Shallow-Water Fish Fauna of Port Honduras, Belize

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ABSTRACT

A Rapid Ecological Assessment (REA) was conducted during the period of July 26 through August 13, 1994 (at the end of the dry season) to gather information on the oceanographic and ecological characteristics of Port Honduras, since this area has been considered part of a corridor of protected areas in southern Belize. A GIS (Geographic Information System) data base was established to incorporate bathymetry, oceanography, ecological data and island attributes. Spatial and vertical salinity distributions showed the marked influence of the oceanic waters in the hydrological characteristics of the inner laggon before the period of heavy rainfall start. As part of this REA, a fisheries-independent surveys conducted with otter trawls showed that most of the fish caught were in juvenile stages. The most abundant fish were grunts (F. Haemulidae), mojarras (F. Gerreidae), parrotfishes (F. Scaridae), snappers (Lutjanidae) and small wrasses (Labridae). Fish were most abundant in nearshore areas of dense seagrass habitats. These fish may recruit from reef spawning sites in the north and are transported south by the prevailing nearshore currents.

Keywords: Belize, coastal oceanography, marine fish distribution, GIS, marine protected area.

INTRODUCTION

Port Honduras is located at the southern border of Belize, in the Toledo District. This region has been considered by the Government of Belize as part of a corridor of protected areas from the Maya Mountains to the Snake Cays. The Nature Conservancy and partner organizations in Belize (Belize Center for Environmental Studies, Government of Belize Department of Fisheries, etc.) are working to provide the scientific information and educational training necessary to declare and manage Port Honduras as a protected area. Because of the lack of information on the geographical, oceanographic, and biological features of Port Honduras, a Rapid Ecological Assessment (REA) was conducted by The Nature Conservancy, the Belize Fisheries Department, and the Belize Center for Environmental Studies in order to gather information on the oceanographic and ecological characteristics of the coastal and marine ecosystem of the area.

Regarding shallow-water ichthyofauna, relatively little is known of the fish communities of Central America (Robins, 1972; Weinstein and Heck, 1979; Greenfield and Johnson, 1990; Sierra and García-Arteaga, in preparation). In Belize, Sedberry and Carter (1993) described the seasonality of the fish community structure of the mangrove creeks, seagrass beds, and sand-rubble habitats of the barrier reef lagoon located near Ambergris Cay. This paper presents the fish distribution in different habitat types of the neritic zone of Port Honduras, Belize, at the begining of the wet season.

STUDY AREA

Port Honduras occurs in a tropical moist lifezone, at the southern end of Belize (Figure 1). This area is characterized by high rainfall, high temperatures, and microtides. Annual rainfall in Belize ranges from 1350mm in the north, to 4530mm in the mountainous south. The rainfall is highly seasonal, with distinct wet (from late August through February and dry (from March through July) seasons. Mean monthly air temperatures are not particularly variable with highs above 26°C and lows around 20°C (Government of Belize Meteorological Records).

The ecological system that forms Port Honduras includes three related components: coastal and tidal wetlands, the marine lagoon itself, and the mangrove islands with its associated shallow banks (Figure 2). The coastal ecosystem is divided roughly into equal parts of mangrove and tidal wetlands (about 415 km^2) and a marine lagoon (410 km^2).

MATERIAL AND METHODS

One-hundred and twenty stations were located along six transects within Port Honduras and an additional three transects were conducted near Monkey River, 17km northeast of the Punta Ycacos Lagoon (Figure 3). Surface temperature (to the nearest 0.25°C) and salinity (to the nearest 0.5%) was measured from water taken from a niskin bottle 0.5m below the surface. A refractometer and a surface thermometer were used for measuring both parameters. Vertical temperature and salinity profiles were obtained using a SEACAT CTD (conductivity-temperature-depth device). The CTD was deployed to record vertical water mass parameters.

Vertical visibility and water depth were measured as well. The former was determined using a standard 20cm Secchi disc, and water depth was measured (to the nearest 0.5m) using a fathometer. Bottom type at all stations was classified according to the benthic community, based on field analysis and substrata and lifeform evaluation (Sullivan *et al.*, 1994). Arc/Info software (ESRI, Redlands, CA) was used in the spatial analysis of field survey data. This information was used for mapping oceanographic factors and fish distribution.

