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MARINE FISHERY DEVELOPMENT IN
LIBERIA, 1952-54

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INTRODUCTION

This report on the development of marine fisheries in Liberia under the program of the Foreign Operations Administration is intended to describe the condition of the fisheries of Liberia in 1952, to outline briefly the principal activities of the marine-fishery technician, and to indicate in a general way the lines of development and the progress made during the period 1952-54. The survey and investigation, undertaken at the request of the Liberian Government, was supervised during the early part of the work by the Office of Foreign Activities of the Fish and Wildlife Service of the Department of the Interior and during the later part, by the Technical Cooperation Administration.

Liberia, lying from 4° to 8° north of the equator on the southwest bulge of the west coast of Africa (Fig. 1), has a low, sandy coastline approximately 350 miles long. The continental shelf is narrow, scarcely exceeding 30 miles in width, and the coastline is dissected by numerous river systems arising in the country or beyond the border in the mountainous interior and running to the sea in parallel courses at distances of 25 to 40 miles apart. The larger rivers, which are flooded during the wet season, are the Cavalla, the Mano, the St. Paul, the St. John, the Lofa (Laffa), and the Cestos, all of which rise in the interior plateau. Most of the rivers, particularly the smaller ones, have few tributaries but meander through areas which are generally swampy and choked with mangroves near the coast. The smaller rivers are generally blocked by sand barriers during the dry season, forming lagoons which may become nearly fresh. All of the estuaries are definitely brackish during the dry season and the larger ones may be navigable by motor launch for 25 miles or more from the ocean.

The type of aquatic life in the rivers, the lagoons, and in the in-shore ocean area is largely controlled by the rainfall and the related temperature and salinity of the water. The rainy season, with rainfall of 20 to 45 inches a month, is from April through October. The dry season, with monthly rainfall of only 5 inches a month, is from November through March. Because of the extensive lagoons, the lower stretches of the rivers provide important fishing areas for small-scale operations. In August 1953, the Liberian Cartographic Service established tide and river gauging stations in the Mesurado and St. Paul rivers which doubtless, if maintained, will provide useful information for the future fishery development.

THE FISHERIES AND FISHERY RESOURCES

Before 1952, the fisheries which supplied the major catch were the gill-net fishery, the beach-seine fishery, and the line fishery conducted by the Kru tribe. The trawl fishery holds great promise but was only being introduced at this time.

In the following pages there is presented an account of these principal fisheries with comments on boats, gear, methods, catches, and often fishermen, together with fragmentary information, gathered

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in the course of the 2-year period of operation, on the fish and their habits and apparent abundance in the different seasons.

The Trawl Fishery

Before World War II, a trawler, large enough to fish in waters deeper than 20 fathoms, operated in the area around Monrovia. A German operating company also had a small canning plant for fish on a waterfront street in Monrovia. At the outbreak of the war, the company's equipment was confiscated by the Liberian Government but little could be learned of this operation in Monrovia.

In December 1952, a small trawler owned by the United Nations was put into operation by the FAO fishery staff and used for 9 months. This trawler was a Greenland-type gill-net vessel approximately 22 feet long, powered by a 12 h.p. diesel motor, and could fish in a maximum depth of 10 to 12 fathoms with a 31-foot trawl made in Liberia. From this operation it was learned that bottom fish which support the beach-seine and small trawl fishery migrate into waters deeper than 12 fathoms during certain seasons.

In early 1953, a 45-foot trawler capable of dragging to a depth of 60 fathoms entered the fishery. This vessel was owned and operated by a Frenchman from Abidjan, Ivory Coast. The main grounds fished were from 8 to 20 fathoms deep off the mouth of the St. Paul River. Drags were made using a large trawl of $2\frac{1}{2}$ -inch mesh size for a duration of 1 to 2 hours with catches averaging between 200 and 1,200 pounds per drag. Due to poor marketing, fishing was held to 2 or 3 drags a day. The fish were sold in case lots of 50-60 pounds at the general price of 15-30¢ per pound, according to species and size. This enterprise was not successful and the vessel left Liberia after about two months of operation.

In November 1953, a trawler approximately 45 feet long arrived from Italy with an Italian skipper and engineer. This fishing vessel was brought to Liberia by a newly-formed company, the Liberian Fishing Enterprise. Considerable forethought went into the planning of this company and advice was asked of the marine technician through the Liberian Department of Agriculture and Commerce.

On November 3, 1953, the boats began operating in water deeper than 20 fathoms. About a thousand pounds were taken of a species heretofore not seen in the commercial catch, from an entirely different population of fish beyond the inshore population which made up the catches of the small trawl and beach-seine fishery. The species has not yet been identified.

On the next day, the vessel fished in waters 12 to 18 fathoms deep. The first drag yielded 700 pounds and the second drag 1,200 pounds. The fish caught were of the same species taken by the beach-seine fishery.

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It was reported that the catch averaged 40,000 pounds per month for the first two months of operation.

In 1954, another trawler owned by this same company arrived in Liberia. The vessel used an otter trawl of Italian design of 2 to 2½ inch mesh throughout. The trawl was towed from either side with 6 millimeter cable. The length of the cable used in dragging was approximately three times the depth of the water. When the trawl reached the surface the drive lines were hauled on board by hand over the stern, but the winch and boom were used to pick up the net over the side. The vessel was manned by captain, engineer, two Liberians to operate the winch, and two to three Liberians as fishermen-deckhands. The drags varied from one to two hours duration.

The catch was dumped on the stern of the vessel and the net was immediately set out for the next drag. The fish were then separated by size and species into boxes weighing 20-23 pounds. The boxes of fish were taken to the bow of the boat, washed down, and stacked under shade.

The boat generally made two to four drags early in the morning, and approximately the same number of drags in the afternoon. The afternoon catch was brought into the port around 6 to 7 p.m., where the boat was met by a pickup truck of the fishery company. The fish was then taken to the company's market and immediately placed in a refrigeration chamber holding over five tons of fish. The fish were disposed of during the day.

The following prices were charged to the consumer for the trawl-caught fish on February 12, 1954 (the increased cost per pound for case lots was to prevent buyers from reselling at a higher price):

	<u>Price per lb.</u>	<u>Price per case and per lb.</u>		
Sting rays and sharks	7.5 ¢	\$ 1.50	7.5 ¢	
Gbaple (<u>Ilisha</u>)	8-10.0 ¢	2.00	10.0 ¢	
White boy (<u>Sciaenidae</u>)	10.0 ¢	2.25	11.2 ¢	
Catfish (<u>Ariidae</u>)	10-24.0 ¢	2.75	13.7 ¢	
Cassavafish (<u>Sciaenidae</u>)	15.0 ¢	4.00	20.0 ¢	
Sole (<u>Soleidae</u>)	15.0 ¢	4.50	22.5 ¢	
Bia bia (<u>Pentanemus</u>)	15.0 ¢	3.50	17.5 ¢	
Butternose (<u>Galeoides</u>)	20.0 ¢	5.00	25.0 ¢	
Grunters (<u>Pomadasys</u>)	20.0 ¢	5.00	25.0 ¢	
Pogies (<u>Ephippidae</u>)	20.0 ¢	Insufficient for case lots		
Sea shrimp (<u>Penaeus</u>)	25.0 ¢	"	"	"
Crabs (<u>Callinectes</u>)	about ½ to ¾ lb. -- 15.0 ¢ each			
Lobster (<u>Panulirus</u>)	about 2 lb. ----- 75.0 ¢ each			
"	about 1½ lb. ----- 50.0 ¢ each			
"	about 1 lb. ----- 30.0 ¢ each			

The Gill-Net Fishery

The gill-net fishery has long been conducted by crews or companies of 7 to 9 fishermen of the Fante Tribe on the Gold Coast, signed

THE FISHERIES AND FISHERY RESOURCES (cont.)

to 2 to 3 year contracts, and transported with their gear by steamer to Liberia. The money made by the company during the period of the contract is divided into shares for the boat owner, the chief fisherman, and the crew. The areas fished near Monrovia are Kings Grey Point, Camp Johnson, Mamba Point, Monrovia Free Port, and the St. Paul River.

The craft used by the company is a large, stable, sea-worthy dugout, called an Accra canoe, generally from 16 to 26 feet long and powered by 6 to 8 paddlers or by sail (Fig. 2) and large enough to hold a large herring gillnet, up to 9 persons, and 2,000 pounds of fish.

Gillnets, generally hung 2:1, are variable in length but generally exceed 200 yards and are over four fathoms deep. The netting is made

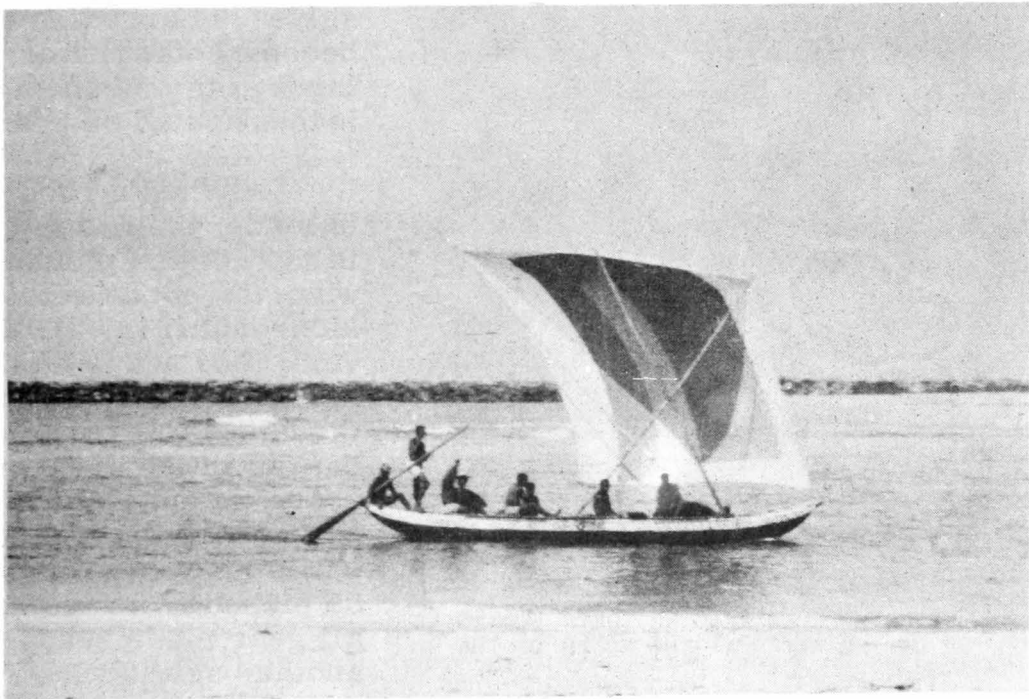


FIG. 2 - AN ACCRA CANOE SAILED BY FANTE FISHERMEN ENTERING THE MOUTH OF THE MESURADO RIVER AT MONROVIA, DECEMBER 1953.

in Europe of 36/6 cotton twine, 1 7/8 inch stretched mesh, 540 meshes deep, 200 yards long, and sells for \$125-250 in Monrovia, depending upon the merchant. The corks are variable and generally spaced from 24 to 36 inches. The leads used are flat pieces 3 to 4 inches wide by 8 to 10 inches long, weighing from 4 to 8 ounces, and are crimped in the middle over the lead-line $\frac{1}{2}$ fathom apart. They are sometimes removed from the nets when they are on the drying racks (Fig. 3).

When the crew is ready to fish, the nets are taken from the drying racks and placed in six or eight bundles, depending on the size of the crew, and placed in the canoe ready for setting. The time of departure for the canoe to the fishing grounds varies with the area and season from early in the morning to dusk.

