A SURVEY OF FISHERIES RESOURCES IN THE BRITISH SOLOMON ISLANDS PROTECTORATE WITH RECOMMENDATIONS FOR THEIR DEVELOPMENT

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C O N T E N T S

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INTRODUCTION

At the request of His Excellency Mr. J. Gutch, British High Commissioner for the Western Pacific, I carried out a survey of fisheries in the British Solomon Islands Protectorate, from 17th January to 14th February, 1956.

My visit covered the waters along the North coast of Guadalcanal from Honiara eastwards, the Florida Group, Malaita, the North and East coasts of San Cristobal, Santa Ana and Santa Catalina, in fact, the central part of the protectorate.

Three different Government boats were made available for the purpose of this survey. A number of coastal villages and small islands were visited, as well as some inland waters and sites suitable for building fishponds.

Upon my return to Honiara, the administrative seat of the Protectorate, His Excellency the High Commissioner requested me to prepare a report on my visit and to formulate recommendations for the development of fisheries in general.

The fullest cooperation was received from the Senior Agricultural Officer, Major R. Hill, and his staff, as well as from a number of officials in Honiara; from District Commissioners Russell, Roberts and Tedder, District Officers, Missionaries, various Headmen; from the brothers Kuper in Santa Ana and from Mr. Timmeus Teioli in Malaita.

Much of what I have written here for the central part of the Protectorate will in all probability be applicable to the rest of the Solomon Islands.

GENERAL DESCRIPTION OF THE PROTECTORATE

The British Solomon Islands Protectorate is administered by the Colonial Office through the High Commissioner for the Western Pacific at Honiara, Guadalcanal. There are four districts: the Western comprising the New Georgia group, Shortlands, Choiseul and Santa Ysabel, with headquarters at Gizo; Malaita, with headquarters in Auki; the Eastern, comprising San Cristobal, Ugi, Ulawa, Santa Cruz, Vanikoro and many outlying islands, with headquarters at Kira Kira; and Central, comprising Guadalcanal, Florida, the Russell Islands and Savo, with headquarters in Honiara. The total area is some 11,300 square miles, comprised by ten large islands or island groups, and outlying islands, extending over 900 miles of ocean between latitudes 5°10' and 12°45' South, and longitudes 155°30' and 170°30' East. The main islands are arranged in double chain, linking up with Bougainville (under Australian Mandate) to the extreme North West, and running from there in two parallel lines to the South East; Choiseul, Santa Ysabel and Malaita make up the northeast portion (and in that order); Shortlands, the New Georgia group, Russell Islands, Guadalcanal and San Cristobal, the southern portion. The small group named Florida (or Nggela) lies between Malaita and Guadalcanal. The Santa Cruz group lies to the extreme East and can be regarded as geographically an extension of the New Hebrides group.

AREAS AND POPULATION

Island or Island Group	Area Square miles	Native Population 1945	Per square mile
Guadalcanal	2,500	13,787	5.5
Florida	235	3,813	16.3
New Georgia Group	2,030	7,382	3.6
Shortlands	97	914	9.4
Choiseul	1,113	4,498	4.0
Santa Ysabel	1,802	4,800	2.7
Russells	65	347	5.3
Malaita	1,572	42,000	26.8
San Cristobal	1,249	7,962	6.3
Rennell and Bellona	273	1,330	4.9
Santa Cruz Group	323	4,495	13.9
Ontong Java	30	715	23.9
Sikaiana)		317)	
Tikopia)	20	1,517)	105.9
Outlying Islands)		283)	
Total	11,309	94,160	Av. 8.3

In 1955 it was estimated that the population of the Protectorate included approximately 94,000 Melanesians, 4350 Polynesians, 590 Europeans, 250 Chinese and 10 other Asiatics.

CLIMATE

The climate is wet and hot but tempered by cool winds. There are two definite wind seasons: the southeast and the northwest. The southeast season varies from year to year; typically it begins in mid-April and continues to the end of October or the beginning of November. There are comparatively few winds from any other direction, when once the southeasterly season is established. Steady winds may then blow for days at a time, but are usually stronger between 10.00 hrs. and dusk, and often die away altogether in the evening: they become day breezes from the northeast on coasts protected by mountains from the southeast. Southeast winds begin to decrease in frequency from about the September equinox to December, when there is a tendency for winds to swing round to northwest through northeast; but even in January spells of southeasterly weather are known. The northwest season is typically one of storms that blow for a few hours or for several days with little warning, followed by periods of calm or even southeast winds. It is the season of hurricanes in the Santa Cruz group.

Squally weather occurs in both seasons and may appear without warning. The rare tropical cyclone is heralded for several days by persisting lowering and overcast skies, increasing wind, and interference with the normal diurnal rise and of barometric pressure. Rainfall figures are few, and always from recording stations near the coast; therefore, average figures probably bear little relation to those that might be recorded at higher altitudes.

The rain is mostly orographical and the mountainous terrain must cause big differences, both in rainfall intensity and frequency over comparatively small areas. The highest figures are recorded on coasts with a southeasterly aspect; but the disposition of high land masses and water channels may cause heavy and frequent rain, particularly if the wind is thus directed against high land. Convectional rains tend to be prevalent when the sun is near its zenith, in calms between the seasons, when a daily build-up of temperatures in the many valleys filled with damp vegetation, results in afternoon thunderstorms.