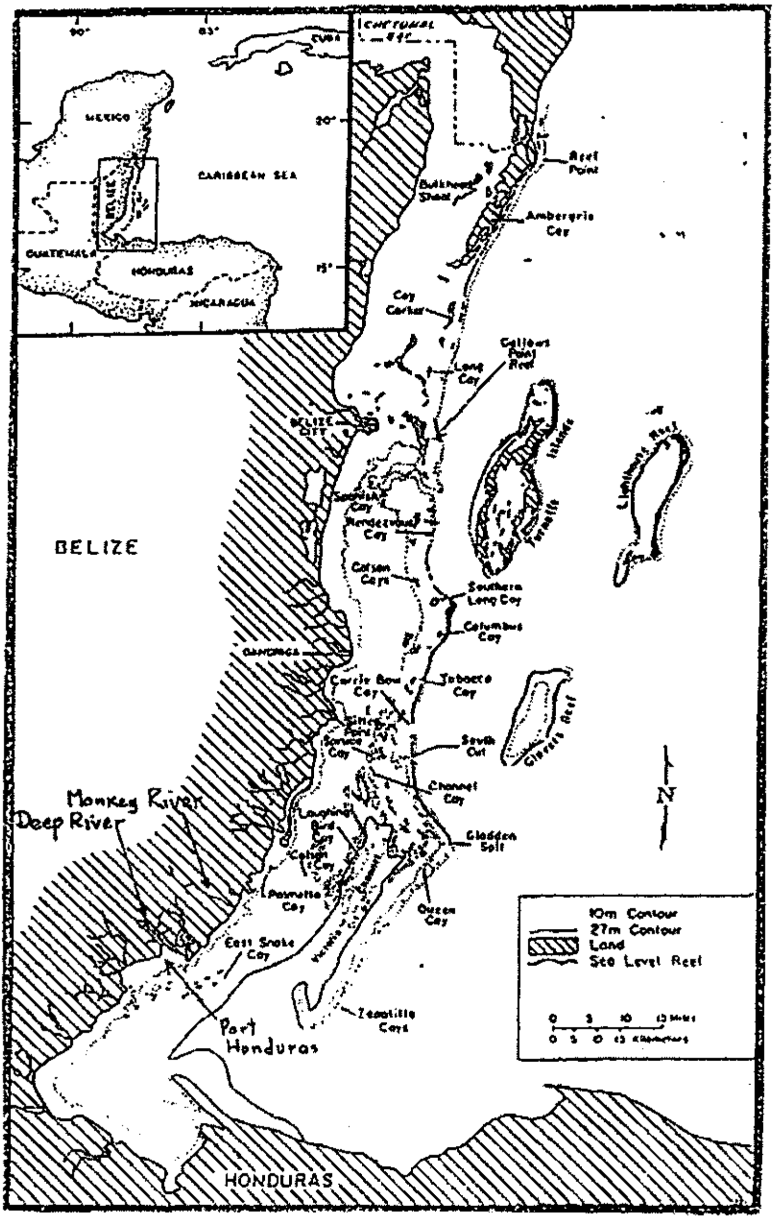

Figure 1. Map of Belize showing submerged reefs (Burke, 1993), and the location of Deep River, Monkey River, and Port Honduras.

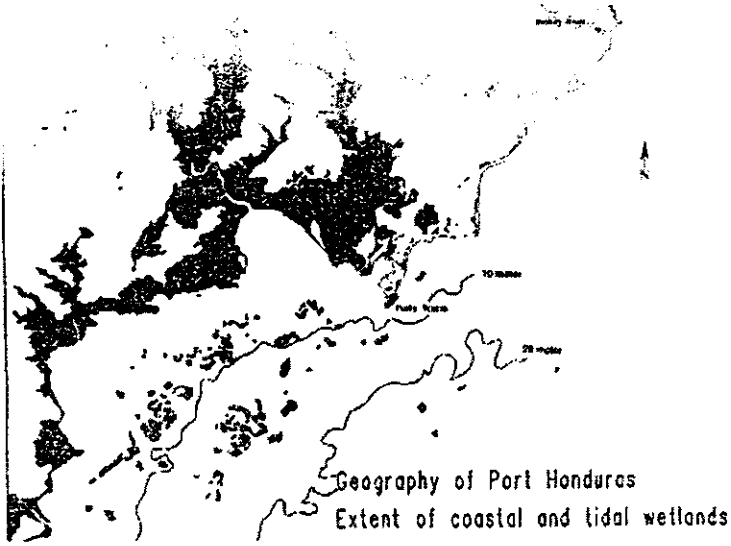

Figure 2. Map of coastal wetlands and mangrove islands in Port Honduras generated through a Geographic Information System.

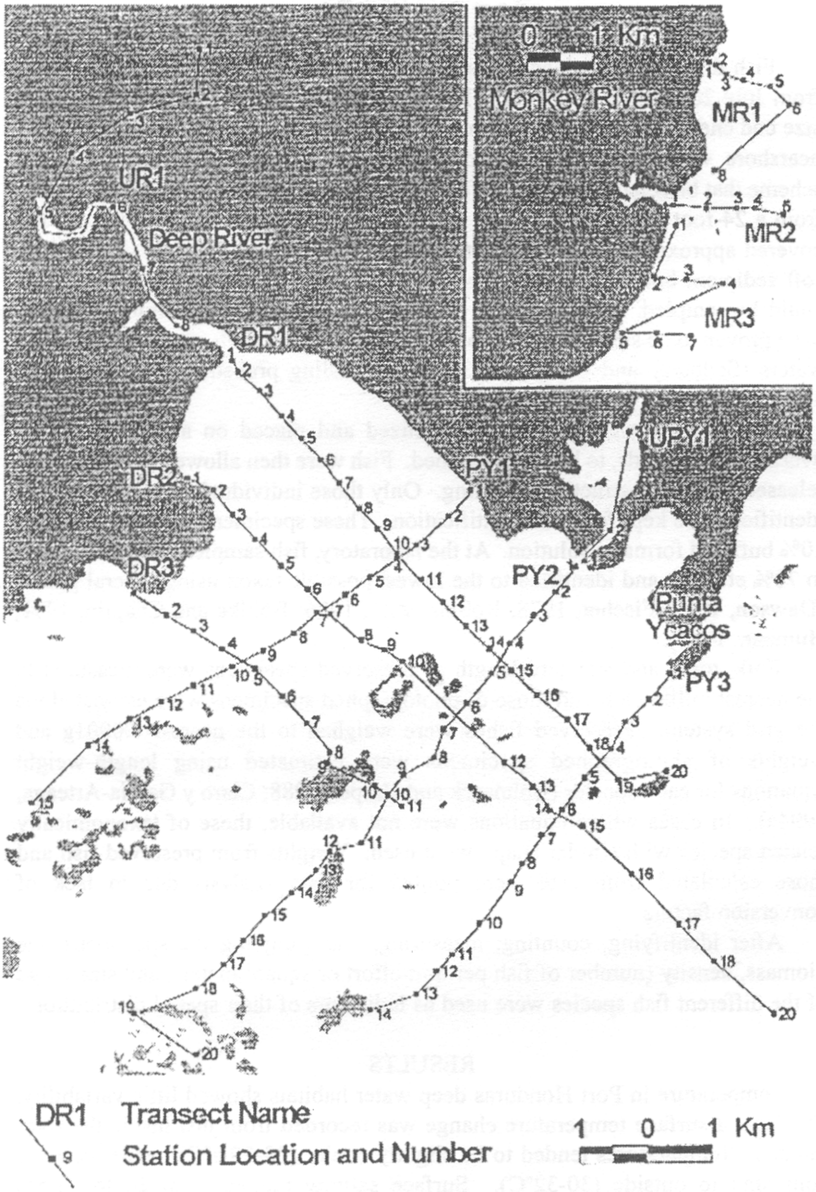

Figure 3. Location of sampling stations in Port Honduras and Monkey River.