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FIG. 3 - FANTE FISHERMEN MENDING THEIR BONY GILL NETS ON THE DRYING RACKS AT THE MOUTH OF THE MESURADO RIVER.

When a school of fish is seen on the surface, the net is shot around it in the same manner as a lampara or a purse seine. The net circle is closed and the net hauled into the canoe until the circle diameter is 75 feet or less. The crew then jumps from the canoe into the circle of the net, splashing and making a commotion in the water, driving the fish to gill or entangle themselves. Large fish either become entangled or break through the mesh. The net is then hauled on board.

When a good catch is made, the fish are left in the net and picked out when the canoe returns to Monrovia (Fig. 4). If a very good set is made and the catch is too large for the canoe to handle, other canoes in the area will share the catch on a percentage basis. If a poor set is made, the fish will be picked from the net and all gear made ready for another set.

The herring, generally called bony, Sardinella cameronensis, predominates in the catch of the Fantes in August and December. In January, the catch changes from Sardinella cameronensis to Sardinella aurita. Though the seasons of abundance are as named above, the fishery is conducted the entire year and the seasons vary with locality. The fishermen in Monrovia do not like to fish during August when the weather is generally very bad because they claim that the fish are in poor condition.

During November, December, and January, large schools of small herring are seen in the lagoons and brackish-water areas of the rivers from Marshall to Robertsport. In March and April, the small fish are seen schooling in number in the Monrovia Free Port area. Sardinella

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constitute about 95 percent of the catch. The remaining 5 percent is bumper (*Chloroscombrus*), pike (*Sphyraena*), bia bia (*Pentanemus*), butternose (*Galeioides*), cassavafish (*Cynoscion*), white boy (*Sciaenidae*), flying fish (*Cypselurus*), and gar fish (*Strongylura*).

When fish are scarce, the majority of the catch is sold fresh directly to the consumer (Fig. 5). The price of fresh bony varies from three fish for 10 ¢ to six fish for 15 ¢, or an average price of 5-15 ¢ per pound. In periods of glut, the majority of the fish are smoked in kilns 3 feet high and 6 feet in diameter and sold directly in Monrovia or shipped by truck to the Firestone Plantation. These fish generally sell 2 to 3 for 10 ¢, or 10-15 ¢ per pound.

In seasons when bony are very scarce, the Fante people will fish for mackerel, cavalla, bonga, mullet, or others for home use. The net used for mackerel is a 3-inch stretched mesh size, 12/8 cotton twine, variable in length and width. This netting can be purchased in Monrovia at times for \$225-275 for a piece 200 yards long by 540 meshes deep.

The cavalla nets used generally in August and September by the Fante fishermen are made of heavy cotton seine twine of 8-10 inches stretched mesh, variable in length, and approximately 3 to 4 fathoms deep. The technician observed only one net of this type in Monrovia, though he was told there were three. According to reports, it is possible to catch up to 50 large fish in one night's fishing. One large hammerhead shark with an estimated weight of 300 pounds was caught in this net.



FIG. 4 - AFTER THE ACCRA CANOE IS BEACHED THE CREW REMOVE THE FISH FROM THE NET. IN TIMES OF SCARCITY THE BOAT IS ANCHORED IN DEEP WATER TO AVOID THE INTERFERENCE ASHORE BY THE CONSUMERS. THE PREDOMINATING SPECIES IN THIS CATCH IN JANUARY IS SARDINELLA AURITA.

THE FISHERIES AND FISHERY RESOURCES (cont.)



FIG. 5 - WHEN THE FISH HAVE BEEN REMOVED FROM THE NET THE CHIEF FISHERMAN SELLS THE FISH TO CONSUMERS, TO WOMEN RETAILERS, OR TO THEIR OWN WIVES FOR SMOKING AND THEN RESELLING. AN ARGUMENT MAY TAKE PLACE BETWEEN THE BUYERS AND THE FISHERMAN OVER THE PRICE.

The bonga fishery is for shad, Ethmelosa dorsalis. The net used is made of light cotton twine of 1-7/8 inch or 2-1/2 inch mesh, in lengths the same as the bony nets. Bonga do not occur in such large quantities as the bony in the Monrovia area.

An effective and simple type of gill net has been evolved by the coastal people of Liberia for fishing in the creeks, rivers, and lagoons (Figure 6). This net is made of the palm leaf fiber, which is rolled by hand into small pieces of twine 12 to 18 inches long. These short pieces are then rolled into longer pieces to form the twine. The nets made are generally not over 150 feet long, varying in depth from 2 to 8 feet, with a 2 to 2½ inch mesh hung 2:1. The floats are small and made from the pias-sava-frond pith spaced on the cork line from 12 to 24 inches apart. No lead line is used. The time required to make a net is

from 2 to 4 months, and the finished product resembles a linen net in size and strength. In the village of Gbomgbo Town on the Laffa River, a small net of this type caught approximately 30 pounds of fish, mainly mullet, in one evening of fishing.

The Beach-Seine Fishery

Beach seining is one of the favored methods of fishing in Liberia because of the large return for a small investment. Failures of beach-seine enterprises in Liberia have not been caused by a lack of fish but by poor business methods or improper care of equipment.

Beach-seines were first brought into Liberia from Europe by

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enterprising Liberians in the early 1900's and have existed in the different areas since that time. Since 1952, the number of beach-seines has increased in the Cape Mount area from 1 to 5 and in the Monrovia area from 5 to 12. In 1952 the majority of the beach-seines fishing in Liberia were owned and operated by the fishing tribes from the Gold Coast. This had changed considerably by 1954 with half of the nets owned by Liberians and an additional 20 percent owned with Liberian partners.

Like the Fante bony fishermen, beach-seine crews are hired from among the different fishing tribes from the Gold Coast and are brought to Liberia to fish for a 2 to 3 year period. The general practice of a Liberian owner is to hire a chief fisherman and a crew of 6 to 15 to fish the net. The owner of the fishing canoe and net generally takes half of the catch, and the remaining half is divided into shares. If bystanders help pull the net, they are given enough fish to eat from the crew's share.

The best season for fishing a seine in the Monrovia area is from July through November. In this period, the fish are abundant enough in the muddy water from the streams so that a net may fish both day and night. During the rainy season, 8 to 10 sets may be made in a 24-hour period, with catches ranging up to 600 pounds per set. In the dry season, only 2 to 3 sets are made with catches exceeding 600 pounds, mainly of small fish.

The beach-seine generally has wings of 150 to 300 feet in length, variable depth to 18 feet, and 2 to 3 inch mesh made from 12/8 cotton



FIG. 6 - TWO FISHERMEN FROM GBOMGBO TOWN ON THE LAFFA RIVER ARE SHOWN EXAMINING A LOCALLY-MADE GILL NET FOR MULLET AND OTHER BRACKISH WATER FISHES. THIS NET IS VERY SHALLOW, IS SIMILAR IN APPEARANCE TO LINEN, AND DOES NOT HAVE A LEAD-LINE.

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twine. The belly is heavier seine twine of $1\frac{1}{2}$ to 2 inch mesh and the bag is of very heavy seine twine of 1 to $1\frac{1}{2}$ inch mesh. The bag and belly vary but are generally between 12 and 18 feet long.

A drive rope equal to or longer than the wings is attached to the shore and laid out from a canoe. When the end of the rope has been reached, the wing is attached to it and laid out and finally the bag is thrown overboard. The other wing is thrown out heading toward shore and finally the second drive rope is laid to the beach. The drive ropes are then hauled in by three to ten persons on each rope, dependent upon the size of the seine. As the wings move toward the shore, the two beach crews move in to a distance of 75 feet or less from each other. When the wings reach shore, two men keep the lead line on the bottom and two men keep the cork line from fouling. On a heavy swell, the bag is pulled up on the beach. The trash, leaves, and jelly fish are thrown out and the fish are placed in large 60 to 80 pound iron pans.

The containers of fish are carried by women, usually wives of the fishermen, to a round, fenced enclosure where the fish are separated by species and size into piles and sold. The consumers and women retailers stand outside of the enclosure and point out the pile of fish which they wish to purchase. The operation is supervised by a police inspector who sees that the fish are sold by the fishermen at the government price of not more than 20¢ per pound. The average price varies from 10 to 15¢ per pound.

The catch of the beach-seine sometimes includes mammals such as dolphins or manatees. When either of these animals is seen, an attempt is made to set the net around it. The technician observed five dolphins caught in two days. The beach-seine operating at the mouth of the Mesurado River sometimes picks up a new-born baby dolphin. They are called sea monkeys in Liberia.

A population of manatees exists in the Bendu region of Fishermen's Lake. Two have been taken in the seine there, a male and a female, although the net was torn up in the process. The area they inhabit mainly is the Moffi River near Bendu where they are said to destroy a considerable amount of rice in flooded fields. The flesh resembles pork.

Line Fisheries

The line fishery is conducted commercially by members of the Kru Tribe and by the coastal people for subsistence. The three types of line fishing are long line, hand line, and trolling, depending upon species sought and the season.

The long-line fishery is conducted seasonally along the entire coast of Liberia. The species of fish caught are grippers (Lutjanus), barracuda (Sphyraena), sand cavalla (Trachinotus), shiny nose

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(Polydactylus), and sharks and rays. Generally speaking, this is not a productive fishery because of the large amount of bait needed. The technician was told this type of gear was tried by the mission at Bendu and proved to be very unproductive in that area.

The lines are either of heavy seine twine bought from the stores or handmade from the palm fibers. They vary in length up to 500 feet and have as many as 250 hooks with 12 to 18 inch gangions on a line. The hooks vary in size for the species sought. The fishermen engaging in this fishery are generally proficient in the use of a cast net and catch small brackish-water fish for bait. The preferred bait species are Gerres melanopterus, mullet (Mugil), and bony (Sardinella).

The lines are baited and placed after dark in an area unobserved by other people and without any location markers. If the line is placed in an area where there are a number of boats, the fisherman will stay with his line all night because if he is seen and if he does not tend it, the line will not be there in the morning. Long lines, marked by floats, are used in the daytime when the water is still turbid. Fifteen floats were seen in a small area by the rocks at the mouth of the St. Paul River. Eight fish, generally grippers (Lutjanus), is considered a very good catch. Rays weighing up to 300 pounds are caught in the brackish-water sections:

The commercial catch of the hand line fishery by the Kru fishermen is of many species, such as the following: "salmon" fish (tuna); mackerel; barracuda; red snapper (sea bream); cassava fish (weakfish); grippers (red snapper); sea gripper (grouper); mangrove perch (Tilapia); sharks and rays; sea catfish; butternose (threadfin); and shiny nose (threadfin).

Variations of the hand line fishery, dependent upon the species sought, are as follows:

1. When the fishermen are fishing in the ocean on the mud bank off of the St. Paul River, small hooks are used, up to three per line, and placed within six feet of the bottom weight. The bait used is bony (Sardinella) or gbaple (Ilisha). The catches of a single fisherman seldom exceed 20 pounds a day.
2. When the fishermen are fishing in the ocean and the fish sought are at unknown depth, a hand line is anchored at one end and hooks placed on it approximately every six feet. The other end of the line is attached to a float or canoe. There are generally two fishermen to a boat if the line is long. The catch seldom exceeds 20 pounds a day.
3. Small anchovies are used as bait in offshore fishing for pelagic tuna and sailfish. The white fibrous root of a plant is wrapped around the hook as a lure. Only one hook is used per line, but two lines may be fished by a fisherman. Catches seldom exceed 250 pounds a day. There are usually two fishermen to a canoe and the area fished is generally 15 to 35 miles offshore.