Rain in the comparatively dry northerly plains of Guadalcanal sometimes seems the result of convection currents, from the heated, grass-covered land, affecting the prevailing wind currents to such an extent that they are forced up again after passing over the mountains, and thereupon lose more moisture: a form of instability rain, in fact. Frontal or pseudo-frontal rains do not seem to occur. The lowest average rainfall is recorded in proximity to the Guadalcanal plains at Lunga, where it would appear that, in spite of their being in a "rain shadow" during the southeast season, these plains are yet so far away from the mountains that the orographical rains are comparatively infrequent in the northwest season.

Average rainfall per year in inches:

Lunga (Guadalcanal)	in 28 years	74.89
Aola (Guadalcanal)	in 25 years	102.21
Giro (New Georgia Group) . . .	in 24 years	113.51
Vella Lavella (New Georgia Group)	in 7 years	125.22
Arundel (New Georgia Group) . .	in 29 years	128.84
Rendova (New Georgia Group) . .	in 31 years	170.83
Shortland Island	(period not known)	143.43

The highest average annual rainfall over a period of 15 years has been recorded at Peow (Santa Cruz group) and it was 233.02 inches.

The following table shows approximate values of sea level of temperature (degrees Fahrenheit) and relative humidity (per cent):

		Southeast Season	Northwest Season
Temperature:	mean max.	86 to 88	88 to 91
	Absolute Max.	89 to 91	92 to 94
	Mean min.	74 to 76	76 to 78
	Absolute min.	72 to 75	73 to 74
Relative humidity: mean	(at 0900 hrs.)	75 to 85	75 to 85

Temperatures as low as 49°F have been recorded at 6,000 ft. altitude and in one instance a shade temperature of 104°F was recently recorded on Guadalcanal plains. Relative humidity varies only a little during the day, but increases at night-time and then probably always exceeds 90 per cent.

ECONOMIC DATA

Imports of animal food

Item	1953 Quantity lbs.	1953 Value £	1954 Quantity lbs.	1954 Value £.
Meat, fresh	57,394	6,545	56,661	8,630
" canned	274,729	36,802	601,377	76,018
" fancy	153,726	19,246	6,128	901
Bacon, ham	10,523	2,281	5,647	1,671
Fish	72,356	7,460	116,814	10,949

Export of shells

Item	1953 Quantity tons	1953 Value £(A)	1954 Quantity tons	1954 Value £(A)	1955 Quantity tons	1955 Value £(A)
Trochus	505	94,059	717	185,915	607	181,927
Green snail	57	12,397	78	14,460	83.9	19,025

Shells take the second place amongst exports, coming after copra.

EXISTING FISHERIES

As mentioned earlier, my visit covered the central part of the Protectorate. Since there are no reports extant dealing with earlier fisheries research, an entirely virgin field was open to me. It is quite fortunate that a fisheries survey was requested without further delay, as the importance of fisheries resources for the local population is quite considerable. For instance, the second most valuable export from the Protectorate is trochus and green snail shell, and the main supply of animal food is provided by fish and other aquatic animals.

In regard to shell, my observations have led me to believe that steps should be taken urgently to prevent the extermination of trochus. As far as the food supply is concerned, fisheries are generally at a very low level of development, not only from the point of view of fishing techniques, but also regarding the preservation of fisheries products. On the other hand, in the neighbourhood of islands where the population was composed of fishermen, I have seen reefs which were overfished with simple but effective gear.

There is no oyster culture, but wild oysters are found. Fish culture, whether in ponds or natural waters, in fresh or brackish water, is entirely unknown. Animal food is not abundant and the most obvious solution would be to harvest it from the sea or inland waters.

There are also blacklip oysters (Pinctada margaritifera), but little is known of available quantities of this very valuable shell.

It must not be thought that the fish population of shallow waters near the shore is exceptionally rich; there are only reasonable quantities of fish for the subsistence of the islanders.

In waters 5 to 20 fathoms deep there are still untapped resources of reef fishes. These, however, are difficult to catch with the available gear except for some predatory species which are caught on hook and line. Pelagic species of non-predatory habits also offer untouched resources in waters from 3 to 20 fathoms deep.

In the very deep waters around the islands there are presumably great quantities of fish. I have myself seen big schools of yellowfin tuna (Neothunnus macropterus) and small tuna (Euthynnus affinis) but nothing is known of their seasonal habits. We also caught Spanish mackerel, barracuda, dolphin, trevally, bonito and bigeyed tuna by trolling. In the last area there must also be large numbers of scads (Decapterus macrosoma); we found them in the stomachs of all fishes caught while trolling, sometimes four or five together in the case of small tuna, which we caught mainly on the southwest coast of Florida.

I have made a list of aquatic animals existing in the protectorate, but this was made difficult by the variety of languages and dialects so that the local names are not wholly reliable.

Expensive equipment, including motor boats, and skilled fishermen would be needed to catch tuna and other deep sea species. I am almost certain that a prosperous fishing industry could be developed in the Solomon Islands with Japanese fishermen supplying a cannery as in American Samoa. This lies, however, beyond the scope of my investigations and I will only deal here with the development of fisheries resources by the indigenous populations.