Fish data were obtained through a fisheries-independent survey conducted from July 26 through August 13, 1994. An otter trawl with a 0.555 mm mesh size cod end was used for the surveys. 36 stations were deployed from shallow, nearshore waters (less than 1m depth) to 10m depth, following a sampling scheme that bisected the estuary. Tows were conducted by pulling the otter trawl from a 24-foot fiberglass boat for 2 minutes at a constant speed (3 knots); this covered approximately $300m^2$. Otter trawls were dragged across seagrass and soft sediment bottoms so that most demersal (bottom and near-bottom) fishes could be sampled. Although this method has\ some obvious limitations, they have proven to be suitable for sampling fishes for community analysis in shallow waters (Sedberry and Carter, 1993). The trawling procedure is explained in detail in Sullivan *et al.*, 1994.

After each tow, fish were anesthetized and placed on a board, with an overlay of 5cm grids, to be photographed. Fish were then allowed to recover and released for non-destructive sampling. Only those individuals that could not be identified were kept for later identification. These specimens were preserved in 10% buffered formalin solution. At the laboratory, fish samples were transferred to 70% ethanol, and identified to the lowest possible taxon using several guides (Dawson, 1969; Fischer, 1978; Robins *et al.*, 1986; Böhlke and Chaplin, 1991; Humann, 1994).

Fork, total, and standard length of preserved specimens were measured to the nearest millimeter, and those of photographed specimens were estimated via the grid system. Preserved fishes were weighed to the nearest 0.0001g and weights of photographed specimens were estimated using length-weight equations for each species (Bohnsack and Harper, 1988; Claro y García-Arteaga, 1994a). In cases where equations were not available, those of taxonomically related species with similar shape were used. Weights from preserved fish and those calculated from size were pooled for data analysis due to lack of conversion factors.

After identifying, counting, measuring, and weighing the specimens, the biomass, density (number of fish per unit effort or square meter), and size range of the different fish species were used as indicators of their spatial distribution.

RESULTS

Temperature in Port Honduras deep water habitats showed little variability. The largest surface temperature change was recorded from just inside the river mouths. Temperatures tended to be slightly cooler (28-29.5°C) inside the river compared to outside (30-32°C). Surface salinity ranged from 20 to 33.5% (Figure 4). Salinities below 30% were recorded mostly in nearshore areas, and at some stations in the vicinity of mangrove islands. Vertical profiles along a transect from upper Deep River to 10km offshore (Figure 5) illustrates the increasing salinity and mixing in the water column of the inner lagoon of Port

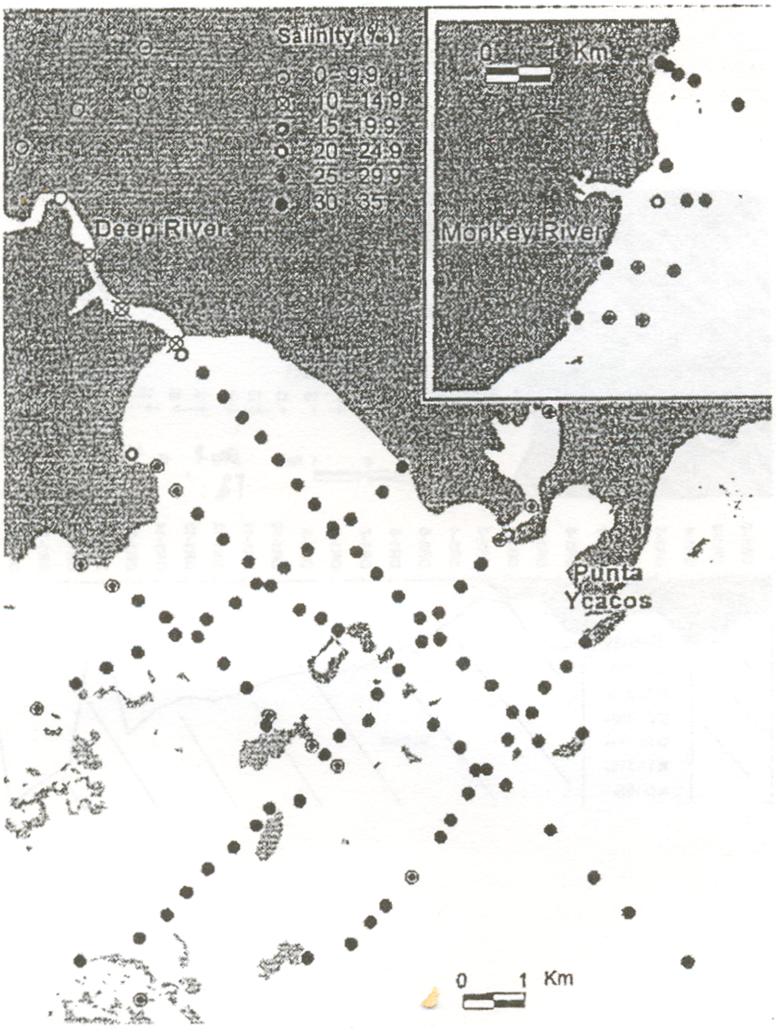

Figure 4. Spatial distribution of surface salinity.