THE FISHERIES AND FISHERY RESOURCES (cont.)

4. Hand lines with 2 to 3 hooks of medium size spaced 2 to 4 feet apart on the line, heavily weighted with a sinker and baited with sand crab, are thrown out into the surf at the mouths of the rivers and lagoons. The line is secured on the beach and is placed on a set-up stick. The stick falls down when a large fish is on the line. This is the main method used for taking sand cavalla (Trachinotus), but is also effective for taking grippers (Lutjanus) in season. One fisherman may operate three set lines with catches of 3 to 5 large fish per day not uncommon. Catches generally do not exceed 100 pounds.
5. In the Monrovia Free Port, a fisherman will use a very small hook on the end of a short line with a small weight 12 to 18 inches above it. The hook is then dragged on the surface of the water in a 2-foot circle. Catches of 30 small (3 to 6 inches long) cavalla by this method have been observed but seldom exceed five pounds.
6. In the rivers, two men will engage in bait casting from a canoe. The line is approximately 35 feet long with a medium size hook on the end and with a small weight placed 12 to 18 inches above the hook. The hook is baited with a fresh-water crayfish (fresh-water shrimp) and cast into the area around the base of the mangrove trees and sunken stumps and then retrieved quickly. This is very effective on gripper (Lutjanus), red bellies (Pelmatochromis), jacks (Hepsetus), and sometimes barracuda (Sphyraena). The same type of gear is very effective on small gripper, 'cuda, and cavalla in the Monrovia Free Port.

Trolling is mainly conducted by the Kru Tribe for barracuda, mackerel, cavalla, and gripper, but the local people of other coastal areas visited have learned this method.

The fishery is seasonal by species and area. In Monrovia, many cavalla are caught during August and September; in the Laffa River the season for cavalla is March and April; and in Cape Mount cavalla occurs in October, at the end of the rains. The technician observed schools of large fish in Fishermen's Lake during March 1953. There appears to be a definite migration of these large fish along the coast, but there is much to be learned about them.

Barracuda appear in the ocean during the rains. In October and November they are found schooling in the Monrovia area around King Grey Point. In December and January the Mesurado River had become saline and small 'cuda (up to 24 inches) were found in this area. On examination, they were found to be in a spawned out condition. In February, March, and April, the large fish are found in and near the river mouths, drifting back into the ocean.

The line used for trolling is generally heavy, hard-laid seine twine up to 75 feet in length. The lures used are cut fish bait, hooks wrapped with a white fibrous root, "store-bought" plugs, and spoons. For cavalla and 'cuda, spoons have virtually replaced the first two types

THE FISHERIES AND FISHERY RESOURCES (cont.)

since 1952. For mackerel, cut bait is still used.

In fishing for cavalla or 'cuda, two persons paddle a canoe as fast as possible, dragging two lines. The troll line is tied in a loop to the shoulder of a paddler. When an exceptionally large fish, such as a shark, grabs the bait the fisherman may suddenly find himself in the water. During August and September every able-bodied Kru man will fish in the Monrovia area for cavalla. Over 100 canoes may be seen fishing in an area of a square mile. Good catches for a canoe will consist of about 10 fish per day. The general average is one to three fish per day.

Upon the advice of the marine technician, two members of the Bureau of Fisheries engaged in trolling with their outboard motorboats during off periods from work. On one occasion, with a catch of 64 fish or over 800 pounds, fishing was stopped at noon because of the lack of refrigeration facilities in Monrovia.

Trap Fisheries

There are four basic types of fish traps seen in the brackish and salt water sections of the rivers in Liberia. These are round bank traps, weir traps, weir fences, and set traps. The first two types are the most common and many are used in certain areas. In the Maffa River at Cape Mount, 52 were counted. If the traps are well located they make good catches of mangrove perch (Tilapia).

The round bank trap is constructed on the bank of a creek or river in an area which has little or no water at low tide. The trap is circular, varying from 4 to 6 feet in diameter and with a height of 6 to 8 feet. The sides are made from the coarse center of the piassava palm. In the bottom center of the trap, opening to the water, is the entrance, which is approximately 12 inches square. A trap door is placed above this opening attached by a line to the bait. When the fish starts pulling at the bait, the trap door closes. The bait used is guinea corn, palm kernels, and cassava leaves and roots. In several catches observed there were at least six Tilapia weighing between $1\frac{1}{2}$ to 2 pounds each. This type of trap would seem to be ideal for cropping fish ponds.

Weir traps enclose small areas, generally less than 225 square feet, which are partially dry at low tide. They are made of matting 4 to 6 feet high and variable in length (Fig. 7). The entrance is an opening 2 to 3 feet wide by the height of the trap. The traps are generally baited with palm kernels, cassava root, and guinea corn. Baiting is done just before dark. The entrance of the trap is closed when the owner thinks sufficient fish are inside. These traps are said to do very well in the Dia area during the rains.

Near the mouths of rivers, mangrove flats are flooded to a depth of 1 to 2 feet at high tide, at which time small fish seek food and shelter among the tree roots, and the large fish seek the small fish. Weir traps are built in such areas.

THE FISHERIES AND FISHERY RESOURCES (cont.)



FIG. 7 - A WEIR TRAP IS SHOWN IN THE CREEK NEAR DIA. IN THE PHOTOGRAPH THE DOOR TO THE TRAP IS CLOSED BUT WILL BE OPENED WHEN THE TIDE FLOODS.

Along the bank of the Mesurado River there is a stretch of more than 300 feet which is enclosed by a matting fence 4 to 6 feet high with many entrances for fish. As the tide begins to ebb the entrances are closed and at low tide the people gather the fish which have been stranded there. In some places the people will leave the matting rolled up and then enclose the entire area at one time. In an area such as the Kpo River, when the bar at its mouth closes during the dry season, the water will flood the gulleys and ravines when the rains come. When the water almost reaches the height at which the river will break through into the ocean, the people seal off the gulleys and ravines with the weir fences and catch the fish when the break-through occurs. Some gulleys and ravines are said to be very productive.

The design of set fish traps varies with the maker. They are usually round or rectangular, $4\frac{1}{2}$ feet long by 3 feet high, and the round entrance is eight inches in diameter. The traps are woven like a basket

THE FISHERIES AND FISHERY RESOURCES (cont.)

from the hard exterior portion of the piassava palm. The bait used is palm kernels, guinea corn, and cassava root. The traps are set in the river and left there for a period of 2 to 3 days, catching gripper and mangrove perch.

Why there has been such a development of traps in the rivers and lagoons and not in the ocean is not known. The technician was told that, prior to the war, a German national had set a large wire fish trap a considerable distance offshore and had caught up to 300 pounds per set of two days' fishing. An explanation was never given why he stopped fishing such a successful trap.

Push Net Fishery

The push-net fishery, common throughout Liberia, is operated solely by women in the brackish and fresh-water areas as a subsistence fishery with every aquatic form such as crustaceans and molluscs taken for food, regardless of size. The nets are oblong, varying from 2 to 8 feet long by 1 to 4 feet wide, made from the fiber twine, $\frac{1}{2}$ inch mesh, with loosely tied knots. The nets are made by the women and hung with a 6 to 8 inch sag (Fig. 8).



FIG. 8 - WOMEN RETURNING FROM PUSH-NET FISHING IN THE CREEK AT DIA. OVER 35 FISHERWOMEN AND GIRLS WERE COUNTED ON THIS MORNING IN FEBRUARY. THE CATCH WAS SMALL AND CONSISTED MAINLY OF MANGROVE PERCH (TILAPIA) AND RED BELLIES (PELMATOCHROMIS). THE NET SHOWN IS USUALLY HANDLED BY TWO PERSONS.

The method used depends upon the area fished. In one method, a number of women surround a given area near the bank of a stream and probe into the mud beneath the bank with a stick or their hands. If a fish is felt and does not try to escape, the woman will grasp the fish securely near its head and place it either in a small sack suspended from her waist or in a basket on the shore. If the fish tries to escape, it will be caught in her push-net. This method is used in certain creeks

THE FISHERIES AND FISHERY RESOURCES (cont.)



FIG. 9 - TWO CAST-NET FISHERMEN ARE WORKING THE SHALLOWS IN THE MESURADO RIVER FOR MULLET (MUGIL) AND MANGROVE PERCH. ONE NET IS STILL IN THE AIR WHILE THE OTHER, CAST BY A FISHERMAN ON THE RIGHT (NOT SHOWN), HAS JUST SPLASHED THE WATER.

and streams with good results, but it has its dangers, as large snakes often lie concealed beneath the banks. In the brackish-water areas, a small creek, less than 3 feet deep, will be blocked by the women at low tide and a drive will be made. Many varied types of fish are caught. In November and December the women will replace the netting with burlap sack material and drives will then be made along the gravel shoreline of the rivers. Large quantities of small fresh-water crayfish (fresh-water shrimp) and larval fish are taken. The small fish are made into cakes an inch thick, 4 to 5 inches wide, 8 to 10 inches long, wrapped in leaves, and smoked over the fire. The small shrimp are cooked as soup.

The push-net fishery has done the most harm to the small streams of Liberia. Except for the small streams, the technician does not believe that the fisheries are depleted to the extent that

publications in Liberia have indicated. If the streams were as depleted as one is lead to believe, then the small streams would not be replenished for the annual push-net fishery. If the larger streams were fished as efficiently as the small creeks, there is not a doubt that depletion would occur.

Cast-Net Fishery

Cast-nets or throw-nets were brought to Liberia less than 40 years ago from the Gold Coast. They were so effective that their use spread along the entire coast. At the present time, cast-netting is the only method used for taking mullet and is also used in taking bait for the long-line and hand line fisheries (Fig. 9).

THE FISHERIES AND FISHERY RESOURCES (cont.)

The cast-net varies in diameter from 6 to 15 feet. It has a heavy lead line and a double mesh is placed around the inside of the net next to the lead line for entangling the fish as the net is pulled in. The net is used either by one person wading along the shore or by two persons in a canoe. Good catches of 50 pounds or more per day of fishing are made, but the fishery is very destructive of such fish as the mangrove perch (Tilapia). Many young fish are taken as they remain in brood groups for a long period. The adult fish are vulnerable during the spawning season when they are guarding their nests. Ten nests, guarded by adult fish, were observed in the salt-water area of the lower Mesurado River. A cast-netter was seen working this area but after he had moved through the area no adult fish could be found.

Miscellaneous Fisheries

Most Kru fishermen carry a harpoon in their canoes for dispatching large fish such as sailfish, tuna, and tarpon when they are brought up to the boat to be landed. If a turtle or dolphin (mammal) is seen within throwing distance, it too is harpooned, although very few are killed by this method. Two men were seen fishing from a canoe using a bow and arrow in the upper Junk River. This was the only example of this type of fishery seen by the technician in Liberia. It is believed the fishermen were seeking gripper (Lutjanus), which lie sunning themselves on the top of the water. The technician was told that fish, mainly grippers, were speared from the rocks in the Laffa River near Gbo Town.

The torch fishery for both fish and crustaceans is carried on by two methods. A man holding a flaming torch will wade along the shoreline in shallow water. When a fish is attracted to the light or a crayfish or fresh-water shrimp is seen, the man kills it with a cutlass or machete and places it in a basket. At the end of the rainy season, this fishery is common along the lower St. Paul River. In the other method, a boat with three persons in it will work along a creek on a very dark night. One person paddles, one holds the torch, and the third handles the cutlass, taking fish on the surface. Jacks, fresh-water mullets (Characins), and grippers are taken by this method, but the catch is not great.