I would preferably envisage this development as taking place under the supervision of a tropical fisheries expert working with a 50 ft. fisheries research boat. I doubt that funds would be made available for an expensive fisheries development plan in view of the disproportion between the development budget of the Protectorate for the last few years and the local income. For this reason I will try to keep my recommendations within the possibilities of the Protectorate. Before I pass on to this subject, however, I will give a brief description of the present situation regarding fisheries.

Nggela or Florida group

In this group are many good anchorages and natural harbours. Tulagi has the largest harbour and was formerly the administrative centre. Since the administration was moved to Honiara, Tulagi has become specialised in boat repairs and fitting; it has good government workshops and a small slip. Facilities for repairing small boats are also available at the Mission Centre of the Church of England at Teroniara. Small villages and hamlets as well as Mission stations are found along the coast.

Fishing in the Solomon Islands is chiefly a subsistence activity. Even trochus snails are highly appreciated as food. The only commercial fisheries product is trochus and green snail shell.

The Fisheries (Explosives) Regulation (1) prohibits the use of explosives for the purpose of catching fish and the Trocas Shell Fishing Regulation (2) provides for the supervision of the trochus fishery.

Trochus niloticus

Almost everywhere trochus is found in the Nggela group, and it is gathered by the people in waters up to 5 fathoms deep. It is locally called "Lala". The shells are sold for three shillings a pound to traders

(1) British Solomon Islands. Laws, statutes, etc.
The Laws of the British Solomon Islands Protectorate containing the King's Regulations and subsidiary legislation thereunder enacted on or before the 1st day of January 1948, rev. ed. Suva, Govt. Print., 1950. 2 v. Volume 1. Cap. 55. Regulation no. 14 of 1922.

(2) The same. Volume 1. Cap. 57. Regulations no. 6 of 1920, and 1 of 1940.

after the animal has been removed to be used as food. The minimum authorized size is $2\frac{1}{2}$ ins. base diameter. The lid of a cigarette tin is used as a measure. I have seen undersized shells from which the snails had been removed for food lying on the beaches, and I also observed some small shells in a shop; however, I did not get the impression that it was done on a large scale. In some places I have seen shells 4 ins. and over in diameter which were unsaleable, being damaged by borers at the tip. However, borers are not so serious a pest in the Solomons as in other territories. In general it can be said that the trochus shell of the British Solomons is of good quality.

In many places throughout the group I was told that the trochus population was decreasing. My own observations appear to show a 70-80% decrease for a number of reefs. This does not appear in the exports statistics since the unusually high prices have induced more people to fish for trochus, but it should become apparent in the near future. The local population is well aware of this fact and some reefs have been spontaneously closed to trochus fishing; this has also happened in other parts of the Protectorate. I gathered from some headmen that they would welcome official regulations establishing a closed season. It would be necessary not only to establish such a season, but also to bring the minimum legal size of trochus shell up to 3 ins..

In a number of localities trochus shells were brought to me for examination. In most cases, the numbers of males and females were equal, although in some places the proportion of females was slightly greater. All female trochus $2\frac{1}{2}$ ins. in diameter were found to be mature. Some gonads from $4\frac{1}{2}$-inch specimens were full of ripe eggs, while trochus from 2 3/8 to 3 ins. in diameter had gonads full of unripe eggs. I was only able to examine male trochus about 3 ins. in diameter and these had gonads filled with partly ripe sperm.

Fishing craft

In many villages the islanders build their own proas. In Haroro these canoes are built for sale. The proa can take a different name according to its dimensions and its destination. In Haleita, for instance, a 20 ft. proa is called "Tiola" and a 33 ft. proa "Binabina". This type of boat is found everywhere in the Protectorate and is used for all purposes, including transport and fishing. Considering the simplicity of the tools and the type of materials available, these boats are ingeniously constructed, and they are very fast and stable. They are built from the keel up with planks laced edge to edge with split vines. These planks are reinforced in places on the inside. The ribs are sewn to the planks with vines and vary in number according to the length of the boat, although there are seldom less then three, or more than five ribs. In short, all parts of the boat are tied, sewn or laced together. The seams are made watertight with a substance prepared from tita fruit (Parinarium glaberrimum). In Harora a four-ribbed proa costs £15. Ordinary canoes without outriggers are also used for fishing.

Fishing gear

I have observed the following items of fishing gear in these islands:

Spears: for all kinds of fish in shallow waters.

Lines: handlines for bottom and pelagic fishing; trolling lines for pelagic fishing.

Fishpoles: poles are used with line and baited hook or lure. The latter is made of blacklip pearlshell and shaped like a fish. It is used for small tuna.

Nets:

Soga: a pyramidal net with a base 5 ft. square and 1-inch mesh. This net is placed over the fish in shallow water.

Wotua: a liftnet operated by two men from stages made of poles. This net is used in shallow water and lifted when fish pass over it.

Laga: a scoopnet with ½-inch mesh. A number of these nets are used by a group of fishermen to catch small fish from a school.

