Exploratory Fishing in the Southern Caribbean and Northern Atlantic Coasts of South America

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Abstract

During 1966 and 1967 the M/S LA SALLE, a stern trawler of 130 feet in length specially built in Norway for oceanographic and exploratory fishing work, has been doing exploratory trawl fishing off the northeastern coast of Venezuela and in the Atlantic to the northern coast of Brazil. Special treatment is made of the results concerning such important species as the sea trout or corvina *(Cynoscion virescens)* and West Indian croaker *(Micropogon furnieri)*. These fish constitute the bulk of the commercial fishery in the shallow waters (to 30 fathoms) of the Guyana's coast.

Information is also provided about the results obtained in fishing the deeper waters both in the Atlantic and the Caribbean.

Special observations on prices and marketing of these species together with a general scope of the future importance of this fishery are also given.

INTRODUCTION

THE MARINE RESEARCH STATION in Margarita has since 1962 consistently conducted programs in exploratory fishing over a large part of the eastern Venezuelan coast known as Guyana.

Initially, the objective of these exploratory works was centered on shrimp, but significant quantities of shrimp were not located. The first observations showed that the abundance of other species more than compensated for the absence of shrimp. The data concerning these preliminary investigations were presented at the 17th Annual Session of the Gulf and Caribbean Fisheries Institute, held in Jamaica in 1964.

With the launching in 1966 of the modern oceanographic vessel LA SALLE, purchased for the Marine Research Station, the exploratory programs were notably expanded in geographical range and importance. The previous experience and data from the initial work shaped the objectives of this second stage:

(1) To extend the exploratory area south to the Brazilian border.

(2) To initiate a survey of basic hydrographic conditions simultaneous with the exploratory fishing program.

(3) To chart the bottom of the area for fishermen's use.

(4) To study the distribution and commercial potential of the most important species revealed during the previous exploratory work, such as the corvina or sea trout, *Cynoscion virescens*, and roncador or croaker, *Micropogon furnieri*, including the study of the sea trout biology.

(5) To estimate the daily yield (weight) expected from the richer areas and bottoms.

(6) To provide for adequate training of future skippers in trawling, fish detection, navigation, and seamanship.

This presentation is part of a vast program of fishery investigations in the northeastern seas of South America, intended as a contribution to the development of that zone.

We have decided to present the results by way of ecological facies, instead of using the system of geographical coordinates, which would be misleading and inconclusive.

The M/S La Salle

This ship, delivered by Aukra Bruk A/S (Norway) in November 1965, was used in the above programs and has the following specifications:

Length overall 129.7 feet; molded breadth 31.2 feet; molded depth 13.6 feet; loaded draft 11 feet; class Lloyds + 100 AI "Trawler"; about 432 gross registered tons; dead weight about 250 tons; powered by an 800 hp caterpillar D398 with a Liaaen variable pitch propeller and reduction gear; with accommodations for 6 scientists and a 21-man crew. The LA SALLE has a library, laboratories for meteorology, chemistry (26 m²) and biology (13 m²), all insulated against noise. The laboratories are fitted with gas and compressed air, with adjacent refrigeration and deep freeze chambers.

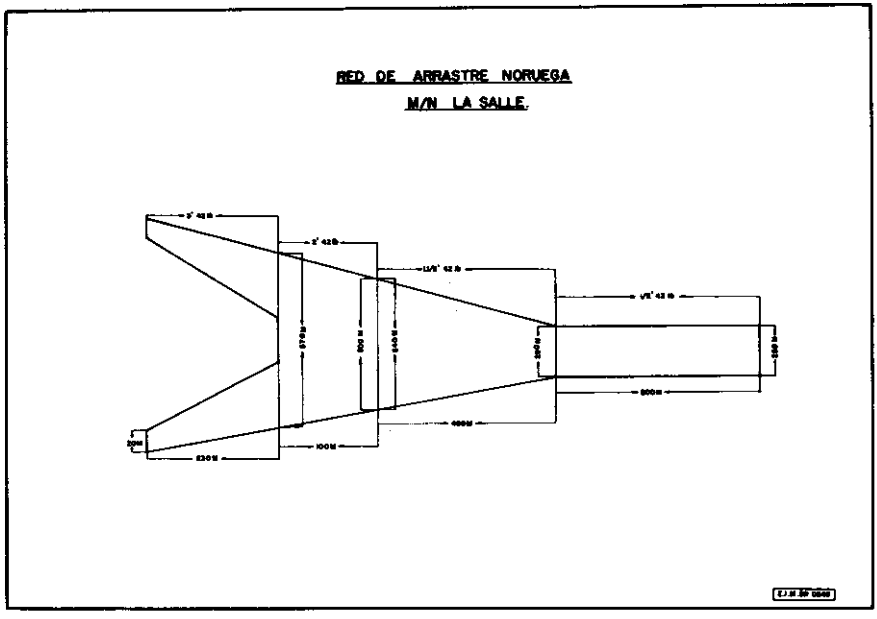

Fig. 1. Type of trawl net (of Norweign manufacture) used in the exploratory fishing. M. (number of meshes) (3′ 42 lb=width of mesh in inches and strength in pounds).