Dynamiting, although outlawed, occurs in Liberia as in all countries where the commercial fishery does not supply the demand. With the increased catch in the Monrovia area, there has been a noticeable decrease in dynamiting. The species usually taken are mullets and grippers. In a case of dynamiting observed near the Bureau of Fisheries Station, dynamiters took only about half of the fish killed and abandoned the rest.

Fisheries for Shellfish and Turtles

There are at least three species of oysters in Liberia which were not recognized and were sent to specialists for identification.

THE FISHERIES AND FISHERY RESOURCES (cont.)

The oyster species in this report are named according to their environment.



FIG. 10 - THE PROLIFIC SETTING OF THE MANGROVE-TYPE OYSTER ON THE PILINGS OF THE FISHERY WHARF IN THE MONROVIA FREE PORT IN DECEMBER.

The "Mangrove Oyster" is small with a valve length seldom exceeding three inches. It spawns prolifically over a period of several months, starting in October, and sets abundantly on rocks, pilings, shells, and mangrove roots (Fig. 10). It has a rapid growth rate and is believed to reach maturity within 18 months. This oyster has a wide salinity tolerance--from 0-34 parts per thousand--and is able to survive high temperatures, occurring abundantly throughout the coastal region of Liberia. The St. Paul and Laffa Rivers proper do not have this species, probably because the salinity is too low over too long a period of time.

The oysters are gathered by both men and women. The mangrove roots bearing clusters of oysters are cut off, taken back to the village, and kept in water until needed for use.

On market days the clusters are taken from the water, steamed open over a smoldering fire, and shucked. The technician was able to purchase several gallons of meats from a village on the Mesurado River for 25¢ a pint.

When the oysters set on rocks, as they do on the breakwater of the Monrovia Free Port, they are gathered with a flat iron or crowbar. In the Little Basea River, oysters are gathered from reefs by divers.

The "Deep Water Oyster" is taken from the main channel of the lower Du River, Snafu Bay area. Reportedly, large oysters similar to those of the Atlantic Coast of America are found in the Baffu Bay area, probably the same species as found in the Du River.

This oyster has a shell length of 5 to 8 inches. It has a wide salinity tolerance ranging from pure fresh to salt water. Judging by its habitat, it probably is not able to stand high temperatures. Its spawning season occurs in October and November. Oysters examined in January were very poor in appearance. As no other means are available, the oysters are taken by diving, but this is hazardous because of large predaceous fish. The shucked meat from this oyster sells for 20¢ per pint in February and March and the shell is sold for 60¢ per bushel. Over 100 bushels of oyster shell were seen at the Snafu Bay dock in 1953.

THE FISHERIES AND FISHERY RESOURCES (cont.)

Twenty bushels were bought for use as cultch. The remaining shell was sold to the chicken farmers of the Marshall-Monrovia area.

The "Rock Oyster" from the Cape Palmas region is famous in Liberia. It is found on rocks in the ocean surf from Cape Palmas to Cape Mount and is also taken from the rocks in the ocean near Royceville. This oyster has a very large shell, 8 to 12 inches long by 1 to 2 inches thick. Nothing is known of its life history.

In the Cape Palmas area, oysters are gathered from the rocks by divers who are paid 4¢ per oyster. In the Royceville area, the women divers swim out to the ocean rocks where the large oysters are found.

The chief predator of oysters in Liberia is the snail. One area of oyster set on the breakwater of the Monrovia Free Port was being observed by the technician. Within a one-week period a snail infestation moved into this area and completely destroyed the oyster population. As many as 30 snails were seen on an oyster at a single time. The species of snail has yet to be identified. Another snail, *Thais nodosa*, is commonly found on ocean rocks. No other common oyster pest was observed. Only brittle starfish have been seen in the waters of Liberia and the mollusc-eating fish are not common in the inshore area.

Many clams are found in Liberia and are eaten by the people but there is only one species of fresh-water clam, *Arca*, which is gathered for commercial use. It is found in sandy tidal areas of rivers and in sandy mud lagoons. In the Monrovia area, it is found abundantly in the lagoon below the Mesurado River bridge, in the area around Providence Island, and on the sand flat at the mouth of Stockton Creek (Fig. 11).

The clam reaches a maximum size of 70 millimeters in width. At the start of the season in October, the average size of the clams taken is between 40 to 50 millimeters. Due to the intensive fishery, the average width decreased in February to between 10 and 20 millimeters. In October and November, up to 200 pounds of clams per day were seen at the Camp Johnson market.

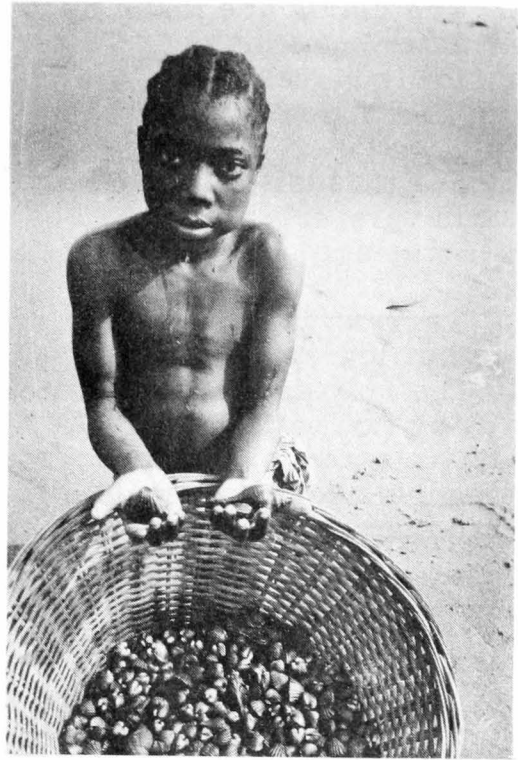


FIG. 11 - A LITTLE FISHING GIRL HOLDING A CLAM AND A SNAIL TAKEN IN THE LAGOON AT THE MOUTH OF THE MESURADO RIVER. THE BASKET, AT THE TIME OF THE PHOTOGRAPH EARLY IN THE MORNING IN JANUARY, HELD APPROXIMATELY 30 POUNDS OF CLAMS.

THE FISHERIES AND FISHERY RESOURCES (cont.)

The clams are taken by women and children wading in several feet of water. As many as 15 persons will fish in a group. As the group slowly moves along, they feel for clams with their feet, collecting them in sacks tied to their waists and dumping them into baskets ashore.

Sea mussels (Mytilus) are not common in Liberia. One species occurs in very small numbers on the breakwater of the Monrovia Free Port. Some are eaten and some are used as bait for fishing.

Terrestrial and aquatic snails are eaten in Liberia. They are gathered at low tide from the rocks, the mudflats, and along the river bank. The only area from Marshall to Cape Mount where snails are not eaten is by the Laffa River. At the town of Bendu at Cape Mount, snail shells have accumulated throughout the years in piles many feet deep. By using unslaked lime made by burning snail shells in a simple fire pit, a mission constructed two large buildings without the use of cement.

In the Sinkor and Congertown districts of Monrovia, sea turtles are taken as they come ashore at night to lay their eggs. Both the meat and the eggs are eaten. Though the turtles are not seen in quantity they are not uncommon, and are most frequently seen in March and April. Kru fishermen sometimes harpoon turtles sleeping on the surface of the water. Their weight varies from 10 to several hundred pounds.

In the Liberian streams fresh-water shrimp are called "crawfish." One species 1/, which makes up 98 percent of the catch by weight and number, was not identifiable in the field. The commercial catch rarely includes any shrimp less than 65 millimeters (from base of eye stalk to tip of telson). The minor species caught, rarely exceeds 54 millimeters and has a different coloration. The season of abundance in the lower St. Paul River is from June to December, when the water is fresh or only slightly saline.

The fishery is prosecuted by both men and women. Generally four or five fishermen will fish in a locality, using 12 to 50 basket traps, depending upon the expected success of the catch (Fig. 12). The baskets are woven by the fishermen out of piassava palm. They have a double opening, one within the other, like a fyke net, with entrance holes 1 to $1\frac{3}{4}$ inches in diameter. The traps are baited mainly with cassava root or palm kernels. They are set out along the rocky gravel shoreline in the afternoon at low water, with rocks placed on top and around each trap, and are tended in the morning. Up to 24 shrimp are caught per trap. Catfish (Clarias) and bullheads (Gobiodea) are also caught occasionally in the traps.

The catch for the day is transferred to a large basket container which holds 50 to 75 dozen crawfish, and held in water until Saturday when it is sold. If the catches are very good, the crawfish may be sold twice a week. The price obtained is 15¢ to 25¢ per dozen, depending on the supply. At the height of the season, over 100 dozen may be sold weekly at a single landing.

1/ MACROBRACHIUM VOLENHOVENII (HERKLOTS). THIS SPECIES IDENTIFICATION WAS MADE BY DR. FENNER A. CHACE, JR., U.S. NATIONAL MUSEUM, MARCH 24, 1955.

THE FISHERIES AND FISHERY RESOURCES (cont.)

Sea shrimp of two species are taken by otter trawl and one species by beach seines. The brown species ^{2/}(Parapenaeopsis atlantica Balss) is fairly abundant and is approximately the size of Crago sp. in the United States. The white shrimp (Penaeus duorarum Burkenroad) is closely related to Penaeus setiferus. It grows very large and would be classified as jumbo on the Gulf Coast. Since only a very few of this species are taken by trawl, 20 pounds is considered a good catch. The area fished is within the 20-fathom line and may not be deep enough to include the main beds.

Although many different species of edible crabs abound in the waters of Liberia, the species supplied by the commercial catch are the blue crabs of the genus Callinectes. The Fante nets, when dragging on the bottom for fish, entangle both crabs and lobsters. The Fante and Kru fishermen when fishing in the rocky area off Kings Grey point use hand-lines for these crustaceans, and the newly established trawl fishery also takes a small number. The catch of large trawlers seldom exceeds 18 crabs and 12 lobsters in a day's fishing. It is possible that a small pot fishery could be established in areas such as the Kings Grey reef.

The spiny lobster (Panulirus), called sea crayfish, occurs in the rocky bottom areas off Liberia. The commercial catch by all types of gear is very small.



FIG. 12 - A WOMAN TENDING HER CRAYFISH TRAPS IN OCTOBER IN THE AREA WHERE THE ST. PAUL RIVER ENTERS THE LAGOON AT ITS MOUTH. IN THE FOREGROUND IS A LARGE BASKET FOR HOLDING THE CRAYFISH (MACROBRACHIUM) IN THE WATER UNTIL THEY ARE SOLD.

^{2/} SPECIES IDENTIFICATION MADE BY DR. FENNER A. CHACE, JR., U.S. NATIONAL MUSEUM, MARCH 24, 1955.

FISHERY DEVELOPMENT PROGRAM

Late in 1952, under the auspices of the Assistant Secretary of Agriculture of Liberia, a fishery program to coordinate the activities of the several agencies and technicians concerned with fishery development was drawn up and submitted to the Department. Two technicians of the Food and Agriculture Organization of the United Nations were assigned to Liberia. One was assigned the field of gear technology and production and the other to processing and marketing. The author of this report, a TCA technician, was assigned the field of marine exploration. Fresh-water pond-culture was assigned to another TCA technician who arrived at a later date.

At the request of the Assistant Secretary of Agriculture, the technicians drew up and presented the draft of an act to establish a Bureau of Fisheries in the Department of Agriculture and Commerce, and a draft of regulations to provide basic protection for the fisheries. The acts had not been approved by the legislative body as late as May 1954, but a temporary Bureau of Fisheries was promptly established, an acting chief appointed, and fishery aides assigned to cooperate with the foreign technicians. Three small buildings were erected to serve as headquarters for this agency.