Atola: a rectangular net stretched between a bent bamboo pole and a cross bar. This type of net is used for reef fish. When a fish is driven into the net, the net is released and the fish enmeshes itself. The bamboo pole is 11 ft. long and the net is 14 meshes deep and 58 meshes long, with 1½-inch mesh.

Wai: a gillnet for large reef fish. The net is 53 fathoms long and 4 fathoms deep, with 1-ft. mesh. It is made of Boila rope.

Wugoh: This is a surrounding net made of pandanus leaves, 12 fathoms long, 2 fathoms deep, with 2-inch mesh. The main species caught with this net is "buma".

The aquatic fauna of the Nggela group

On the whole, it can be said that the Nggela group has a reasonable fish population. In the deep areas outside the reefs, quantities of pelagic fish can be found. Near the south-west coast of Florida Island I have observed many large schools of small tuna (Euthynnus affinis) preying on young scads (Decapterus macrosoma). These schools were followed by numbers of frigate birds and other sea birds. Five large schools in all were sighted, mainly between Tulagi and the mouth of the Utahe passage, but also in the wide mouth of the passage. Nobody was fishing these schools. Some schools of small tuna were also seen in the northwest part of the group.

These small tuna should not be mistaken for young specimens. They were all adults and about 20 ins. long. All those taken were about to spawn.

Fifteen miles northeast of Florida, schools of Decapterus were seen and these fish were found in the stomach of the dolphin and other fishes caught. Some whales were seen in the same area but could not be identified. Spanish mackerel, cavalla, Caranx crumenophthalmus and flying fish are found outside the reefs. The temperature of the sea water was 82° to 83°F, and the salinity about 35 per mille. Very near the shore I found a salinity of nearly 32 per mille in the vicinity of fresh water outlets. All these observations were made on surface water.

The flora and fauna of the reefs gave me a good general impression, with the exception of trochus, which raises a problem of over-fishing (see above), and some reefs near villages which may suffer from excessive fishing pressure. Fortunately, pelagic fishes sometimes come into shallow places on the reef. I saw some small sardine schools. The blacklip pearl oyster is present in the group. I saw some specimens in Haroro which measured 5 and 6 ins.. This shell is locally called "aro". It is found in 5 fathoms of water and I would not be surprised to find greater quantities of these oysters in greater depths, in the same area. 5 fathoms seems to be about the limit to which local skindivers can go. This is unfortunate, as these shells are quite valuable.

Mangrove oysters are found in the group and the people of Vura gather them for familial consumption. In Soso, on Vatilau island, I saw shells of a freshwater shellfish (Batissa unioniformis) locally called "tueh", which is eaten locally. This same mollusc is sold in large quantities on the Suva market under the name of Kai mbuli; it is taken from river bottoms. Giant clams are also present in the group. There is no freshwater fish cultivation.

Malaita District

Malaita has the largest population of the Protectorate. The seats of the District Administration is in Auki. This town has a good harbour with a landing jetty, but no repairs facilities for boats. There is a number of villages and hamlets along the coast and in the interior; in addition, many islands and artificial islets are inhabited. The population is divided into "bush people" living in the interior and along the coast, and "saltwater people" living on the islands and islets. These artificial islets are found in the Lau lagoon, where they are occupied by fishermen (the women and children are sometimes occupied in fishing), and in the Langa Langa lagoon. In this latter place, the population of the islets is composed of fishermen and boat builders; here also, women and children take part in fishing activities. Some women also make shell money.

The saltwater people living on artificial islets must obtain their vegetable food from gardens located on the mainland. Some have their own gardens, but most have to barter fish for vegetables. Fish is also sold for Australian currency or shell money. Porpoise teeth are also used as currency.

Most of the fish caught is eaten locally and in the interior of Malaita. Small quantities have been shipped to Honiara. Fish preservation is practically unknown. The only items which could be included under this heading are roasting and cooking, which do not preserve fish for long periods. A very interesting experiment is being made by the District Commissioner with a smoke oven of Scottish design. Some small consignments of smoked fish have been sent to Honiara.

Shells are the only products of the sea exported.

Trochus niloticus

What has been said regarding this shell in the Nggela group is also applicable to the Malaita district. I had the opportunity to work on small trochus at a number of places in this district and to collect more precise observations. Two inch females were found mature, the gonads being filled with eggs in various stages of maturity. One $2\frac{1}{2}$-inch female had ripe eggs and two $2\frac{1}{2}$-inch males had nearly ripe sperm. It seems, therefore, that sexual maturity is reached when the shell attains a base diameter of 2 in. to $2\frac{1}{2}$ ins.

In Maka, on February 3, I was told by Mr. Aziel Lae'alaha, Council Delegate, that a closed season had been declared locally from February 1 to July 31. As a consequence, I was only able to examine four trochus, three females and one male, all 2 ins. in diameter. They were all mature, although the gonads were not fully developed. Two $4\frac{1}{2}$-inch females with completely ripe eggs were also brought to me.

Mr. Timmeus Teioli, District Clerk, told me that fishermen from the Langa Langa and Lau lagoons make sailboat trips of up to one month outside the Malaita district for trochus.