The LA SALLE is remotely controlled from the bridge, cruises at a speed of 11.5 knots and has a fuel capacity of 100 tons, permitting one-month cruises. Auxiliary power consists of two caterpillar 100 hp diesel engines coupled to two 85 KvA generators and a fresh water generator. This machinery and exhaust tubes are elastically suspended to reduce noise and vibrations. Deck equipment consists of ABAS hydraulic purse seine winch, 12-ton hydraulic trawl winch, 2 hydraulic hydrographic winches with 1500 and 50000 meters of wire respectively, and hydraulic steering gear. A unique feature is that the trawl gantry is hydraulically operated. There is a tank with running sea water for holding specimens. The refrigerated fish hold capacity is 5.5 cubic feet. There is a recording thermometer for surface water temperatures. Navigational and fish-finding equipment consists of the following: 2 echo sounding devices, SIMRAD EH 26 and EH 36 of 38 Kc and 18 Kc respectively; SIMRAD sonar SK 2; radio telephone 100 W; radio direction finder; Decca radar with 48-mile range and an autopilot.

The Fishing Gear

Specifications for the Norwegian and U.S. shrimp nets used in the exploratory work follow:

	U.S. shrimp gear	Norwegian gear
Ground rope, length	41.0 m	44.00 m
Head line, length	38.0 m	40.00 m
Total length	18.0 m	38.25 m
Bridles, length	2.5 m	12.00 m
Mesh at the wings	5.0 cm	7.5 cm
Mesh at the top	5.0 cm	3-5.0 cm
Mesh at cod end	2.5 cm	1.3 cm

The otter doors employed for both types of gear have a length of 220 cms, a width of 115 cms and a weight of 650 kgs. From 10 to 18 Norwegian plastic floats of 5 liters capacity were used as needed.

The selection of the above gear was made primarily to conduct a fauna investigation, hence the rather small mesh. Quite obviously, they are not the most appropriate for commercial use.

Expeditions and Explored Areas

Based on our previous southeastern Caribbean work, the direction of our efforts was changed to zones shown by earlier exploratory research to be most promising. In 1967 the M/S LA SALLE made three exploratory fishing voyages to the northeast (NE) of Drago, the Gulf of Paria and the Guianas, respectively. These cruises were designated LS-16-P, LS-23-P and LS-26-P.

EXPEDITION LS-16-P was made from April 17 to May 5, 1967 accomplishing the following work: Gulf of Paria, 4 exploratory hauls; Orinoco, 5 hauls; Essequibo, 14 hauls; and Surinam, 14 hauls. In the Atlantic zone of Surinam and NE of Drago, 3 and 6 additional hauls were made.

EXPEDITION LS-23-P was made between July 18 and July 31, 1967 covering the following: Orinoco, 9 hauls; Essequibo, 17 hauls; Surinam, 22 hauls; Atlantic Surinam, 5 hauls; and NE Drago, 5 hauls.

EXPEDITION LS-26-P was made between September 14 and September 27, 1967 covering the following: Paria, 3 hauls; Orinoco, 5 hauls; Essequibo, 13 hauls; Surinam, 27 hauls.

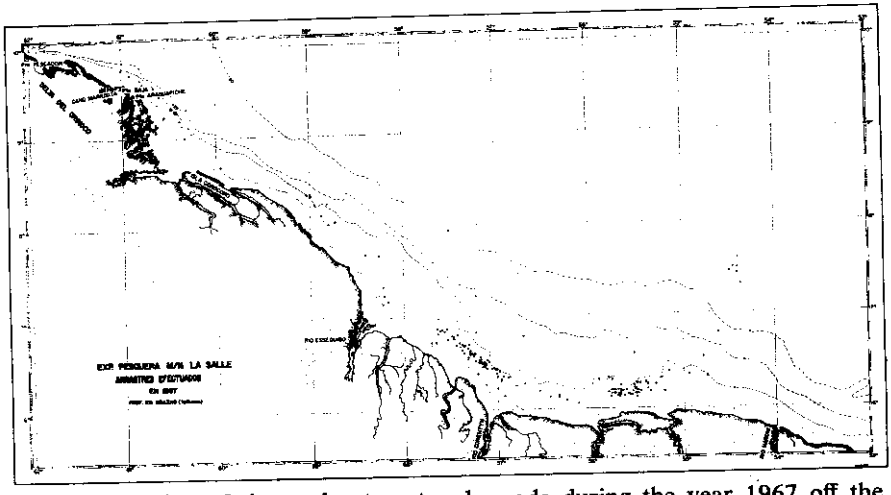

Fig. 2. Location of the exploratory trawls made during the year 1967 off the N.E. Coast of South America, between S.E. Trinidad and Surinam. Each dot represents one trawl.