Working with the Liberian fishery head, appointed in December 1952, a series of reconnaissance surveys and exploratory fishing expeditions were undertaken, including observations of the fish catch to estimate production; extensive collection of the fish fauna for taxonomic study; surveys of river and brackish water fishing areas; observations of the sport fishery; trials of commercial gear; and observations of shellfish resources.

In addition to demonstrating the construction and operation of improved fishing gear, such as trolling spoons and lines, a series of net-making demonstrations was carried out in the village in an effort to improve production. These educational efforts appeared to be successful.

Marine Fisheries Survey

Observation for the marine fisheries was the first major project undertaken in order to learn the different species comprising the commercial catch in Liberia. With the compilation of these data, the following was learned:

1. With the exception of one or two species, the same marine fishes support the beach-seine fishery and the small trawl fishery. The population of fish migrates into waters over three fathoms deep in December, out of the reach of the beach seines. In February or March, the population moves out beyond the 12-fathom line, beyond the reach of the small trawl. Ten species of fish comprised over 90 percent of the catch by weight and number. Sole are caught in abundance only during January and February, in the area off the St. Paul River with the small trawl.

FISHERY DEVELOPMENT PROGRAM (cont.)

2. A population of bottom fish differing from the inshore beach-seine population was found in commercial quantities beyond 30 fathoms.
3. Offshore hand-line fishing was practiced throughout the dry season, October to June, for dolphin, sailfish, little tuna, tuna, bottom groupers, and sea breams. The largest catches of tuna were made in November when the ocean water reaches its maximum temperature.
4. The bony (herring) fishery for Sardinella cameronensis and S. aurita is seasonal, with August, December, and January landings being the largest.
5. The main schools of cavalla (Caranx hippos) arrive in the Monrovia area in August and September. At the start of the season the fish schools contain many age groups. In the middle of the season the fish have separated into schools of distinct age groups by size. At the end of the season, as the fish become scarce, they band together once again, in schools of many age groups.
6. In the rainy season, June through October, the beach-seine catch was composed of many juvenile fish, particularly those of the genera Trachinotus and Caranx. During the dry season, many small mackerel are caught.

A collection of over a thousand marine fishes, crustaceans and molluscs was made and sent to the U. S. National Museum in Washington for identification. Photographs of nearly all of the fish species were made and assembled with provisional identifications, vernacular names, and distribution notes. The study of this extensive collection had not been completed when this report was written.

Brackish-Water River Surveys

Brackish-water river surveys were conducted in every river system from Marshall to Cape Mount, Liberia. The following marine fish were found in the lagoons during the rains: gripper (Lutjanus); sole (Bothidae and Soleidae); cassavafish (Cynoscion); white boy (Sciaenidae); ten-pounder (Elopidae); sea catfish (Arius); butternose (Galeoides); shiny-nose (Polydactylus); and grunTERS (Pomadasys).

During the dry season, the following marine fish were seen in the lagoons and rivers: barracuda (Sphyraena); cavalla (Caranx); mackerel (Scomberomorus); butternose (Galeoides); shiny-nose (Polydactylus); grunTERS (Pomadasys); burro (Gerras); tarpon (Megalops); ten-pounder (Elopidae); mullet (Mugil); sand cavalla (Trachinotus); and sea gripper (Petrametopen).

Some fresh-water fish adapt themselves readily to the transition from fresh to salt water. Mangrove perch (Tilapia) have been seen

FISHERY DEVELOPMENT PROGRAM (cont.)



FIGURE 13 - AN INEXPERIENCED LIBERIAN, AFTER MINOR INSTRUCTIONS, WAS ABLE TO MAKE SPORT CATCHES WHICH WELL EXCEEDED 300 POUNDS. THE LARGE GRIPPER (LUTJANUS) WAS HOOKED BY THE YOUNG FELLOW ON THE LEFT. HIS FATHER ASSISTED IN THE LANDING OF THE FISH. (PHOTO BY THOMAS CURTIS.)

spawning in salt water in the lagoon near the town of Robertsport in February 1954, and in the lagoon at Monrovia.

Several populations of fish, which could easily be exploited by either net or line fishing, were observed. These populations will be discussed later.

Sport Fishery Observations

Sport fishermen in Liberia use trolling and casting gear. Cavalla, 'cuda, gripper, shinynose, tarpon, and mackerel are taken by trolling in the ocean or rivers, while perch (Pelmatochromis), fresh-water mullet (Characin), and jack (Hepsetus) are taken on spinning or casting gear in the creeks. At the Firestone plantation at Harbel there is a sport-fishing club with wharf facilities at Snafu Bay on the lower Du River. There are generally 20-45 small boats tied up or on the bank near the club. Catches are generally good. In March and April, a few good fishermen land large tarpon in the lower Du River. The Little Bassa and Farmington Rivers in this same area are also good fishing grounds.

FISHERY DEVELOPMENT PROGRAM (cont.)

Sport fishing is carried on by the people of Monrovia, Bomi Hills, and Baffu Bay. The rivers fished are the Mesurado, St. Paul, Kpo, and the Laffa River. Large catches of big fish are not uncommon. Gripper (red snapper) weighing 42, 48, 62, and 82 pounds have been caught in the Mesurado River, Monrovia Free Port, the Laffa River, and Baffu Bay, respectively (Fig. 13). Barracuda weighing 60 and 69 pounds have been caught in the Mesurado River and Laffa River. Tarpon, six and eight feet in length, were caught on the Laffa River by a Kru bait troller. Shinynose weighing over 60 pounds have been caught in the St. Paul River and in the Firestone area.

The annual sport fishing catch is very large and valuable. Since women also participate, the fishery is not limited solely to men.

Trials with Commercial Fishing Gear

One of the principal objectives of the fishery technician was to increase fish production by testing the effectiveness of various methods of fishing practiced in other parts of the world and by demonstrating successful methods to the Liberians. While awaiting the delivery of a trawler from Europe ^{3/}, reconnaissance surveys were completed. There was considerable delay in securing fishing equipment and in making up nets. The most readily obtained gear, such as trolling lines, gill-nets, and equipment already in use, was used first. Later, trawls were used in exploration.

Exploratory Trolling

In order to make the best use of time and gear available, an exploratory trolling survey was conducted simultaneously with initial surveys in the brackish-water areas and the ocean. Trolling was done in the following areas: Little Bassa, Du, Junk, Mesurado, St. Paul, Kpo, Laffa, Little Cape Mount, Maffa, and Moffi Rivers; Snafu Bay; Stockton Creek; Fishermen's Lake; and the ocean from Monrovia to Cape Mount.

It was demonstrated that one-man trolling with a small outboard motor could be commercially successful (Fig. 14). The daily catch averaged well over 100 pounds during this survey. Since the species sought are seasonal, the commercial fishermen would have to move with the fish. The gear needed for this type of enterprise would be a small, Liberian-made boat, less than 14 feet in length, costing less than \$100; a 7.5 h. p. outboard motor costing \$210; and trolling gear costing less than \$50. This initial investment of \$360 could bring a fisherman a minimum annual income of not less than \$1200, which in Liberia would be equivalent to the

^{3/} ALTHOUGH IT WAS EVIDENT SOON AFTER THE TECHNICIAN ARRIVED IN LIBERIA THAT AN EXPLORATORY FISHING BOAT CAPABLE OF USING VARIOUS KINDS OF GEAR WAS ESSENTIAL TO CARRYING ON EXPERIMENTAL FISHING, IT WAS NOT UNTIL LATE 1952 THAT THE PURCHASE OF A BOAT WAS AUTHORIZED. ON JANUARY 28, 1953, THE FISHERY TECHNICIAN AND A FORMER U. S. COAST GUARD OFFICER, COM. G. E. MORRIS FROM TCA/M, DEPARTED TO LOOK FOR A FISHING BOAT IN GERMANY. A 35-FOOT DIESEL POWERED STEEL VESSEL, EQUIPPED WITH TRAWLING WINCHES AND GEAR, WAS PURCHASED IN HAMBURG. ARRANGEMENTS FOR COMPLETE OVERHAUL OF VESSEL AND MACHINERY WERE MADE BEFORE RETURN TO LIBERIA. OWING TO MANY DELAYS BEFORE DELIVERY IN APRIL 1953, AND FAILURE TO OVERHAUL AND REPAIR THE BOAT PROPERLY, ONLY A FEW TRIAL RUNS WERE MADE AND NO ACTUAL EXPERIMENTAL FISHING WAS COMPLETED BEFORE THE TECHNICIAN'S DEPARTURE FROM LIBERIA IN APRIL 1954.

FISHERY DEVELOPMENT PROGRAM (cont.)

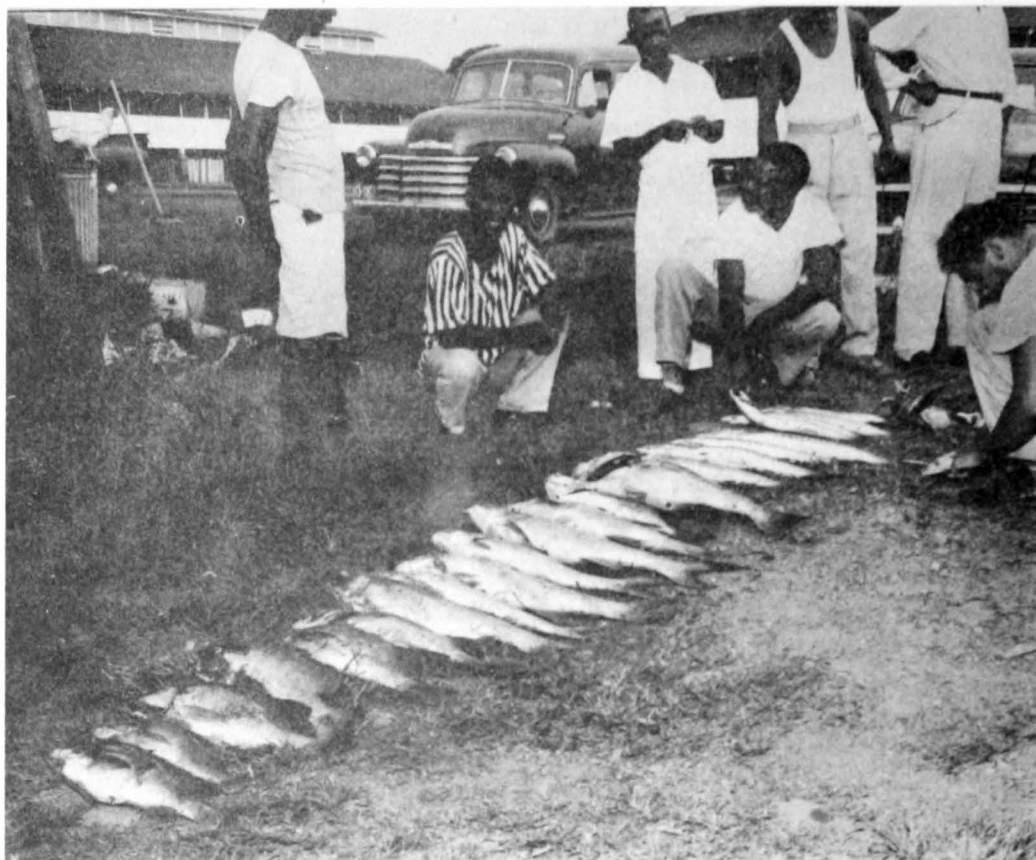


FIGURE 14 - EXPLORATORY TROLLING SURVEY IN THE MESURADO RIVER AT THE END OF DECEMBER SHOWED AN ABUNDANCE OF FISH. TWENTY-THREE GOOD SIZE FISH--GRIPPERS, SHINYNOSE, AND BARRACUDAS WERE CAUGHT IN ONE DAY'S FISHING. (PHOTO BY THOMAS CURTIS.)

income of a skilled laborer. In order to further ensure himself, the fisherman could also invest in small gill-nets valued at \$30 per net to increase his catch. In order to fish in the outlying areas of Monrovia, the fisherman would have to process his fish by simple drying or salting. At the present time, there is regular transportation which would haul the processed product to Monrovia or to areas where there is a demand for it.