Fishing craft

In the Malaita district, hundreds of proas are used for fishing and for transport. On the neighbouring islands and artificial islets, every family owns its proa. They are similar in construction to those used in the Nggela group. These craft are built, under various names, in every village or inhabited island. In Falalei, a fishing proa is called Ola'a, while the faster proas, built of lighter materials for chasing porpoises, are called Raku. Some proas are inlaid with pearl shell; these are mostly large craft, reserved for special occasions. Ordinary canoes are also found.

Besides native type craft as mentioned above, some cutters and boats of European design are built in the Langa Langa area and also on a smaller scale in the Lau lagoon. At the time of my visit, there were 5 boats and 16 cutters under construction in Malaita. These may be fitted with sail only or with engine and sail. The larger craft are used for transport, the smaller for transport and trochus fishing. Cutters and boats are also sold to other islands. A headman told me that a boat was being built in the Lau lagoon for fish transport.

The Langa Langa lagoon is studded with natural and artificial islets, on many of which are small boatbuilding yards. The biggest boat under construction at the time of my visit was 38 ft. long and 12 ft. wide. The boat builders work with simple tools under the most unfavourable conditions and one cannot help admiring their performance.

The timbers used are "Ula" (Intsia bijuga) and "Vata" (Vitex coffassus) for ribs and keels and "Baula" (Calophyllum kajewskii), for planking. In the Langa Langa lagoon, the islanders often bring logs to the sawmill operated by the Roman Catholic Mission at Buma, where they receive 40% of the sawn timber in return.

At the request of the District Commissioner, I examined the boats under construction for possible improvements. In view of the thinness of the ribs used, I suggested putting three or four heavier ribs at intervals and further strengthening the boats with side stringers extending from stem to stern. Some of the boats already had stringers, but they were often too short. These modifications should make the boats much stronger and less likely to spring leaks. In addition, I advised putting air vents on the engine rooms with pipes leading right down, in order to blow all the fuel gasses out. Faulty ventilation of engine rooms is often the cause of explosions and boats occasionally taking passengers should be made as safe as possible.

In the event that mechanization of fishing craft is desired in the future, the local boatbuilding industry is ready to cope with it.

Fishing gear and techniques

Poles; lines and hooks; spears - as mentioned for the Nggela group.

La'a and Abeisai: a square liftnet mounted on two crossed bamboos and a pole. This net is laid in shallow water only and lifted when fish are above it. For sardines, mullet, etc...

Si'ai: small nets used to close the entrance to a stone fish-trap.

Fuo: a net 30 fathoms long and 3 fathoms deep, with floats along the top and shell or stone weights at the bottom. Fish are driven into it with scarelines of coconut fronds.

Eurai: a surrounding net 60 fathoms long and 2 fathoms deep with floats along the top and cowrie shell weights at the bottom. 2-inch mesh. Used to catch reef fish.

Ambe: a surrounding net 30 fathoms long and 1 fathom deep, $1\frac{1}{2}$- or 2-inch mesh, with floats along the top and cowrie shell weights at the bottom. Used for reef fish.

Furai'ia: a large surrounding net, 120 fathoms long, 100 meshes deep, with $2\frac{1}{2}$-inch mesh. Equipped with wooden floats and cowrie shell weights. This net is made up of a number of rectangular pieces sewn together. Used to catch parrot fish.

Furai'funu: turtle net, 80 fathoms long, 14 meshes deep, 20-inch mesh, with wooden floats and shell weights.

Ausae: this is the same as the "Atola" net mentioned for the Nggela group.

Ma: this is a large fish trap, 4 ft. high, made of twigs and shaped like a row of six V's. It is used for closing the mouth of small bays and catches fish both during the flow and the ebb of the tide. The fish are taken from the point of the V with a "La'a" (see above). One example of this trap was observed at Sinerangu, but no fish were caught at the time. Local informants gave me the vernacular names of the two species mainly caught with this trap ("Tomba" and "Eru eru"), but I was unable to find what they were.

Hoima: in the Maramasike Passage, near the shore, are four stages built of poles. A wing made of sticks extends from the shore to the middle of the nearest two stages. Wings also extend from each of the outer stages. A square net ("Ape"), measuring

8 fathoms along each side, is laid on the bottom between the stages and lifted when fish swim over it. It is operated by 12 men, three on each stage. The net itself is made up of 9 pieces sewn together, each piece being the property of one fisherman. It has 2-inch mesh, made of 1/8 in. hibiscus twine. The net is used during the mullet season in May-August. One catch made last year brought 2,000 mullet, locally called "Unehe". This fish receives different names according to its size: manetohuneli, tanusiamama and suluhie; the latter are biggest, about 2 ft. long.

Torches: torches of dried coconut fronds are used at night in a number of places for various types of fishing, including trochus gathering.

Porpoise chasing: porpoises are chased into shallow inlets with a number of canoes. Up to 50 of these animals may be killed in one drive.

Poisons: fish are stupified with "Wao" (the viscera of a sea-cucumber), with the kernels of Barringtonia nuts, or with "kwalomaimai" (a creeping vine).

The aquatic fauna

Many species of fish are represented on the reefs, such as parrot fish, wrasse, spinefoot, rock cod, snapper, half-beak, garfish, eels, surgeon fish, rays, etc.. The individual specimens are generally smaller in the vicinity of population centres. On the whole, these reefs left me with a good impression. Malaita is the most populated island in the Protectorate, so that a certain amount of overfishing in places is understandable.