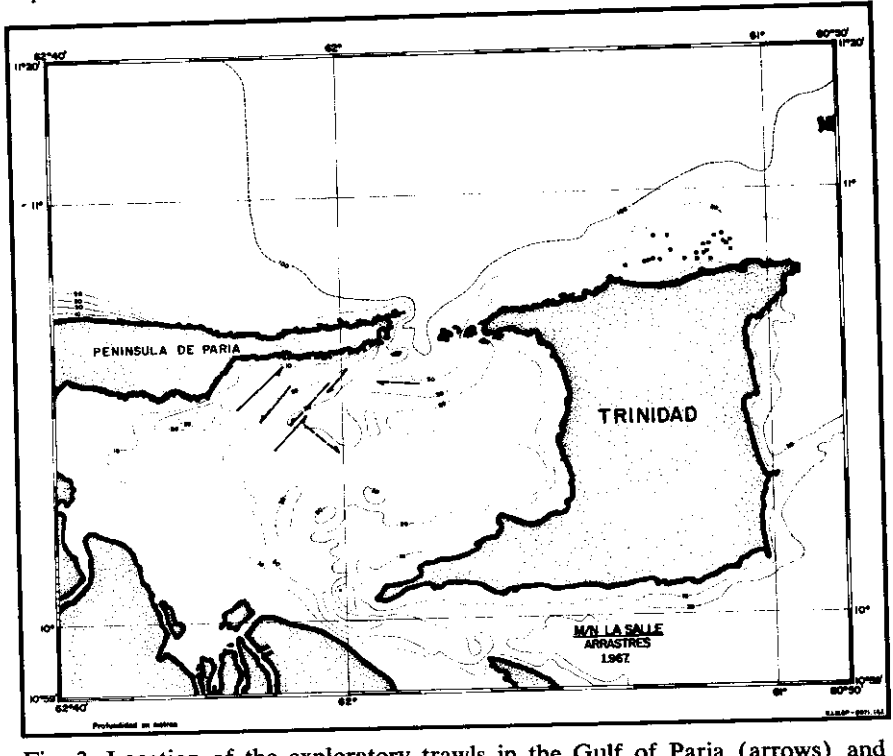

Fig. 3. Location of the exploratory trawls in the Gulf of Paria (arrows) and north of Trinidad (dots). Depth in meters.

The three expeditions encompass a total of 300 effective trawling hours and 47 days at sea.

Later in this paper, geological conditions of the regions explored are given in detail. Here only the outer boundaries will be described.

(1) NE DRAGO
This area was explored from 10°50′N to 10°55′N and from 61°05′W to 61°22′W.

(2) PARIA
At the Gulf of Paria, we explored the bottom between 9°N and 10°36′N and from 60°20′W to 62°14′W.

(3) GUIANAS
This zone was divided by us into three sub-zones: Orinoco, Essequibo and Surinam, in connection with the main rivers found in the area. Such sub-zones we marked thus: Orinoco, from Boca de Serpientes to Boca Grande, or from 10°5′N-61°55′W to 8°30′N-59°50′W; Essequibo is described as the zone extended from SE of the Orinoco's Boca Grande to the west margin of the Corentyn River in Guyana, 8°30′N-59°50′W and 6°N-57°W; from this last point to 5°50′N-54°24′W, we designated the Surinam sub-zone.

The depth, sediments, fauna and yields suggested to us a division into five sections described in fathoms: 0 to 5, 6 to 15, 16 to 20, 21 to 50 and 51 to 200.

In the Orinoco sub-zone we explored 0-5, 6-15, 16-20 and 21-50 fathoms from 8°39′N to 60°45′N and from 60°04′W to 61°00′W.

At Essequibo, we explored sections 0-5, 6-15 and 16-20 from 6°20′N to 8°21′N and from 56°59′W to 59°02′W.

At Surinam, the sections explored were: 0-5, 6-15, 16-20, 21-50 and 51-200 from 6°04′N to 7°37′N and 54°18′W to 56°37′W.

Yields

Table 1 shows that yields increased as we moved from Paria and Orinoco toward the southeast. The greatest yields were obtained off Surinam. The most productive depth off Paria was 0-5 fathoms, where catches averaged 105.10 kg per trawl or 52.55 kilograms per hour (k/h). At Orinoco, Essequibo and Surinam, the best depths were between 6 and 15 fathoms, with average of 159.76, 463.10 and 763.30 kg per trawl or catches of 80 k/h, 232 kh and 364 k/h respectively.