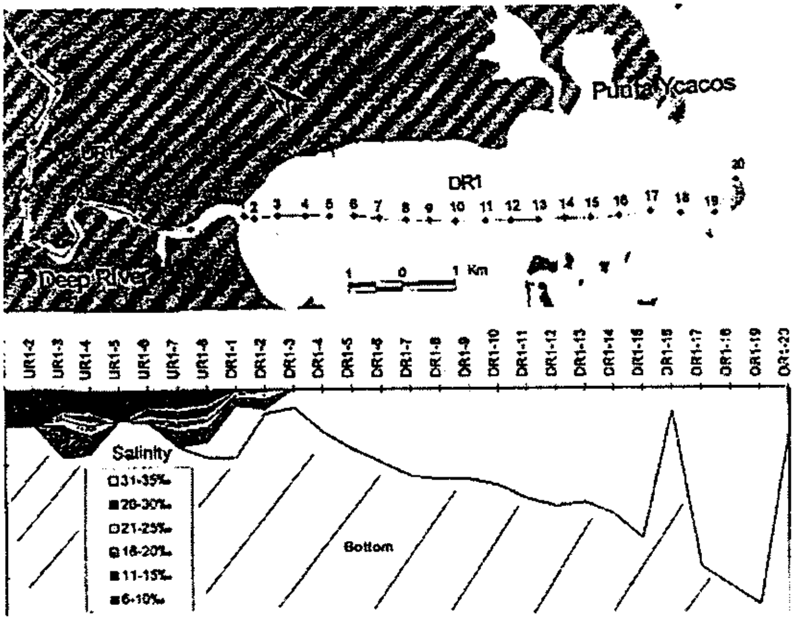

Figure 5. Salinity profile along the Deep River transect.

Honduras. Within a short distance, the brackish outflow is mixed with the saline water entering the lagoon.

Monkey River has a much smaller associated coastal wetland area (see Figure 2) and freshwater flow at the river mouth than Deep River. Low salinities (15-19%) were recorded south of the river mouth (Figure 4). The CTD temperature and salinity profiles from station MR2-1 located at the mouth of the Monkey River at a 1.2m depth (Figure 6), shows a surface freshwater layer of 26%. Bottom salinities were 32%; thus, suggesting only slight mixing. At station MR2-2, located 0.52km from the river mouth, in 8m of water, only a thin brackish water lens occurs at the surface. The bulk of the freshwater plume flows south along the shore (see Figure 4). Stations MR2-4 and MR2-5, located 1.3km and 1.6km off of the river mouth, respectively, illustrate the uniform well-mixed water column of the coastal shelf.

Table 1 shows fish abundance and diversity as well as the physical conditions (salinity, visibility, depth, and bottom type) of the trawl sampling sites. Fish biomass, number of fish per tow, and diversity, varied greatly in the Port Honduras region. The highest diversities (H>2.00) were recorded in dense seagrass beds nearshore (stations PY1-7, PY2-1, PY3-1, UPY1-1) and the lowest over muddy bottoms with poor vegetation.

Fifty-five species belonging to 22 families were identified in the coastal zone of Port Honduras (Appendix 1). More than 20 species of snapper (Lutjanidae), grunt (Haemulidae), parrotfish (Scaridae), croaker (Sciaenidae), and mojarra (Gerreidae) have commercial value. The rest are small or non-palatable species that are usually common in seagrass habitats: anchovies (Engraulidae), pipefishes (Syngnathidae), small wrasses (Labridae), filefishes (Monacanthidae), puffers (Tetraodontidae), and gobies (Gobiidae) among others.

Appendix 1 shows the abundance (by number and biomass) of each fish species. Excluding the anchovy, *Anchoa hepsetus* (a very gregarious fish), Haemulidae, Gerreidae, Labridae, Scaridae, and Lutjanidae were the most abundant fish families. *Haemulon aurolineatum, H. plumieri, Eucinostomus havana, E. melanopterum,* and *Lutjanus synagris* were the most abundant species. Among snappers, *L. synagris* and *L. analis* comprised the highest biomass (0.3236g/m^2 and 0.3880g/m^2, respectively). *H. plumieri* encompassed about 60% of the grunt biomass. This species and *H. aurolineatum* were the most numerous among grunts (0.0267 and 0.0208ind./m^2, respectively). Other species such as *Ariopsis bonillai, Pomacanthus arcuatus,* and *Sphoeroides sp.* had high biomass because of their comparatively large sizes, but were found in small numbers (Appendix 1).

Fish density, biomass, and species number were notably higher in shallow waters and in dense seagrass than over other bottom types located in deeper waters (Tables 2 and 3). Low biomass in the 0-1.9m depth class was due to the small size of fish inhabiting shallow sites.

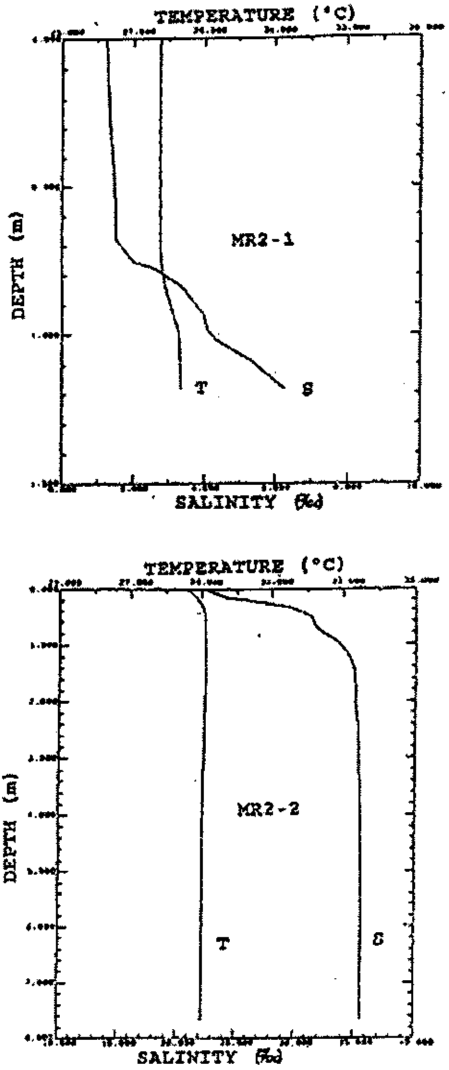

Figure 6. Salinity/temperature profiles in stations MR2-1 and MR2-2 at the mouth of Monkey River (see Figure 3 for stations location).