With the continued success of the technicians trolling, a keen interest in the plugs and spoons used was developed. In 1952, less than 10 percent of Liberian fishermen used this type of gear. In 1953, more than 90 percent used this type of gear. It was estimated that the troller's catch in the 1953 season was double that of the preceding year.

Exploratory Gill Netting

Because gill nets are cheap and easy to make and to operate, an exploratory program was conducted on this type of gear in order to determine (1) what species of fish were available and could be taken by gill

FISHERY DEVELOPMENT PROGRAM (cont.)

nets, (2) whether the species available were able to support a subsistence fishery or a commercial fishery, and (3) what size mesh and twine were the most efficient for these species.

Eighteen gill nets of various sizes and types were constructed using (1) 1-7/8 inch stretched mesh, 36/6 cotton twine; (2) 4 inch stretched mesh, 12/8 cotton twine; (3) 3 inch stretched mesh, #69 Nylon twine; and (4) 4-1/2 inch stretched mesh, #69 Nylon twine. These nets were fished in the ocean and lake at Monrovia Free Port; at Daynewey on the Laffa River; at Kayku on Garni Creek; in Robertsport's brackish lagoon; at Bendu on Fishermens Lake; and at Dia on the Mani River.

Summary of findings of the gill net investigations:

1. All areas investigated showed sufficient amounts of fresh-water fish and marine fish to support subsistence fisheries or a commercial fishery on a small scale.
2. The 1-7/8 inch mesh cotton nets were found to be very good for use on small fishes such as bony (herring), ten-pounders, mackerel, and young cavalla. The mesh was not large enough nor was the twine strong enough to hold and catch large fish.
3. The 3 inch mesh nylon nets fished very successfully, catching fresh-water mullet (Characine), mullets (Mugil), mangrove perch (Tilapia), shinynose (Polydactylus), and plankfish (Notop-terus (Fig. 15)). Since the thread size was small, numerous holes were torn in the nets by the larger fish. Number 69 nylon twine in 2 and 2-1/2 inch mesh would be very satisfactory for catching the larger fish.
4. The large fish caught in the 4-1/2 inch mesh nylon #69 twine were able to tear holes easily in this net. The quantities of large holes torn in the nets indicate that considerable numbers of large fish exist in these areas.
5. Fishing was found to be very poor during the full moon. Large amounts of phosphorescent plankton were seen on the nets in most areas. This did not, however, prevent the nets from fishing properly. The nylon nets fished far more successfully than the cotton nets.

The following size nets are recommended for fishing in the lagoons and rivers of Liberia:

1. For shallow, sandy lagoons and rivers, a net made of HB nylon twine #69, depth of 4 to 6 feet, of 2 and 2-1/2 inch mesh, 300 feet long.
2. For fishing in the creeks and rivers for mullet and fresh-water mullets, a net of HB nylon twine #69, of 2 and 2-1/2 inch mesh, 8 to 12 feet deep, lengths of 50, 100, and 150 feet, depending on the area to be fished.
3. The Nylock cabled twine, HB 104, in 3 and 3-1/2 inch mesh in the same size, lengths and depths as in 2. above, for fishing creeks and rivers, but for lagoons the depths and lengths as specified in 1. above.

FISHERY DEVELOPMENT PROGRAM (cont.)

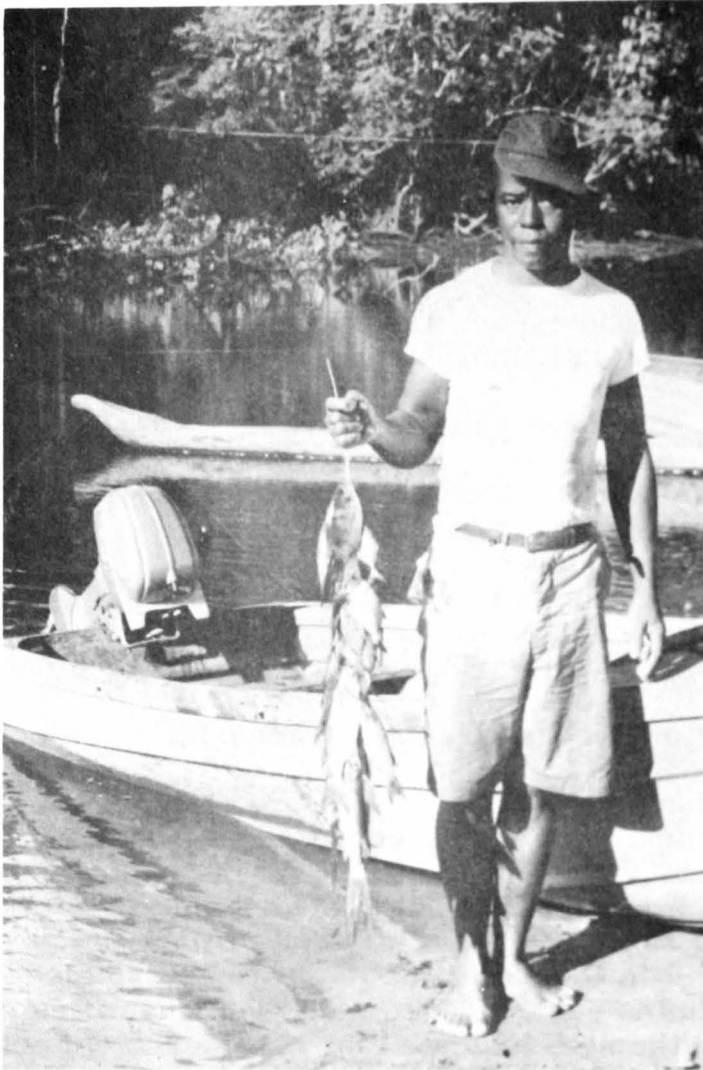


FIG. 15 - THE EXPLORATORY GILL NET SURVEYS SHOWED THAT FISH IN THE CREEKS WERE SUFFICIENT FOR A SMALL SUBSISTENCE FISHERY OR FOR A SMALL COMMERCIAL ENTERPRISE.

4. For the large fish, the HB 346 nylon cabled twine in mesh sizes of 4, 4-1/2, 5, 5-1/2, and 6 inches, and in the same size, lengths, and depths mentioned in 1. and 2.

Exploratory Trawling

An exploratory trawl program originally planned to include the entire Liberian coast was not possible, but a limited program was carried out instead. The FAO fishery staff showed that a small boat trawl operation could be carried on commercially, as shown by the catch figures of the boat:

<u>Year</u>	<u>Month</u>	<u>Pounds</u>
1953	January	5,810
"	February	4,738
"	March	2,601
"	April	1,850
"	May	2,160
"	June	1,011
"	October	2,088
"	November	1,023
1954	January	4,337
"	February	1,655
Total		27,303

On January 6, 1953, the marine technician accompanied the small trawler and recorded the following data:

Six drags of 30 minutes each were made in 5 to 8 fathoms of water off of the St. Paul River with 20 fathoms of drag rope out. The net was first on the bottom at 9:42 a. m. and last on deck at 1:52 p. m. , at which time fishing was discontinued so that the fish could be disposed of at 2:30 p. m. at the Bureau of Fisheries station.

It may be seen in the following table of catch figures that, by number, 10 species comprised over 90 percent of the catch. The total catch weighed 224.5 pounds, of which 96 pounds was sole. It was found

FISHERY DEVELOPMENT PROGRAM (cont.)

that the same 10 species comprised over 90 percent of the catch by weight. Although the leading 10 species may vary in number and weight throughout the year, they still comprise the same approximate percentage.

Numbers of fish and crustaceans taken in six drags by the small FAO trawler:

COMMON NAME:	SCIENTIFIC NAME:	DRAGS:						TOTAL FISH CAUGHT:	PERCENT OF TOTAL:
		1	2	3	4	5	6		
FISH:									
CASSAVAFISH	<u>CYNOCLION</u>	13	17	18	27	13	13	101	13
WHITE BOY	<u>SCIAENIDAE</u>	21	15	16	16	24	8	100	13
SOLE	<u>SOLEIDAE</u>	25	49	42	16	23	15	170	22
CATFISH	<u>ARIUS</u>	3	6	19	7	15	0	150	6
BIA BIA	<u>PENTANEMUS</u>	4	29	45	48	30	4	160	20
GBAPLE	<u>ILISHA</u>	35	14	8	33	27	2	119	15
GRUNTERS	<u>POMADASY</u>	1	0	5	8	0	0	14	2
BUTTERNOSE	<u>GALEOIDES</u>	0	1	0	3	0	2	6	1
STINKER	<u>TRYGON</u>	1	0	9	6	3	0	19	2
ELECTRIC RAY	<u>TORPEDO</u>	0	4	1	0	2	0	7	1
BUTTERFLY RAY	<u>PTEROPLATEA</u>	0	0	1	1	0	0	2	1/
BOATHEAD	<u>VOMER</u>	1	2	6	2	0	1	12	2
PUFFER	<u>LAGOCEPHALUS</u>	1	0	1	0	1	0	3	1/
BLACK BOY	<u>JOHNIUS</u>	0	1	2	1	0	0	4	1
CAVALLA	<u>HEMICARANX</u>	1	1	0	0	1	1	4	1
BURRO	<u>BRACHYDEUTERUS</u>	1	0	0	2	0	0	3	1/
RIBBONFISH	<u>TRICHIURUS</u>	3	0	0	1	0	0	4	1
BUMPER	<u>CHLOROSCOMBRUS</u>	0	1	2	0	2	1	6	1
TOTAL FISH		110	140	175	171	141	47	784	101%
CRUSTACEANS:									
LOBSTERS	<u>PANULIRUS</u>	2	1	0	0	0	0	3	-
CRAB	<u>CALLINECTES</u>	1	5	0	3	0	3	12	-
SHRIMP	(NOT IDENTIFIED)	11	10	0	0	0	0	21	-
TOTAL CRUSTACEANS		24	16	0	3	0	3	36	-

1/ LESS THAN 0.5 PERCENT.

Shellfish Surveys

Investigation of the possibilities for oyster farming was carried on during 1952 and 1953. The species chosen by the technician for preliminary experiments was the mangrove type which spawns prolifically. It was observed in December of 1952 that oysters of varied sizes had set abundantly on the bottom of a boat. The technician immediately placed cultch strings (oyster shells strung on a wire) in the waters of the Free Port of Monrovia near the Fishery Station. A good catch of 20 to 40 small oysters per shell was collected on the cultch.

In March, one string of cultch was removed when the spat started to show excessive mortality due to overcrowding. The oysters on each shell were measured and counted and the shell's relationship to the bottom recorded. The oyster shells were removed from the strings and placed in a chicken wire container in a position which was above the algal growth found on the second string of cultch. It was believed that the algal

FISHERY DEVELOPMENT PROGRAM (cont.)

growth was prevented in the upper area by long exposure to the air at low tide. This was found by the technician to be wrong because algae immediately grew on the container and did not grow at the same level on the neighboring cultch string. In April, the second string was removed and growth of the small oysters recorded. The shells were then planted in the harbor area. Shortly thereafter, an accident occurred in which the wire container was knocked off the underside of the fishery wharf. There was no opportunity for further study and the effort had to be abandoned.