In addition to fish, the reef offers squid and octopus, turtles, lobsters, crabs, sea cucumbers, sea urchins, giant clams, turbo shells and many other species of shells, the most important of which is trochus. The presence of blacklip pearl shell is worth mentioning, although the quantities available are small, according to my informants.

On the deeper slopes of the reefs and in the open ocean, numbers of pelagic species can be found, such as barracuda, Spanish mackerel, dogtooth tuna, small tuna, horse mackerel, scad, flying fish, shark, yellowfin tuna, skipjack and dolphin as well as cetaceans such as porpoises and whales. One reef near Sinarango is called "Kingfish Shoal" and is actually alive with kingfish, but the sharks are also very numerous there.

No higher catches should be expected from the shallow reefs, down to 3 fathoms depth. Trochus is threatened by overfishing and needs to be protected. The reefs are the private property of some islanders.

There is no freshwater fish cultivation. Some turtles are raised in saltwater ponds. Giant clams are sometimes brought to a reef conveniently close to an islander's home and left there to grow bigger before they are eaten. Sea urchins are found in quantities on the west coast of Malaita and are appreciated as food. Women divers collect them for home consumption.

Crabs ("kuka") are caught by torchlight in December and January, when they are loaded with eggs. It is chiefly the eggs ("lami") that are sought after. They are dried in bamboo containers over a fire and can be kept for some days.

Surface observations indicated a temperature of 82°-83°F and a salinity of 34 - 35 per mille.

San Cristobal and Neighbouring Islands

The islands of Ugi, Santa Ana and Santa Catalina were visited, as well as a few localities on the north coast of San Cristobal and the peninsula at the eastern tip of this island. The seat of the District Administration, Kira Kira, on the north coast of San Cristobal, was among the localities visited.

This district is not densely populated. The only concentrations I saw were at Pawa (mission) on Ugi, Pamua (mission) and Kira Kira on San Cristobal, and the islands of Santa Ana and Santa Catalina. The rest of the population lives in small villages, hamlets and mission stations.

Fishing is most active in Santa Ana. In the rest of the localities visited, the islanders go fishing only when fish is needed. They dive for trochus or green snail, or gather shellfish for food.

Trochus is present on the reefs but, according to the islanders, not as abundant as before. Some specimens $2\frac{1}{2}$ ins., 3 ins. and 4 ins. in diameter were examined. The gonads were found to contain eggs in various stages of maturity, and immature sperm. (The males examined were only $2\frac{1}{2}$ ins. in diameter). The shells were of good quality.

Mr. Kuper, of Santa Ana, informed me that 36 different fishing methods were used in the area, including, of course, even the simplest ones. He personally has tried a very short Japanese longline with some success. The bulk of the catch was yellowfin tuna ("Waiau"). We caught Spanish mackerel and yellowfin tuna by trolling. I observed a large school of yellowfin tuna and flying fish between Santa Ana and San Cristobal and small schools of sardines just outside Star Harbour (San Cristobal). In this latter locality, I was able to examine a turtle pen.

Most of the reef fish mentioned for Malaita are also present here. My observations showed a surface temperature of 82°F and a surface salinity of 35 per mille.

On Santa Ana there are two lakes which contain practically no fish of any value for food. The only freshwater fish I have seen were gambusia, a mosquito-eating minnow, and "gori", a small dark fish belonging to the family Ophiocephaloideae. Small freshwater crayfish are found in the streams of San Cristobal. Ugi has both freshwater crayfish and Kuhlia rupestris, Lac., a freshwater fish.

There is no freshwater fish cultivation in the District.

Guadalcanal

Sailing from San Cristobal to Honiara, I had the opportunity to observe fish from Graham Point (the Eastern tip of Guadalcanal) on westwards. In the south and north entrances to the Marau Sound, there were many schools of small tuna and a few schools of small horse mackerel. The latter could not be identified but would most probably be either Decapterus sp. or Caranx crumenophthalmus. In the North Entrance, near a reef, I saw a school of trevally. We caught bonito and barracuda opposite Aola, and small tuna in the vicinity of Lunga Point. In addition, two schools of small tuna were sighted beyond Lunga Point.

Fish supplies from local catches are inadequate in Honiara, chiefly due to the scarcity of fishermen. Some fresh fish is received from Berande. There is also an import of fish from outside the Protectorate. Frozen fish is sometimes sold in the butcher's shop at Honiara at £A.-/2/6d. a pound.

Some Chinese merchants have motor boats plying among the islands, where they sell general merchandise and buy copra and shell.

A trader stated that 60% - 65% of the trochus trade is in the hands of one Chinese merchant. Trochus ready for export at Honiara includes 40% small, 40% medium and 20% large shells. These shells are exported to Hong Kong, Japan, Australia and Europe. The price of trochus in February, 1956, was £A.535.0.0. per ton; green snail was worth £A.430.0.0.