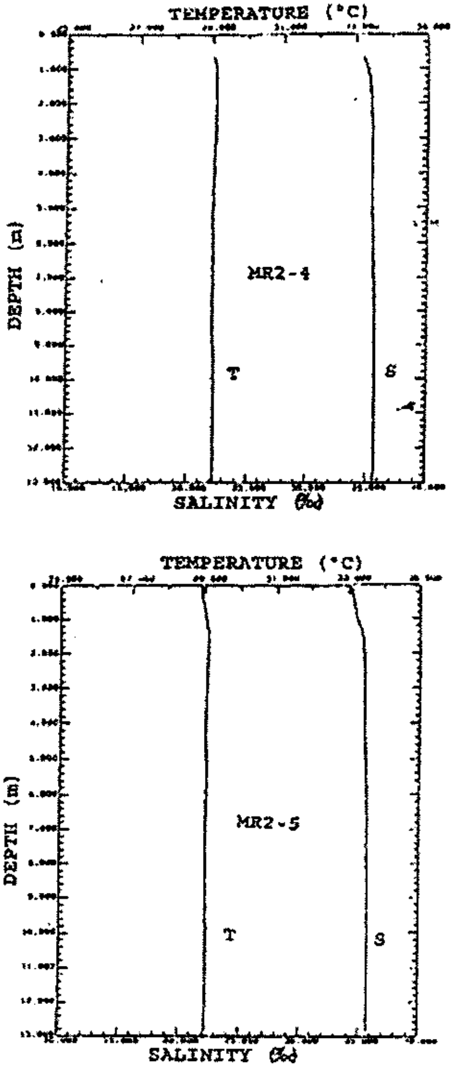

Figure 7. Salinity/temperature profiles in stations MR2-4 and MR2-5 at the mouth of Monkey River (see Figure 3 for stations location).

Table 1. Data from otter trawl stations at Port Honduiras. Vert. Vis.: Vertical Visibility; H': Shannon-Wiener (1949) index.

Sta.	No. indiv.	No. species	Species Diversity (H')	Fish biomass (g)	Salinity (%)	Vert. Vis. (m)	Depth (m)	Bottom type
DR1-1	8	3	0.90	13.3	17	1.2	2.0	sandy shoal
DR1-2	58	9	1.61	631.7	20	1.2	1.2	sandy shoal
DR1-4	9	2	0.32	64.5	30	1.5	2.5	seagrass-sparse
DR1-7	7	3	0.69	305.5	34	2.8	4.5	gray-clay homogeneous
DR1-15	11	6	1.67	211.5	35	3.8	7.5	gray-clay bioturbation
DR2-1	6	6	1.63	1.4	23	0.8	0.8	seagrass-dense
DR2-3	3	1	0.00	1.0	25	1.0	1.9	sandmud bioturbation
DR2-10	1	1	0.00	3.4	32	2.8	3.5	sandy shoal
DR3-1	2	2	0.69	21.5	28	1.5	2.0	mud homogeneous
DR3-2	13	4	0.79	2.8	28	4.0	5.0	seagrass-sparse
DR3-6	14	8	1.90	393.9	30	4.8	8.0	mud bioturbation
DR3-8	5	4	1.35	128.0	29	5.5	8.5	mud bioturbation
MR1-1	11	7	1.79	47.9	34	1.3	1.3	seagrass-sparse
MR1-3	19	2	0.57	0.5	34	2.4	6.2	matrix hard bottom
MR1-5	23	4	0.94	704.2	-	2.2	2.6	seagrass-sparse bed
MR2-1	3	3	1.09	2.7	0	0.4	1.4	sandy shoal-river bed
MR2-2	12	7	1.76	146.5	24	1.3	6.1	sandy shoal-river bed
MR2-3	2	1	0.00	47.0	34	1.8	10.6	mud bioturbation
MR3-8	2	2	0.69	1.4	32	0.8	0.8	seagrass-sparse
PY1-1	30	14	2.37	170.8	33	1.5	1.5	seagrass-dense
PY1-2	16	3	0.82	77.7	30	3.3	3.5	mud bioturbation
PY1-6	5	4	1.33	8.9	32	2.8	7.3	mud bioturbation

Table 1. (cont.) Data from otter trawl stations at Port Honduiras. Vert. Vis.: Vertical Visibility; H': Shannon-Wiener (1949) index.

Sta.	No. indiv.	No. species	Species Diversity (H')	Fish biomass (g)	Salinity (%)	Vert. Vis. (m)	Depth (m)	Bottom type
PY1-7	34	7	1.21	183.5	31	4.0	6.8	mud bioturbation
PY1-10	18	8	1.95	483.1	32	3.8	6.5	grey clay-homogeneous
PY1-15	1	1	0.00	0.0	30	4.0	5.0	mud bioturbation
PY2-1	18	9	2.06	149.0	36	1.7	1.1	seagrass-dense
PY2-2	2	2	0.69	0.7	37	2.3	4.1	mud homogeneous
PY2-4	2	2	0.69	0.1	36	2.3	5.0	Halophila sparse
PY2-6	2	2	0.69	0.4	37	3.0	5.5	mud bioturbation
PY2-7	6	2	0.69	1.4	36	3.2	8.4	mud bioturbation
PY2-12	1	1	0.00	0.5	36	3.8	8.3	mud bioturbation
PY2-19	38	6	1.03	22.1	35	3.5	3.5	seagrass-sparse
PY2-20	26	8	0.74	316.0	28	1.1	1.1	seagrass-sparse
PY3-1	98	14	2.16	567.5	32	1.3	1.3	seagrass-dense
PY3-2	9	4	1.21	285.7	29	2.5	7.3	grey clay-bioturbation
UPY1-1	56	13	2.11	1443.6	10	2.0	3.0	seagrass-dense

Table 2. Fish abundance at different depths in Port Honduras, Belize. Means ± standard errors are shown.