Fresh-water crayfish or shrimp are found abundantly in many rivers and lagoons. The following observations were made in the St. Paul River:

1. Over 95 percent of the catch is comprised of one species (M. volenhovenii), which is characterized by a yellow mark on the inner portion of the first walking leg, and has a variable number of rostral teeth above and below on the rostrum.
2. The commercial species has a low salinity tolerance which has an effect on its movements and migrations from and to the river mouths. There appears to be a tolerance difference according to the size of the animal.
Early in the rainy season the size of the commercially caught crayfish ranges from 65 to 90 millimeters. As the season progresses and the water becomes fresh, large individuals 90-115 millimeters move into the area. During November and December, as the water becomes brackish, the large crayfish disappear, and the commercial size again decreases to 65 - 90 millimeters.
3. The females were found to be carrying eggs intermittently during their entire period of availability in the commercial catch. Increased numbers were found bearing eggs during certain periods, a circumstance believed to be influenced largely by rainfall.
4. Many small young shrimp of the commercial and non-commercial species up to 20 millimeters in length were collected in November and December from the St. Paul River lagoon using a burlap sieve along the sandy, muddy shoreline.
5. It is likely that the small shrimp between the sizes of 20 and 60 millimeters migrate into the creeks and swamp area where they stay until an average growth of 60 millimeters is reached and then migrate into the main river area.
6. During February to April, the commercial fishery in the lower St. Paul River ceases.
7. Predators are numerous, including both land animals and fish.

FISHERY DEVELOPMENT PROGRAM (cont.)

Net-Making
Demonstrations

The purpose of the marine fishery program was to supply not only the people of Monrovia with fish but the outlying areas as well. During the river surveys and trolling program, large numbers of fish were seen in the creeks and rivers near villages where there were acute shortages of fish because the people did not know how to catch them. Demonstrations were given to the people of the coastal towns in net-making by the technician and marine aide. The project was started in December 1953 in the areas from Royceville to Dia and was continued by the marine aide (Fig. 16).



FIG. 16 - THE FISHERY AIDE EXAMINES A NYLON GILL NET MADE IN MONROVIA FOR USE IN THE NET-MAKING AND EXPLORATORY FISHING DEMONSTRATIONS GIVEN IN THE FIELD FROM DECEMBER '53 TO MARCH '54.

Classes were given in six villages and towns to groups ranging from 3 to 10 students. Teaching, supervised by the technician, was done entirely by the Marine Fishery Aide. It was found that at least 3 to 5 days had to be spent in each village for proper instructions. A simplified course of instruction was set up in basic net-making and every student was required to take part in each of the steps until he showed that he had mastered it. Four additional villages and areas have requested the fishery aide to give primary instructions, or advanced instructions in localities which already had received primary help.

As a result of these demonstrations, the Baptist Mission at Bendu has introduced net-making as part of the vocational courses for the people of the area and has ordered five nylon gill nets from the United States and materials to make an additional five nets to fish in this area. The mission, which previously fished a beach-seine successfully, but stopped fishing because they did not know how to mend or repair the bag

FISHERY DEVELOPMENT PROGRAM (cont.)

on the seine, requested the services of the fishery aide to put the net back into production. The Le Tourneau operation at Baffu Bay also requested the services of the fishery aide for net-making and ordered the necessary nylon twine for the nets. Numerous other requests have been made by the people of the villages for information about the purchase of nylon twine.

CURRENT PRODUCTION AND PROSPECTS OF EXPANSION

Since the start of the fishery program in Liberia the trawl fishery has increased to three commercial trawlers between 30 and 50 feet long, one small trawler about 22 feet long, and one exploratory trawler 35 feet long. The increased catch figures by this method are broken down by boat and estimates given for the 1954 catch:

1. The commercial trawler which started operations in November 1953 made an estimated minimum catch of 40,000 pounds per month during the first two months of operation. The technician was told by a reliable source that the catches increased to 3,500 pounds per day in January and February, 1954, or a catch figure of approximately 100,000 pounds per month. Using these two figures for a maximum and minimum estimate for 1954 would indicate a minimum total catch of 500,000 pounds and a maximum of 1,200,000 pounds a year for this vessel.
2. The second commercial trawler to enter the fishery of Liberia was of the same type and size as 1. above, and started fishing in March 1954.
3. The third commercial trawler is smaller than the two previously mentioned, has lighter gear, and considerably less depth of operation. The catch of this vessel varied from 150 to 700 pounds per day when checked by the technician.

Since 1952, the number of beach seines in the Monrovia area has increased from five to twelve, and in the Cape Mount area from one to five. The number of sets made per day varies with the season and is generally from two to five. The catch per set also varies with the season with catches up to 500 pounds per set being made in the rainy season. A very conservative estimate of the annual potential production is 10,000 pounds per net.

It was noted during the 1952 season that the largest catch of cavalla made by trolling on any one day did not exceed 50 fish. At the height of the 1953 season, catches of 50 to 200 fish per day were seen on the local markets. This increased catch was due to the change-over by native fishermen from crude, home-made trolling gear to commercially manufactured lures, demonstrated by the technician and aides.

Aside from the foregoing scattered estimates of production, there is no basis for estimating the fishery yield in Liberia. No statistics have

CURRENT PRODUCTION AND PROSPECTS OF EXPANSION (cont.)

been collected and the scattered nature of the fishery will make future collection of total figures extremely difficult. Gross estimates are available only for the yield of the small fishing area immediately off the Port of Monrovia. For 1954, it is estimated that the catch made by 12 beach-seines amounted to 120,000 pounds; by two small trawlers, 75,000 pounds; by two large trawlers, 500,000 pounds; and by the troll fishery, 40,000 pounds. These figures total 735,000 pounds, but in addition, the yield of the line fishery and the gill nets, cast nets and miscellaneous methods, cannot be approximated.

Fisheries Capable of Increased Production

Cavalla--The only area in Liberia where cavalla are intensively fished is off Monrovia. It was definitely shown that replacing hand-powered canoes with small, outboard-powered boats would greatly increase production. It was also shown that large, heavy beach-seines are feasible for cavalla fishing. This type of fishery could be increased in all coastal areas of Liberia.

Mullet--Mullet are abundant in all of the coastal areas of Liberia and are not exploited by any means other than cast nets. It is believed that production could be greatly increased by fishing with set and drift gill-nets in the rivers, streams, and lagoons during the rainy season. Nets should be made of Nylock cabled twine, HB 104, in stretched mesh sizes of $2\frac{1}{4}$, $2\frac{1}{2}$, $2\frac{3}{4}$, and 3 inches.

Mackerel--Mackerel were seen in all of the areas visited by the technician. The only method used for taking this species of adult size is the canoe troller. A gill-net made of Nylock cabled twine, HB 69, in stretched mesh sizes of 2 and $2\frac{1}{2}$ inches and HB 104, in stretched mesh sizes of $2\frac{1}{2}$ and 3 inches would be effective in the lagoons and in suitable places in the ocean. These nets could be fished either as set nets or drift nets in the length and depth determined by the area to be fished.

Gripper (LUTJANUS)--At the present time, this population of fish is exploited commercially mainly by long-line gear. If a small operation of mechanized trolling were started for this species in conjunction with another type of fishery such as set gill nets, this should be profitable to a small fisherman. A gripper fishery alone could not be sustained intensively for any period of time in a single area.

Barracuda--These fish are often found in large schools; however, their abundance is not sufficient to support a full-time mechanized troll fishery. Combined with another fishery, such as gill-netting, this fishery should prove profitable to a small operator. It is believed that a large number of holes torn in the experimental gill-nets in the harbor area were caused by entangled barracuda. A gill-net made of Nylock cabled twine, HB 346, in stretched mesh sizes of 4 to 6 inches should prove satisfactory for this species.

Shinynose--This is a species which is highly desired and little exploited. It is anadromous--migrating into fresh-water areas up the rivers.

CURRENT PRODUCTION AND PROSPECTS OF EXPANSION (cont.)

It is found in the ocean at the mouths of the rivers during the end of the rainy season. It is exploited only at the mouths of rivers and is taken with beach-seines. This fish grows very large and will occasionally take a trolled spoon. Its size range is from juveniles to 66 pounds. Set gill-nets made of Nylock cabled twine, HB 104, in stretched mesh sizes of 3 to 4 inches and HB 208, in 4 to 5 inch mesh should be very effective for this species in streams and rivers. This would support a seasonal fishery for a small operator.

Mangrove Perch (TILAPIA)--From the observations made, one of the most efficient methods of taking this species would be light, collapsible traps which could be operated from a canoe. This type of fishery should prove highly profitable to any small operator with 10 or more traps.

Tuna--At the present time, tuna are believed to be one of Liberia's most undeveloped fishery resources. It was not possible for the technician to make any offshore investigation on this species. Catch statistics showed that the season of greatest abundance occurred in November and December, when the warmest water appears along the coast. The technician believes a successful fishery could be started either by using bait from the inshore area or by using the Japanese method of long-line fishing. Further investigations of this resource should be carried out.

Effects of Increased Production

It was thought that increased production of fish and reduced fish prices might harm the small fishermen of the area. In 1952, during a period of good fishing in the ocean, the number of boats operating diminished each day. A number of these fishermen could be classified as marginal--fishing as long as there was a high reward for small effort. With the drop in prices, the marginal fishermen quit fishing. The true fisherman, however, increased his effort and his catch. Barracuda, gripper, mackerel, and red snappers, caught by the small-scale fishermen, are classified as premium fish because of high quality and bring considerably higher prices than trawl- or seine-caught fish. Prices of these fish will probably always be higher regardless of how large the landings of the country become, because the populations of these fish are small and the fishery for them is highly specialized.

It was also believed that, with the increased production in the Monrovia area, a saturation point would soon be reached and fish would have to be sent to the interior of the country. The large increase of fish landings occurred, however, during the season when there had been a shortage and as a result, all the fish were consumed in Monrovia. With the increased supplies at government prices of 20¢ per pound or less, the consumer bought two to three times as much for the same amount of money as he had spent previously. The demand, therefore, still existed and was unsatisfied in the areas outside of Monrovia. With the trawlers now operating in Liberian waters, the Monrovia market should be saturated and some fish will be sent inland. In the outlying areas, with the exception of Cape Mount, the production of fish still does not meet the demand. Since many of these towns are small, only a small amount of fishing gear would be needed to satisfy the demand and create a surplus. With proper organization of markets and transportation, productive fisheries could be developed in those areas.

APPENDIX

Extracts from The Marine Fisheries Program in Liberia--Annual Report for 1955, by Lew L. McFerren, Marine Fisheries Specialist, USOM/Monrovia.

To supplement the descriptions of fishery development in Liberia presented by George C. Miller in the body of this report, extracts are made from the annual report of Mr. Miller's successor, Mr. Lew L. McFerren, as Fishery Technician in Liberia for the year 1955. The presentation of these extracts in this report is justified by the fact that Mr. McFerren's annual report, which was multilithed by the Audio-Visual Center of the United States Operations Mission in Monrovia, was issued in only a limited edition and therefore likely unavailable to interested readers.

At the end of Mr. Miller's assignment in Liberia, he was replaced by a professional fisherman, at the request of the Liberian Government. Mr. McFerren, an Alaskan fisherman with extensive experience in the fisheries of the Pacific Northwest States and in other waters, arrived in Liberia on December 13, 1954 and departed on the same date in 1955.