At NE Drago the most productive depths proved to be the 16-20 fathom section with an average of 475 kg per trawl or 237.5 k/h. This yield was well below those obtained in previous years.

It should be noted that the figures shown for both edible and trash fish in the tables cannot be construed as final. The tonquicha *(Macrodon ancylodon)*, the cacumo catfish (*Bagre* sp) and the sea trout (*Cynoscion virescens*), the latter not over 30 cms, were all considered as trash in spite of the fact that in many places they are regarded as edible fish; the tonquicha *(M. anchlodon)* by itself is one of the edible fish with largest demand in Guyana (Lowe, 1962).

Yields in Surinam obtained in a single fishing day during daylight hours, with six hauls of 2 hours trawling in depths of 9 to 12 fathoms were: sea trout, 3,740 kg; croaker, 360 kg; small shark, 230 kg; trash, 2,350 kg. The total catch was 6,680 kg.

TABLE 1

Catch in kg per hour by depth for sub-zones off the northeast coast of South America.

Fathoms	0 to 5	6 to 15	16 to 20	21 to 50	51 to 200	Total hauls
PARIA						7
Sea trout	0.55					
Croaker	4.40	1.85				
Small sharks		0.60				
Various edible	18.85	2.50				
Total edible	23.80	4.95				
Trash	28.75	10.80	12.50			
Total	52.55	15.75	12.50			
ORINOCO						17
Sea trout		6.76	9.86	0.53		
Croaker		2.83	0.40			
Small sharks		3.83	2.06			
Shrimp			0.13			
Mackerel		0.50	0.26			
Various edible		2.16				
Total edible		16.08	12.71	0.53		
Trash	4.43	63.80	37.13	4.43		
Total	4.43	79.88	49.84	4.96		
Essequibo						43
Sea trout	26.66	34.36				
Croaker	15.00	32.33				
Small sharks	6.66	20.00	0.83			
Shrimp		3.50				
Mackerel		3.10	3.33			
Lamparosa		0.30				
Red snapper		0.16				
Various edible		0.10	0.66			
Total edible	48.32	93.85	4.82			
Trash	75.00	137.70	15.00			
Total	123.32	231.55	19.82			
SURINAM						71
Sea trout	73.33	94.26				
Croaker		49.20				
Small sharks	8.33	13.70				
Shrimp		1.30				
Mackerel		8.20				
Carey		0.53				
Guasa		2.23				
Manta		24.03				
Various edible		2.53	4.66	1.66	14.90	
Total edible	148.32	195.98	4.66	1.66	14.90	
Trash	233.33	168.30	3.33	6.66	11.56	
Total	314.99	364.28	7.99	8.32	25.65	
NE DRAGO						11
Lamparosa		94.60	145.00	0.25		
Croaker		4.70	40.00			
Paguara		0.30				
Bagre		3.00				
Picua		0.25				
Various edible		0.65	2.50	0.50		
Total edible		103.50	187.50	0.75		
Trash		31.60	50.00	3.75		
Total		135.10	237.50	4.50		

Besides the small shark *Carcharhinus porosus*, we found large quantities of the shark *C. limbatus* swimming around our nets when these floated while being hauled. Sharks yielded 56 kg per line-hook hour.

Since the most abundant and interesting species obtained in our expeditions were the sea trout, *C. virescens*, and the croaker, *Micropogon furnieri*, we will discuss these species.

The sea trout, *C. virescens*, was found all over the area between Paria and Surinam, and it proved to be more abundant as we proceeded toward the southeast. In Paria, it was restricted to the facies 0 to 5 fathoms with an average yield of 0.55 kg per hour, while in Orinoco its location widens to three facies: (1) 6-15 fathoms, averaging 6.76 k/h; (2) 16-20 fathoms averaging 9.86 k/h; and (3) 21-50 fathoms, with an average of 0.56 k/h.

At Essequibo and Surinam, the sea trout is found only in the two upper facies or those between 0-5 fathoms and 6-15 fathoms; average yields at Essequibo were 26.66 k/h and 34.36 k/h respectively for the two facies, while these showed in Surinam, 73.33 k/h and 94.26 k/h.

There seems to be a definite connection between the presence of sea trout and the salinity of waters at lower depths, since every catch was made in salinities of 35 and 36 parts per thousand (ppt) with the exception of a single catch hauled from water with a 34 ppt salinity.

The largest sea trout, *C. virescens*, was 950 mm total length (TL) with a weight of 3500 grams. This female, with ovaries in process of maturation, was caught off the Orinoco river in the 6-15 fathoms facies.

Sizes measured in total length averaged the following:

Region	Facies	
	0 to 5	6 to 15
Orinoco	761 mm	607 mm
Essequibo	781 mm	615 mm
Surinam	742 mm	709 mm

Few specimens measured less than 250 mm TL. Exceptions were 113 mm TL and 83 mm SL and a weight of 8 grams. It appears that the species spawns in shallow waters, as is the case with other species of the same genus. This has not been verified.