	Depth (m)		
	0.1 - 0.9	2.0 - 4.9	5.0 - 10.0
Density (no. fish/tow)	25.5±9.0	16.2±5.0	12.1±2.0
Biomass (g/tow)	189±70	265±130	111±30
Species richness	7.3±1.5	3.9±1.3	3.9±0.7

Table 3. Fish abundance at different bottom types in Port Honduras, Belize. Means ± standard errors are shown.

	Abundance		
Bottom type	Density (no. fish/ tow)	Biomass (g/tow)	Species richness (no. species/ tow)
Seagrass-sparse	17.4±2.1	166±100	4.7±0.9
Seagrass-dense	41.6±11.5	466±240	11.0±1.5
Sandy shoal	16.4±8.0	160±100	4.6±1.5
Sandmud-bioturbation	3	1	1
Mud-homogeneous	2	22	2
Mud bioturbation	8.6±3.9	84±39	3.4±0.7
Matrix hard bottom	19	1	2
Halophila-sparse	2	0.1	2
Grey clay-homogeneous	12.5±6.1	394±90	5.5±2.5
Grey clay-bioturbation	10.0±2.1	249±30	5.0±0.9

Figures 8-11 show the distribution (in number of fish per tow) and mean size of four of the most abundant fish species. Lane snapper (*Lutjanus synagris*) was the most abundant and widely distributed species in Port Honduras as 96 out of 571 total fish caught belonged to this species; lane snapper was captured at 20 out of 36 sampling stations (Figure 8). The highest densities (more than 10 fish/tow) were found in nearshore areas. They were particularly abundant in the area adjacent to the mouth of Monkey River. A wide size range was observed, but juvenile stages with less than 120mm TL (which must belong to O+ year class, according to Claro and García-Arteaga, 1994a) was dominant. The smaller individuals appeared in nearshore areas (Fig. 8).

Yellowtail snapper (*O. chrysurus*), another commercially important species, was found mainly in nearshore stations (Figure 9) as juveniles (33-119mm TL). Tomtate (*H. aurolineatum*), was also primarily distributed in nearshore waters (Figure 10). Yellowfin mojarra (*Gerres cinereus*) juveniles were found in 12 stations, including some located far from shore (Figure 11).

DISCUSSION

Most of the area of Port Honduras is deeper than 5m. Due to the presence of the deep channel (over 20m in depth) offshore, the water of the embayment is predominantly oceanic despite some terrestrial runoff. The REA was conducted just at the beginning of the wet season, so the freshwater influence could increase in the following months as the terrestrial runoff becomes greater.

The deeper basins in Port Honduras region are somewhat protected from vertical mixing by the shallow banks, and retain the density inertia of the tropical surface water circulated in from the Gulf of Honduras. It is this volume of oceanic water from the Gulf of Honduras that maintains oceanic salinities and the marine nature of the embayment. Oceanic influences are determined by the circulation and the meso-scale eddies within the Gulf of Honduras.

Deep River cannot be considered as the only source of freshwater outflow from the upper part of Port Honduras. In fact, numerous small creeks and discharge points may be spring-fed and less seasonal than the flow from Deep River.

Most of Port Honduras was extremely turbid. In general turbidity was highest close to shore, as indicated by low Secchi measurements of less than 2m (Table 2). Turbidity decreased over the deeper areas of the bay and in some of the enclosed mangrove lagoons.

Fish fauna in Port Honduras seems to be less species-rich than in the Ambergris site studied by Sedberry and Carter (1993) where 87 species were caught throughout the year (with no significant difference among seasons) using 10-minute otter trawls. Divergence in habitats can explain this difference. At the Ambergris site, which is very close to reefs and shallow in depth (2m or less), species belonging to typical reef fish families such as Serranidae, Apogonidae,

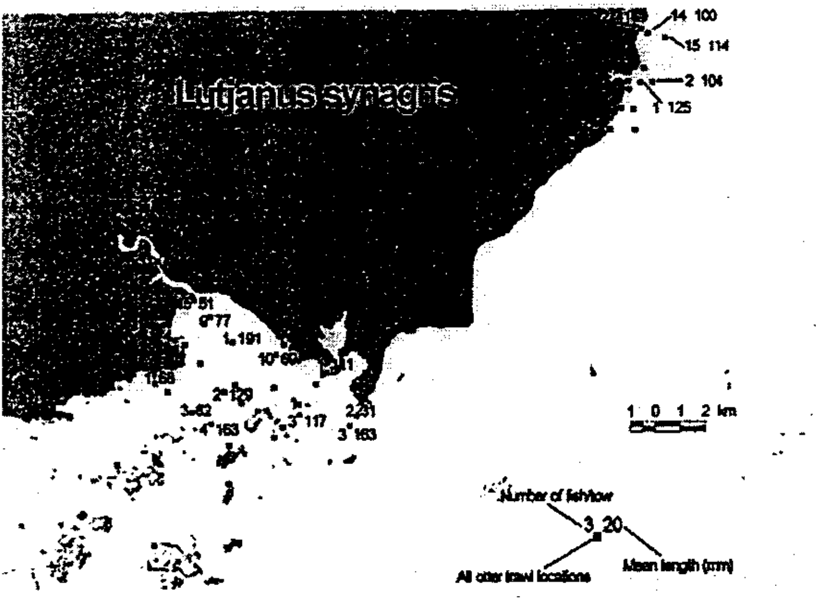

Figure 8. Distribution of lane snapper (*Lutjanus synagris*).