In general, the fishery development program sponsored by the International Cooperation Administration and the Liberian Department of Agriculture and Commerce followed the general pattern established by Mr. Miller in previous years, namely an operating program concerned chiefly with the training of Liberian fishermen in the manufacture and use of modern fishing gear and in the operation of power craft, the exploratory program to investigate the fishery resources, and a general technical assistance program to encourage more efficient production and marketing of the fishery harvest. Certain aspects of this program are so interesting, and the results so surprising, that sections of Mr. McFerren's report relating to exploration and the development of industrial fishing are quoted in extenso, as follows:

"No good fishing grounds, with the exception of isolated small patches, have been discovered along the Liberian coast. There are, however, good fishing grounds just north of the Liberian/Sierra Leone boundaries, where the outer boundary of the continental shelf swings suddenly seaward, creating a submarine plateau of far greater proportions than any along the Liberian shores. These fishing grounds are within the reach of vessels operating out of any Liberian port. In the shallow water areas, six to ten fathoms, the bottom is muddy and yields good catches of estuarine fishes, while sea bream and snappers are caught in deeper water on a sand-shell and sand-shingle bottom.

From the limited number of samples taken by International Cooperation Administration (Liberia) fisheries technician, the writer of this report, and compared at the Freetown Fisheries Station by the technicians stationed there, no great difference is observed in the character of the bottom of the inshore waters off Sierra Leone and the waters of corresponding depths along the Liberian shores."

APPENDIX (cont.)

"At the present time there are three distinct groups of fishermen. First and foremost in production are the power trawlers. These vessels range in size from fifty to one hundred and twelve feet. They are operated by a combination of Europeans and Liberians. All of them operate out of Monrovia, going to the fishing grounds early in the morning, and returning to port about two or three o'clock in the afternoon--in order that the catch will be sold on the same day, while it is still fresh.

Before World War II, there was a German trawler operating out of Monrovia for a short time. In 1950, a small, poorly equipped, French trawler--in transit to South Africa--worked the grounds out of Monrovia for about two months. In 1953, a group of Liberian and European business men organized the first fishing company to purchase trawlers and employ modern techniques.

The first of this fleet, the Madonna Di Trapani, a fifty-foot diesel-powered craft, purchased in Italy, arrived at Monrovia on November 1, 1953. In April 1954, the second vessel, the Madonna Del Rosario, another fifty-foot diesel trawler arrived. These vessels were a success at the beginning of the project, but the grounds they were working were so limited that by the spring of 1955 the daily average catch was down about seventy-five percent.

Other vessels joined the fleet. By the first of May 1955, there were five vessels operating out of Monrovia, all of them dragging on the St. Paul River flats-- the only grounds rich enough to support a large power trawler. By this time those grounds were so over-fished that the best any of the vessels could do was to make expenses. These vessels traveled for great distances along the coast, hoping to find new fishing grounds. Early in June all of this fleet, except the Madonna Di Trapani, was tied up. New fishing grounds had been found and charted by the I. C. A. Fisheries Technician, but the local vessels were not equipped to operate there, since the grounds were some distance from Monrovia, and would require ice in order to transport the fish. Plans were being formulated, about this time, either to convert the vessels, or purchase new ones for the more distant grounds.

The second group in production are the Fanti fishermen."

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"After three months of this trial-and-error fishing with various types of gear, along with data gathered from the native and commercial fishermen, it seemed evident that Liberia would have to seek fishing grounds beyond her own continental waters in order to have an adequate supply of fish the year round.

A study of the U. S. Hydrographic ocean charts of West Africa, No. 2199 and No. 2200, show the continental shelf to be very close to the Liberian shores. There are no off-shore islands, rocks, or reefs, and no large fishing grounds were indicated--other than what might be found on this rather confined slope.

APPENDIX (cont.)

Just west of the Sierra Leone-Liberian border, the 200 fathom curve swings suddenly seaward, thus forming a very large submarine plateau, from 70 to more than 100 miles wide. The plateau extends to west and north-westward, until it forms a potential fishing ground for several thousand miles. Almost no information was available on these grounds, but the chart soundings looked good. Soundings of eight to fifteen fathoms were consistent over large areas, and there were some off-lying islands. The idea of exploring these grounds was suggested in the April monthly technician's report to the Agricultural Adviser of the International Cooperation Mission. He immediately arranged a conference with the Assistant Secretary of Agriculture and other interested parties. At this conference the charts of the grounds were introduced, along with information supplied by the Agricultural Adviser, and representatives of the American, French, and British Embassies. It was decided that the Fisheries Technician should make a trip to these grounds via Freetown, Sierra Leone, and gather all possible information.

The writer arrived in Freetown on May 3, 1955, and arrangements were made at once, through the Liberian Consul, for appointments with various Sierra Leone officials. These included the Minister of Agriculture, Chief of the Bureau of Fisheries, and the Assistant Secretary of Interior Affairs. There were no official objections to fishing these grounds outside the three-mile limit.

Arrangements were made to go to the grounds on a local 50-foot trawler on May 9th. Much information was gathered from local fishermen and various government officials, and on Monday, May 9th, the trip was made to the fishing grounds, arriving at about 10 o'clock a.m. Three shots were made with the trawl net, each lasting approximately one hour. The total catch for the three shots was 2,900 pounds, mostly estuarine fish, but of considerably better quality than those taken on the St. Paul River Delta at Monrovia. This catch, for three hours' operation, could be compared with the catch of the Monrovia trawlers for about 100 hours' trawling.

The report on the Sierra Leone grounds was received in Monrovia with favor, and arrangements were commenced almost at once by local businessmen to organize companies, obtain vessels, and employ competent fishermen for the operation there.

The first of these new vessels, the M. S. Virgen de Soccoro, a modern, refrigerated, diesel ship, 112 feet long, arrived September 7, 1955. She had stopped off on her way to Monrovia from the Virgin Islands, off French Guinea and Sierra Leone, and in nine hours' fishing had picked up 54,000 pounds of fish, a good percentage of which was red snapper and other fish of good quality."

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"In view of the fact that Sierra Leone shores border on these fishing grounds for less than two hundred miles, before reaching the French Guinea border, it was decided the French Guinea grounds should also be

APPENDIX (cont.)

investigated. The writer arrived at Konakri, French Guinea, on August 18, 1955, where conferences were held with various government officials. It was found that there were no complications or restrictions outside the three-mile limit. Three trips were made to the off-shore grounds from Konakri, one in a small fishing vessel with very limited capabilities and capacity. The catch for approximately six hours' fishing was 2,800 pounds, comparable in quality to those taken off Freetown. The second and third trips were made in very small, experimental vessels. On these trips little fishing was done because of heavy weather, but what fishing was done showed encouraging results.

On September 23, 1955, the M. S. Carabucuto, another modern refrigerated ship, 106 feet long, arrived in Monrovia. The writer made an experimental trip on this vessel to the grounds lying off French Guinea, where the highest average catch, on any one day on the grounds we worked, was approximately 3,000 pounds per hour. The total catch was 34,000 pounds of high-quality fish. This trip, because of the experimental work, took nine days from Monrovia and return. The average trip to these grounds, for the same number of hours' fishing, will take no more than five days.

In June 1955, construction was well under way on two cold-storage and ice manufacturing plants, the rehabilitation of another commenced, and others were planned. Various unavoidable difficulties have delayed the completion of any of the projects. The cold-storage and ice-making plant is now expected to be completed before the first of the year. The plant being rebuilt is almost ready. The others, though not abandoned by any means, are temporarily stalled.

The nearest of these new grounds is approximately 175 miles from Monrovia. It is difficult for vessels to work these grounds without ice, so at the present time vessels are working nearby grounds, until the ice-making plants are in production. While these grounds are not so productive, the yield is good enough to show a profit for each day's operation."

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"Whenever and wherever fish can be obtained it becomes second only to rice as the most important food. While much work remains to be done before Liberia will have a plentiful supply of fish, the International Cooperation Administration has already contributed somewhat to the supply through work in classifying some of the important commercial species, introduction of new gear and techniques. By a very fortunate combination of circumstances and conditions, the past year has seen the arrival of several large and modern commercial fishing vessels that are equipped to work the newly discovered fishing grounds. These new grounds are rich in population and quality, and are not of too great distance from Liberia. An understanding has been reached with the Governments of Sierra Leone and French Guinea, and no complications should arise from the operation of Liberian vessels in these waters.

Cold-storage plants should soon be in operation for the preservation

APPENDIX (cont.)

and storage of fish. Two new fish markets have been put into operation and others will soon be completed. Curing plants are soon to be established. Trucks have been obtained and it is expected that cured and frozen fish will soon be reaching the people of interior villages.

The trawlers are presently operating under a great handicap-- because the cold-storage and ice-making plants are not yet in production and the vessels are prohibited from working the best fishing grounds. Handicapped as they are, the vessels are showing a profit every day, and this will be multiplied many times over once the plants are in production. It is possible that others, seeing this lucrative operation, will enter the field and increase the fleet. It is certain that the fishing grounds can support a large fleet of trawlers, tuna and sardine fishermen."

Mr. McFerren was fortunate in being able to obtain more complete estimates of fishery production in Monrovia than were available to Mr. Miller. The following table of fish production during eleven months of 1955 is quoted directly from Mr. McFerren's report:

Fresh Fish Landings at Monrovia, Liberia
January 1 to July 1, 1955 and July 1 to December 1, 1955
(Unit - Pounds)

	Power Vessels	Fanti Canoes			Native Canoes					Misc. Nets, Lines & Traps	Total
	Trawl Net	Beach Net	Gill Net	Fanti Net	Throw Net	River Net	Hand Troll	Hand Line	Long Line		
January	31,722	8,043	6,850	14,000	500	1,500	1,500	500	2,500	5,000	72,115
February	34,361	6,000	8,500	12,000	500	2,000	1,200	500	4,500	7,500	77,061
March	58,475	4,500	7,000	25,000	500	2,500	1,800	500	5,000	10,000	135,275
April	38,622	3,500	2,500	18,000	500	2,500	3,500	500	3,500	9,000	82,122
May	21,361	4,500	1,000	3,000	500	1,500	4,000	500	2,000	12,000	50,361
June	17,014	6,000	1,000	1,000	500	1,500	4,500	500	3,500	14,000	50,014
Total	201,555	32,543	26,850	73,000	3,000	11,500	16,500	3,000	21,000	57,500	466,948
July	22,800	3,500	1,000	1,500	500	1,000	4,500	500	3,500	1,500	44,000
August	19,740	8,000	1,500	10,000	750	750	1,000	500	4,000	5,000	51,240
September	75,860	6,500	4,000	12,000	500	500	1,000	500	4,000	5,000	114,360
October	193,475	8,500	3,500	12,000	500	1,000	4,000	1,200	2,500	7,500	234,175
November	161,750	9,000	3,000	14,000	500	1,500	4,000	1,500	4,000	9,500	213,250

1/ The Virgen de Socorro arrived September 7, 1955.

2/ The MS Carabucuto arrived October 11, 1955, with the first load of fish.

3/ The Virgen de Socorro went out of commission on October 23, 1955.

Figures on trawl net and Fanti net landings are correct to within about five percent.

Trawl net figures are taken from the logs of the commercial trawlers.

Fanti net figures were in most cases taken from the Fanti Bos'n's log. These logs are kept by the Bos'n, and only record the amount of money received for the daily catch, and from this the tonnage estimates have been made.

It is impossible to keep accurate figures on the native Liberian fisheries as they keep no books, and do not always land at the same place. An attempt has been made to keep track of the number of canoes fishing, but on many days this also had to be estimated. The figures might be off 10%, or even more, but the average should not be off more than 10%.