We found few specimens near sexual maturity. More frequently specimens with ovaries at first stage of development were observed.

The stomach contents of large numbers of sea trout were examined in the different regions, and frequently found to contain residues of shrimp of the species *Xyphopenaeus kroyeri* and *Penaeus* sp.; Sciaenidae fish, mainly *Stellifer* sp., *Ophioscion* sp., and *M. ancylodon;* also *Trichiurus lepturus, Arius* sp. and *Engraulidae*. Sciaenidae were the most dominant species in stomachs.

Consistently in our expeditions, we registered a discernible reduction in sea trout catches after sundown. This fact we attribute to a vertical migration, since a change of depth did not yield better results.

We found the croaker, *M. furnieri*, to be next in importance to the sea trout. The croaker was taken together with the sea trout in every region explored. We also caught it in the 6-15 fathoms facies, with an average 1.85 k/h, as compared to an average of 4.40 k/h in the 0-5 fathoms facies. In the Orinoco, the croaker was caught in 6-15 fathoms with an average yield of 2.83 k/h and in 16-20 fathoms with a 0.40 k/h.

It was found at the Essequibo in the 0-5 fathoms facies with a 15.0 k/h average, and from 6-15 fathoms it yielded 32.33 k/h. At Surinam, it was located at the facies 6-15 fathoms, with a yield of 49.20 k/h. NE of Drago we found the croaker along with the lamparosa, *Vomer setapinnis,* at the 6-15 fathom facies with a yield of 4.70 k/h and at the 16-20 fathoms facies averaging 40 k/h; it was in this latter area where we found the largest specimens, with sizes up to 518 mm TL, 435 SL and a 1.700 grs. weight.

Although its presence is less constant and its capture more sporadic, the mackerel, principally *Scomberomorus maculatus* and to a lesser extent *S. caballa,* are worth mentioning. These species are particularly valuable as edible fish in the Venezuelan market.

Overall capture was especially good at Surinam, between 6 and 15 fathoms, with a record single haul of 440 kg.

The lamparosa, *V. setapinnis,* is another interesting species at NE of Drago. We made catches of 94.60 k/h in the 6-15 fathoms facies, 145 k/h in the 16-20 fathoms facies and 0.25 k/h in the 21-50 fathoms facies. In this same region, during previous years, we have caught up to 1000 k/h of lamparosa alone, with no other species in the same catch.

The preceding figures do not necessarily reflect the areas' full potential. The general objective of the expeditions was to conduct systematic explorations. On the other hand, we sometimes remained at one spot after determining that commercial catches could be made.

Hydrographical Data

Date on temperatures, salinity and dissolved oxygen were taken only at the time we were trawling for sea trout, principally in order to establish whether changes in those conditions affected the abundance of that fish. Full scale hydrographic research was not attempted.

During the month of April, surface temperatures for the whole area remained between 27° and 28°C, except in two stations at the coast of Surinam, where a slight drop was registered. In July, temperature at some stations rose above 28°C. In September, across the Essequibo River we registered between 28.50° and 29.16°C. In Surinam, however, the 27°C was constant. At a depth of 20 meters, we recorded an almost invariable temperature level between 25° and 26.5°C.

Salinity increased with depth in all stations. At depths most probed, those between 5 and 12 fathoms, the salinity level was constantly of 35 and 36 ppt. At the surface, the pattern was variable and registered from 10 ppt, 20 miles in front of the Orinoco Delta, in July, up to 35.60 ppt 15 miles across the Surinam in the same month.

Dissolved oxygen was recorded in a wide range, regardless of station or time of year. At the surface, we registered about 4 ml per liter and between 2.5 ml per liter and 3 ml per liter at the 20 m depth level. At this latter depth off the Corentyn and Coppename rivers, during July, we registered an almost total absence of oxygen.

From the above, it is apparent that commercial size sea trout seems to favor waters of relatively high salinity. The fact that off the Orinoco this species is found in deeper levels suggests that it avoids low salinity but keeps rather close to fresh water. Since we found no female specimen with signs of spent ovaries, it is possible that this cycle takes place in a lower salinity.