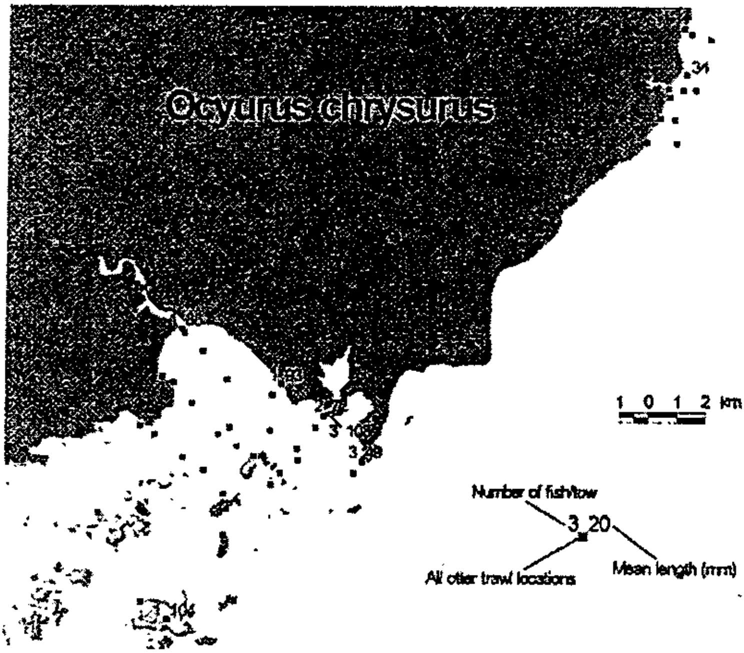

Figure 9. Distribution of yellowtail snapper (*Ocyurus chrysurus*).

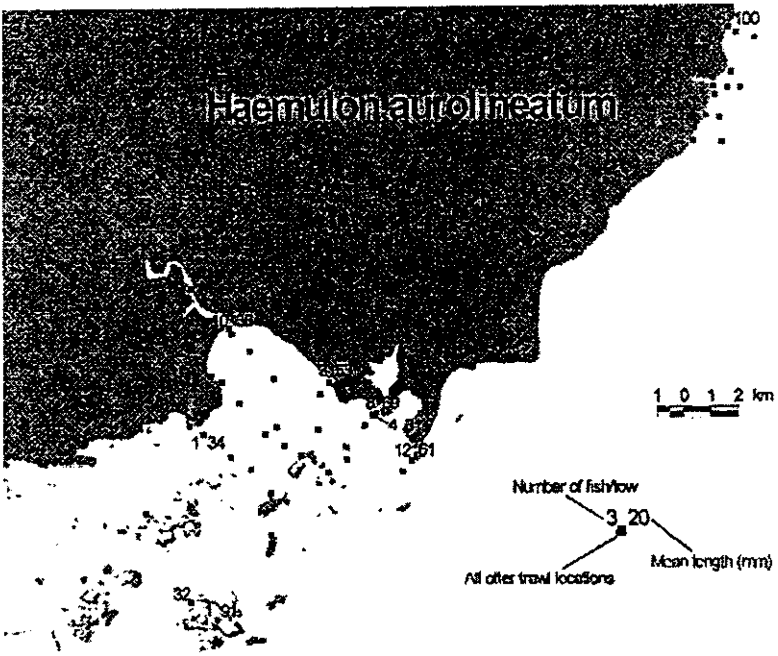

Figure 10. Distribution of tomtate (*Haemulon aurolineatum*).

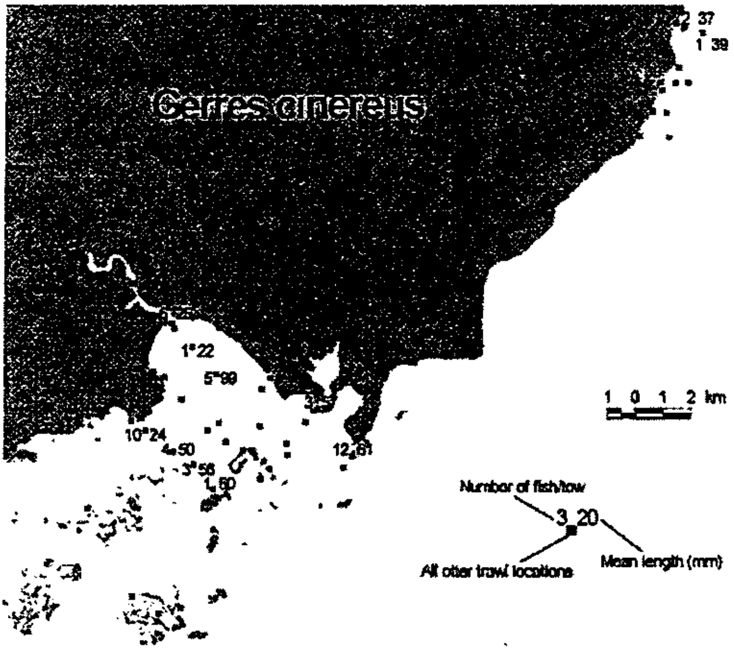

Figure 11. Distribution of yellowfin mojarra (*Gerres cinereus*).

Holocentridae, Muraenidae, and Chaetodontidae contributed to its higher species richness.

In fish communities associated with mangrove habitats in north central Cuba, Claro and García-Arteaga (1993) recorded a similar fish species checklist to that in Port Honduras. The number of fish species is much higher than those reported in other Caribbean semi-enclosed coastal lagoons like Nichupté and Bojórquez, in Cancún (Jordan *et al.*, 1978) and Tunas de Zaza, which is located on the south central coast of Cuba (González-Sansón and Aguilar Betancourt, 1983), both of which are highly impacted by coastal development or fisheries.

In Port Honduras, the highest diversity (H>2.0) was found in seagrass beds, where this kind of habitat provides a good source of shelter and food for small fish. In contrast, habitats with poor vegetation bottom types had lower diversities.