PRELIMINARY GLOSSARY OF THE NAMES OF AQUATIC FAUNA IN THE PROTECTORATE

Locality+	Vernacular*	English	Scientific
Tulagi	Unknown	Yellow-tailed caesio	Caesio erythrogaster C.V.
Leitonga	Aku	Small tuna	Euthynnus affinis Cantor
Florida Group	Unknown	Scad	Decapterus macrosoma Blkr.
Baroni & Leitonga	Kokorru	Red reef snapper	Lutjanidae
Florida Group	Malahau) Kioh) Palahoho)	Spanish mackerel	Cybium spp.
Malaita	Duru	Flying fish	Exocoetidae
"	Unknown	Blue striped runner	Elagatis bipinnulatus Q.G.
"	Unknown	Dolphin	Coryphaena hippurus L.
Lau Lagoon	Mamula	Trevally	Caranx spp.
Ngonosila	Kalua	Mullet	Mugilidae
Make	Unehe	"	"
Lau Lagoon	Manua) Maramarakwa)	Parrotfish	Scaridae
" "	Ulafa	Rock cod	Serranidae
Haroro	Kohohha	" "	"
Lau Lagoon	Hale	Red snapper	Lutjanidae
" "	Mou	Spinefoot	Siganidae
" "	Kota	Garfish	Hemirhamphidae
" "	Soke	Shark	General Name
Falale	Alifo	Sardine	Clupeidae
Malaita	Sopilo	Dogtooth tuna	Gymnosarda nuda Günther
Santa Ana	Buma	Horse mackerel	Caranx crumenophthalmus Bloch
" "	Waiau	Yellowfin tuna	Neothunnus macropterus Schlegel
Honiara	Sau	Bonito or skipjack	Katsuwonus pelamis Linn.
Vatilau Island	Gomma	Torpedo trevally	Megalaspis Cordyla Linn.
Honiara	Ono	Barracuda	Sphyraenidae
Longapolo	Gohi	Hardy heads	Atherinidae
Malaita	Gwarasu	Whale	General name
"	Kirio	Porpoise	Delphinidae
Lau Lagoon	Fonu	Hawkbill turtle	Chelona imbricata
" "	Watona	Sea cucumber	Holothuroidea
" "	Unknown	Sea urchin	Echinoidea
" "	Ima	Giant clam	Tridacna spp.
Haleita	Lala	Trochus	Trochus niloticus Linn.
Lau Lagoon	Sifala	"	" " "
Ngonosila	Kuka	Crab	Unknown
St. Ana	Gori	A freshwater fish	Ophiocephaloidae
" "	Gambusia	Mosquito fish	Gambusia patruelis B. & G.
Haroro	Aro	Blacklip pearlshell	Pinctada margaritifera Linn.

\+ The locality mentioned is that where the vernacular name was noted or where the species concerned was caught.
* Vernacular names often vary according to the size of the fish.

SUGGESTIONS AND RECOMMENDATIONS FOR THE DEVELOPMENT OF FISHERIES

Taking into consideration the vast distances separating the various islands of the Protectorate, the number of these islands and their low density of population, the long way both the country and its population have to go towards effective development, it is quite understandable that a modern fisheries industry manned by local labour and intended to meet local consumption requirements would not offer any attractive prospects in the near future.

A modern fisheries industry could only be established with foreign personnel supplemented by some local labour. Its output would have to be directed towards a foreign market.

To improve local fisheries and thus provide the islanders with a greater cash income (shell) or a more abundant supply of sea foods (fish, shellfish, marine mammals) it is necessary to have new simple fishing gear and boats, to promote fish and oyster cultivation, to give education in simple preservation methods and to protect fisheries resources.

In the suggestions made below, care has been taken to encompass, as far as possible, activities which can be undertaken as part-time work by either male or female workers. Indeed, most of the islanders now engaged in fishing are also farming at least part of the time. Customs will change slowly but the present domestic economy cannot be expected to fit in a modern pattern where fulltime work is essential to make any business profitable. However, if progress is adapted to the islanders' present way of life and the co-operation of the people is forthcoming, great improvements can be effected for their own profit.

The various steps and methods capable of bringing about such improvements are given below:

Trochus niloticus L.

In every locality of the Protectorate where I have been able to investigate the trochus fishery, there are definite indications of overfishing and immediate steps should be taken to prevent the extermination of the species. The islanders themselves are already convinced of the necessity of protection and many have closed their reefs of their own free will.

From what I have observed, different parts of the same reef may belong to different owners, so that one part may be closed to trochus fishing, while the rest is not. Such a step is meaningless, since trochus may move as much as fifty yards away from their previous location in one single night, in search of food or for other reasons.

I would therefore advise:

(1) increasing the minimum legal size from $2\frac{1}{2}$ inches across the base to 3 inches;

(2) closing the reefs to trochus fishing for six months in every year.

In connection with point (1), precedents can be found in various other territories such as Fiji, where the minimum size is $2\frac{3}{4}$ ins., the Trust Territory of the Pacific Islands, with a minimum size of 3 ins., and New Caledonia where steps have recently been taken to increase the limit from 3.2 ins. (8 cm.) to 3.6 ins. (9 cm.), with effect from May 1st, 1957, and to 4 ins. with effect from 1st May, 1958.