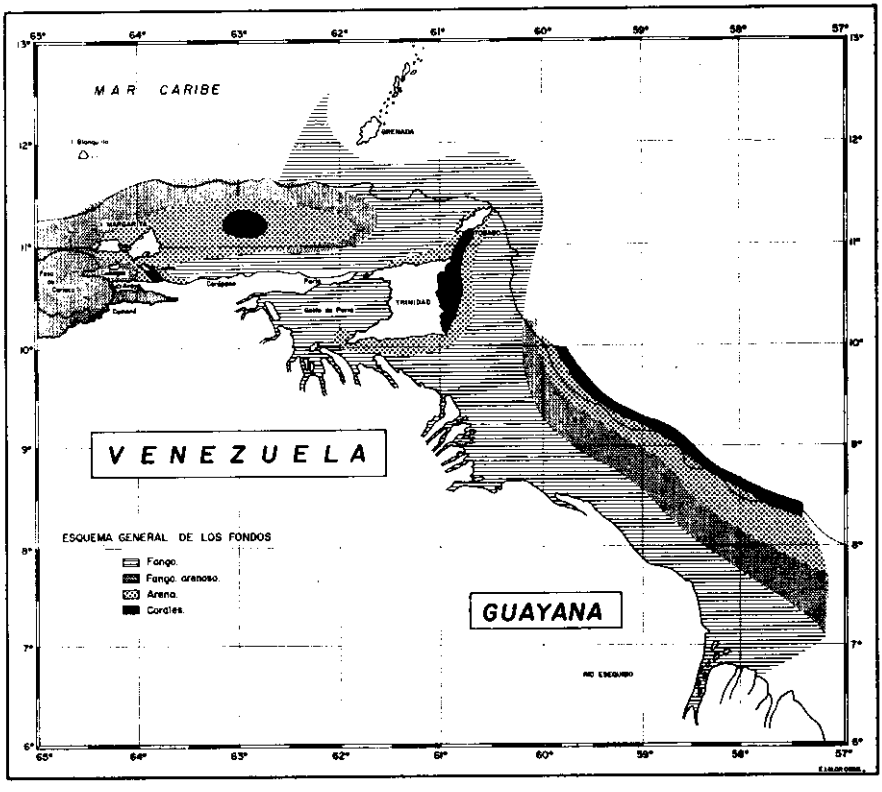

Fig. 4. General distribution of bottom sediments in the study area. (Fango= mud; Fango arenoso=sandy mud; Arena=sand; Corales=Corals).

General Geological Characteristics of the Ocean Bottom of the Area Under Study

Sediment samples collected during our expeditions and studied in our Geology Department allow us to draw the following conclusions:

(1) ZONE NE OF DRAGO: The sea floor in this zone is generally muddy, except between Trinidad and Tobago where a section of coraline sand is found, extending all along the eastern coast of Trinidad.

(2) In the GULF OF PARIA the bottom is muddy, with the exception of sandy areas located on the west coast of Trinidad, the platform of El Soldado Key, south of Trinidad and Boca de Serpientes. Trawling is possible in this area, except on the margins of the Serpientes Channel.

(3) GUIANAS ZONE: If we were to section the Orinoco Delta with a line drawn WSW-ENE, we would observe four different types of bottom soils:

(a) a muddy section from 0 to 25 fathoms, starting from the coast and extending to the 35-40 mile limit,

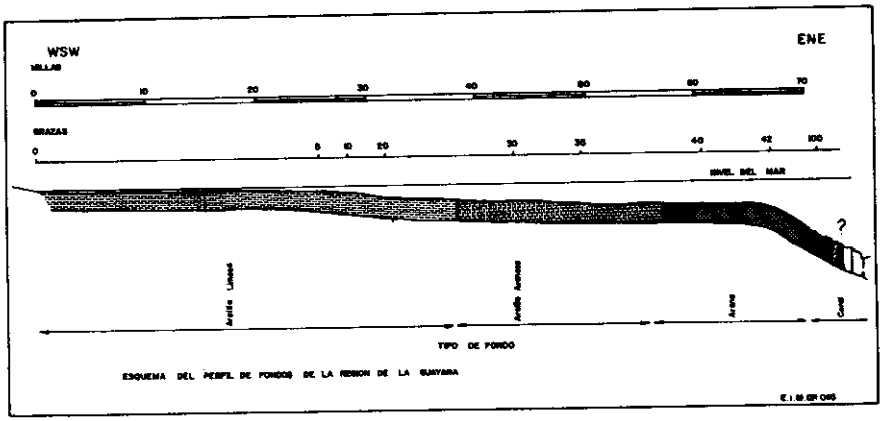

Fig. 5. Topographic profile showing the characteristics of upper layer sediments offshore of Venezuelan Guyana and transecting the Boca Grande of the Orinoco River. 8°50'N - 60°40'W; 9°25'N - 59°30'W.

(b) a mixed section of sand and mud at a depth of 25-40 fathoms and from the 40 mile line to the 55 mile line from the coast, and

(c) a shelly sand section found between 40-50 fathoms and from 55 to 70 miles from the coastal line.

Trawling can be conducted in these sections with due care around the spots shown in the nautical charts of the area where sunken ships from the last World War are found. Another impediment for fishing lies in the physical composition of the mud found between 0 and 5 fathoms, which is semi-liquid and can easily clog and finally tear open the net by sheer accumulation of weight. It can even endanger the ship by settling and bogging the otter doors.