Fish abundance in Port Honduras seems to be much lower than in other seagrass-mangrove areas such as Ambergris, Belize (Sedberry and Carter, 1993) and north central and south western regions of Cuba (García-Arteaga *et al.*, 1990; Valdés-Muñoz *et al.*, 1990; Claro and García-Arteaga, 1993). However, most of the fishes captured during the survey were small juveniles that appeared mostly in nearshore areas, with dense seagrass habitats. The relative abundance of juvenile fish at Port Honduras is supported by the conditions of its habitats: sheltered mangrove areas along the mainland and keys and abundant seagrass beds. These conditions usually provide food and refuge for small fish. The high turbidity prevailing in this area also favors small fish survival, as visibility may reduce predator ability to catch prey.

Vertical and horizontal distribution of salinity as well as fish distribution in the areas adjacent to Monkey River confirms the prevailing southward nearshore current flow mentioned by Hortshorn *et al.* (1984).

No information exists on the inshore transport of fish larvae and juveniles from oceanic habitats to coastal areas in Belize. However, taking into account the geographic location of the Belizean barrier reefs and the prevailing southward nearshore currents (Hortshorn *et al.*, 1984), it is likely that some portion of the recruits generated at the northern spawning sites may be transported by this water movement and the Gulf of Honduras component of the offshore current, that veers to the southwest forming a counterclockwise gyre in the Gulf. Further surveys of the mangrove prop root community during the wet season may provide more accurate information on the abundance of juvenile recruits in this region.

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Appendix 1. Fish abundance at Port Honduras, Belize.

Family *Species*	Biomass g/m^2	Density ind./m^2
Engraulidae	0.1000	0.0367
Anchoa hepsetus	0.1000	0.0367
Synodontidae	0.0662	0.0046
Synodon foetens	0.0062	0.0046
Ariidae	0.6525	0.0067
Ariopsis bonillai	0.6525	0.0067
Batrachoididae	0.0800	0.0067
Porichthys sp.	0.0800	0.0067
Sygnathidae	0.0265	0.0100
Sygnathus pelagicus	0.0019	0.0033
Sygnathus floridae	0.0233	0.0033
Hippocampus sp.	0.0013	0.0033
Serranidae	0.0138	0.0100
Serranus flaviventris	0.0138	0.0067
Epinephelus itajara	0.0000	0.0033
Grammistidae	0.0190	0.0033
Rypticus sp.	0.0190	0.0033
Apogonidae	0.0015	0.0033
Phaeoptyx sp.	0.0015	0.0033
Lutjanidae	0.9146	0.0467
Lutjanus synagris	0.3236	0.0160
Lutjanus mahogoni	0.0041	0.0033
Lutjanus griseus	0.0000	0.0033
Lutjanus apodus	0.1302	0.0050
Lutjanus analis	0.3880	0.0067
Ocyurus chrysurus	0.0638	0.0057
Pristipomoides aquilonaris	0.0049	0.0067
Gerreidae	0.5627	0.0773
Gerres cinereus	0.0439	0.0133
Eucinostomus melanopterus	0.0010	0.0067
Eucinostomus lefroyi	0.0153	0.0081
Eucinostomus havana	0.0683	0.0167
Eucinostomus gula	0.0733	0.0058
Eucinostomus argenteus	0.0314	0.0167
Diapterus rhombeus	0.3295	0.0100
Haemulidae	0.7707	0.0825
Haemulon sciurus	0.0032	0.0033

Haemulon plumieri	0.4743	0.0208
Haemulon parrai	0.1543	0.0033
Haemulon flavolineatum	0.0055	0.0100
Haemulon bonairense	0.0121	0.0067
Haemulon aurolineatum	0.0705	0.0267
Haemulon sp.	0.0069	0.0050
Conodon nobilis	0.0037	0.0033
Pomadasys corvinaeformis	0.0403	0.0033
Sparidae	0.1427	0.0089
Calamus penna	0.0264	0.0033
Archosargus rhomboidalis	0.1163	0.0056
Sciaenidae	0.8443	0.0333
Bairdiella ronchus	0.3663	0.0133
Bairdiella batabana	0.0307	0.0067
Odontoscion dentex	0.4400	0.0100
Sciaenidae non-identified	0.0073	0.0033
Pomacanthidae	0.2557	0.0033
Pomacanthus arcuatus	0.2557	0.0033
Labridae	0.0482	0.0167
Halichoeres sp.	0.0006	0.0033
Halichoeres poeyi	0.0447	0.0067
Doratonotu megalepis	0.0029	0.0067
Scaridae	2.4081	0.0592
Sparisoma rubripinne	0.1785	0.0033
Sparisoma chrysopterum	1.8000	0.0067
Sparisoma aurofrenatum	0.0094	0.0067
Scarus taeniopterus	0.0456	0.0050
Scarus sp.	0.2490	0.0300
Nicholsina usta	0.1256	0.0075
Sphyraenidae	0.0063	0.0033
Sphyraena barracuda	0.0063	0.0033
Gobiidae	0.0016	0.0150
Microgobius sp.	0.0001	0.0033
Parrella sp.	0.0007	0.0033
Gobionellus shufeldti	0.0003	0.0050
Gobiidae non-identified	0.0004	0.0033
Scorpaenidae	0.0097	0.0033
Scorpaena plumieri	0.0097	0.0033
Triglidae		
Prionotus sp.	0.0010	0.0333
Bothidae	0.0039	0.0100

Citharichthys spilopterus	0.0020	0.0033
Citharichthys sp.	0.0004	0.0033
Bothidae non-identified	0.0015	0.0033
Monacanthidae	0.1848	0.0333
Monacanthus setifer	0.0950	0.0133
Monacanthus ciliatus	0.0898	0.0200
Tetraodontidae	0.5234	0.0097
Sphoeroides testudinus	0.1230	0.0042
Sphoeroides spengleri	0.4004	0.0056

Total area sampled = 10 800m^2
Total No. species = 58
Total number of fish sampled = 571
Total biomass = 6439.7g
Average biomass = 0.59g/m^2
Average density = 0.05 ind./m^2