undertaken to compare the remotely collected data to that of diver observations. When the investigators are satisfied that their remotely collected data either correspond to that of direct observation, or can be made to correspond through the use of specifically developed correction factors, the program may enter the deep water phase which would involve only remotely collected data. To evaluate ROV remote sensing methods for deep water fish community analysis, tests should be conducted to compare ROV and manned-submersible results.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.