(d) Farther than 70 miles offshore, coraline formations from the glacial era, typical of the coastal rocky line, are found marking the edges of the continental shelf.

(e) At the Essequibo (Lowe, 1962) our sampling showed the same four sections as described previously, although to a narrower extent. This is probably due to the lower velocity of the Essequibo River and to the currents running to the northwest. Depth markings for the four sections are lower, with the muddy zone extending to some 15 fathoms and 20 miles from the coast, the muddy sand bottoms continuing down to 30 fathoms and 35 miles from the coast, while the shelly sand reaches 40 fathoms at 55 miles. The continental platform ends at 50 fathoms and 60 miles from the coast. No fishing obstacles were found in these sections.

(f) Conditions at Surinam are similar to those above.

ECOLOGY AND DISTRIBUTION OF THE SPECIES

The most important ecological characteristic of the whole region of exploration and sampling is the influence of great masses of fresh water and its

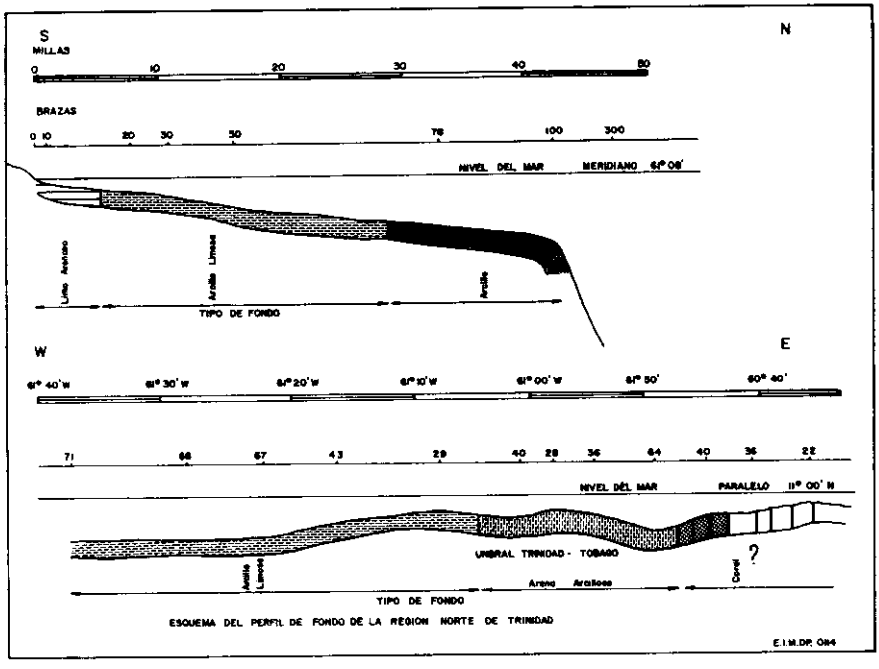

Fig. 6. Topographic profiles showing the characteristics of the upper layer sediments north of Trinidad.

seasonal variations between dry and rainy seasons. The extensiveness of this water flow appears to exercise considerable influence over the distribution of fauna to depths of 15 to 20 fathoms. Likewise, silt deposits carried by rivers also influence the types of fauna that dwell upon the substratum. These ecological characteristics have a direct influence on fishing results since the fauna which inhabit depths of 15 to 20 fathoms off the Orinoco delta to the northeast to the island of Trinidad is found at depths of 6 to 10 fathoms southeast of the Essequibo and also off Surinam. In previous papers (Fundación La Salle, 1962, 1963; Cervigon, 1964) four relatively well-defined facies in the Venezuelan Guyana area were reported. The results of the present explorations off the Guyana and Surinam coasts show similar zonation. These facies are closer to the coast when approaching the French Guiana coast in a southeasterly direction. Similar zonation was reported by Lowe (1963) in Guyana.

In the July 1967 expedition, an extensive collection of species was assembled. Detailed study of 50 hauls was made and a total of 155 species identified. Difficult cases such as those presented by genera *Stellifer* and *Ophioscion* of the family Sciaenidae; *Anchoa* and *Anchoviella* of Engraulidae; and *Harengula* of Clupeidae prevented us from specific identification on board or in the laboratory. This indicates the urgency of making an appropriate review of some of these genera and a general taxonomic study of this highly interesting ecological unit extending from the southeast of Trinidad to at least the eastern French Guiana border.

The faunal zonation corresponds very closely to the sediments. Distinctive to the mud sediments off the Guianas are two communities of fauna which we designate the "yellow fish" and the "white fish" complex. The division of these two faunistic facies is not always clearly defined but distinct diverging tendencies are quite noticeable. The two facies are composed of species eminently euryhaline, such as Sciaenids, catfishes (especially *Bagre* and *Arius*), Engraulids, numerous rays, and sharks. Sea trout, *C. Virescens*, is the dominant species of this complex followed by different Sciaenids and Clupeids. Off the Orinoco, the first facies would be between 3 and 16 fathoms and the second between 16 and 25; off the Surinam, the first would be between 3 and 12 fathoms and the second between 13 and 19 fathoms.

On sandy bottoms off shore from muddy formations, an entirely different fauna is encountered and is formed by species of the families Serranidae, Pomadasydae, Lutjanidae, Mullidae, and Scorpaenidae. We designate this complex as "red fish." From a commercial viewpoint, it is not too promising and it extends to the edge of the coral rock level found at variable depths according to the areas. Off the Orinoco, this facies starts at a depth ranging from 22 to 25 fathoms and off Surinam, between 14 and 19.

Beyond the continental shelf and down to more than 100 fathoms, a fourth facies is identified which we designate "black fish," predominantly composed of Macruridae, Polymixiidae, Chlorophthalmidae, Scombropidae, Peristediidae, and Callyonimidae.

In the first facies, which for the explored area in Surinam we have established to be between 5 and 12-13 fathoms, 94 species were caught and identified; for the second, between 14 and 19 fathoms, 64 species were collected. Between 20 and 30 fathoms, 38 species were collected and between 100 and 200 fathoms 19 species were collected. Even though the number of catches was not the same after every interval, a decreasing tendency in the number of species caught is both obvious and interesting. Net results in terms of weight per hour of catch also decreased progressively as the depth increased. The explanation for these phenomena could be as follows: the ecological conditions of the coastal zone are subjected to constant seasonal variations resulting from periodic river overflow and tides which, in turn, cause the salinity to vary at a particular place over periods of 12 hours. These constant variations maintain this "harbor" ecosystem in a permanent state of immaturity, which prevents it from evolving to its "climax." Many of the species living in this ecosystem pertain to primitive phylogenetic groups (Engraulidae, Clupeidae). Other important representatives of youthful ecosystems such as pelagic species can also be found there. Other typically fluvial groups, perhaps more specialized within their order though phylogenetically primitive, such as catfishes (Cypriniformes), can be encountered in this zone as a first step of an intent of colonization of the sea. Both Engraulidae and Clupeidae found in this zone show the typical characteristics of species inhabiting permanently young ecosystems; these include a wide range of morphologic and meristic variation. Intergrading characteristics like those pertaining to *Harengula* sp. and *H. pensacolae* are not infrequent. The high specific diversity, atypical of youthful ecosystems, can be explained by the fact that it is a bordering zone in which fluvial and marine representatives converge.

In the 20 to 30-40 fathom interval, where the bottoms are not affected by fresh waters, and the ecological characteristics (relatively high temperature,

and plentiful food) are more stable and still favorable, a community more in line with the characteristics of a mature ecosystem can be found. Its species pertain to groups which are more phylogenically evolved (Serranidae, Pomadasydae, Mullidae, Scorpaenidae), and it receives seasonal or casual visits of pelagic elements such as Carangidae and Scombridae. Curiously enough, at these depths, invertebrates such as crustaceans and molluscs are proportionately more numerous than in the shallow facies, which indicates more complex trophic relationship and better use of the energy feeding the ecosystem. Another characteristic of these mature ecosystem bottoms is their low yield in terms of fishing. This is in contrast to youthful ecosystems subjected to intense fluctuations as are pelagic and demersal species of temperate and cold areas which provide more abundant yields.

The ecosystem at depths between 100 and 200 fathoms has not been explored intensively. Conditions there appear to be unfavorable for the development of a complex ecosystem. The number of species is small and widely distributed. No dominant species with important commercial potential has been detected as is true at similar bottoms in tropical Western Africa where merluza *(Merluccius senegalensis)* and cachucho *(Dentex macrophthalmus)* have been located. Small quantities of *Merluccius* sp. were reported in 163 fathoms.

CONCLUSIONS

All of the Guyana area, from southeast of Trinidad to French Guiana at depths ranging from 3 to 30-40 fathoms, is suitable for trawl fishing, with slight danger of gear loss or tear due to topographic obstacles or bottom nature. Both total and edible fishing yields increase as progress is made toward the southeast, reaching a maximum at the explored coastal seas of Surinam, between 5 and 12 fathoms.

Maximum yields in the area are obtained between 5 and 21 fathoms; yields tend to decrease noticeably beyond such depths.

The most important commercial species are the sea trout, *C. virescens,* and the croaker, *M. furnieri.* Off the Venezuelan Guyana, the best sea trout yields are obtained between 16 and 22 fathoms, while southeast of the Orinoco Delta such yields are obtained between 5 and 12 fathoms.

The Gulf of Paria did not seem to offer good possibilities for commercial exploitation. However, northeast of Boca de Drago a high-yield area was located where the lamparosa, *V. setapinnis,* was almost constantly present in large quantities.

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