In regard to the establishment of a closed season, my investigations only covered scattered localities, in the months of January and February, and this is insufficient to show the best time of the year for the closed season. In general, I have found gonads full of ripe or nearly ripe eggs or sperm all the year round in other places. The eggs are liberated a few at a time and the female has a protracted spawning period, but we have no definite knowledge of how long this period is. However, there are reliable indications that trochus spawn all the year round. It is possible that spawning is more active at a particular moment, and this may be shortly after February, since at the time of my visit all the gonads with sperm and eggs were in excellent condition. If this hypothesis were verified, it would be advisable to close trochus fishing from December 1 to May 31. However, a six months closed season beginning in any part of the year would be useful, provided trochus fishing is closed in all parts of the Protectorate at the same time.

Precedents for such an action can be found in other South Pacific territories.

Preservation of fish

Preservation methods were practically unknown in all the localities I have visited in the Protectorate. The eggs of the "kuka" crab ("lami") and some small fish are cooked and dried in a section of bamboo; fish is roasted over the fire. These methods allow the products to be kept for very short periods and are apparently the only ones known.

Smoking

The District Commissioner of Malaita has made a trial with a smoke oven of Scottish design. This oven or kiln was built on the island of Adagege, in the Lau lagoon. It is 5 ft. wide, 10 ft. long and 18 ft. high at the roof ridge. It is built of concrete blocks from the ground up to a height of 6 ft. and of ivory palm thatch above that. The roof is made of sheet iron. The oven can accommodate six rows of nine spits each and each spit can take six fish 1 ft. long. The capacity of the kiln is therefore 324 fish. Coconut husks are used for fuel. The technique used originally called for 10 minutes salting in saturated brine and one whole day of smoking. The product was good.

The District Commissioner having asked me for comments on his project, I smoked fish by the method described above, in his presence. From that trial it appears to me that 48 hours of smoking would be necessary under tropical conditions. 24 hours in the oven give an excellent taste, but the product cannot be kept more than two days without refrigeration; fish smoked for 48 hours are not as tasty, but are still well accepted by the population. In addition, large reef fish like those taken in the Lau lagoon should be salted for 6 hours in saturated brine. Two hours salting and 24 hours smoking will be sufficient for small reef fish. Under proper storage conditions, the product should keep up to 10 days. If a strong smoke and salt flavour is appreciated, 12 hours of salting in the same type of brine, and 48 hours of smoking would be necessary, these times being reduced to 4 hours salting and 24 hours smoking for small reef fish. This processing will also protect the fish from flies.

The type of smoking referred to here is known as "cold smoking", in opposition to "steam smoking". The brine used is sea water to which enough salt has been added so that a fish or a potato will float on it.

A demonstration of smoking was also given in Santa Ana Island. The smoke kiln there had a roof and walls of coconut fronds and was 7 ft. long, 4 ft. wide and 8 ft. high. The fronds for such a kiln must be attached very close together on wooden bars, to prevent smoke from leaking out. Coconut husks are burned slowly on the ground, the fire being surrounded with a low wall of loose coral rocks.

In the Adagege kiln, the lowest fish were 6 ft. above the fire; in Santa Ana, the height was 5 ft.. The fish were split open, preferably along the back. It is better to cut any fish over 2 ft. long into pieces.

Both demonstrations were attended by large audiences.

Salting and drying

In three places demonstrations were given in salting and sun-drying and were attended by large audiences. All fish over 6 ins. in length were cut open and gutted. The fish covered with large scales, mainly wrasse and parrotfish, were scalled. Small fish were gutted through a slit in the belly. Slashes were made lengthwise in the flesh of the largest fish. The fish were cleaned in seawater to wash off the blood and slime and put into saturated brine (see above) for 14 hours. On two occasions, the fish had to stay longer in the brine because it was raining. However, 12 hours is sufficient. A biscuit tin was used as a container; indeed, any clean container will do.

After salting, the fish were washed in seawater and dried in the sun. With good sunny weather, large fish dry in 3 days, smaller ones are ready earlier. These demonstrations were made under the most unfavourable conditions, in very rainy weather. Flies were also a nuisance.

I saw the product of the first demonstration later in Honiara. The fish processed on January 28 looked very good on February 13, except for some surface moisture which disappeared after 10 minutes further drying in the sun. Over the period involved, the humidity was very high.

The technique described above is recommended for producing salt-dried fish. If the weather is overcast, the fish can be dried in a copra dryer or in a shelter of coconut fronds, over a slow fire of coconut husks or non-resinous wood.

Cooking and Drying (Fish Flakes)

It sometimes happens in these islands that there is a glut of fish, more than the population can consume or sell immediately. No salt is available, so what can be done to preserve that fish for any length of time? Other factors may create the same problem, such as the rain and the flies I had to contend with during my survey.

In order to help solve that problem, two demonstrations were made, one in good weather with swarms of flies and one with both rainy weather and flies. No preparations were made beforehand and the fish was processed with the utensils available on the spot.

All kinds of fish were brought, parrotfish, snapper, bream, mullet, surgeon fish, spinefoot, sweetlip, trevally, rock cod, and spotted batfish. All were gutted through a slit in the belly; parrotfish were scaled; they were then washed in seawater and the largest fish were cut into pieces to fit the cooking pot. A proper cooking pot was actually used, although any clean fireproof container will do.

The fish were placed in the pot, which already contained three parts of sea water and one part of coconut "milk" (the water contained in the nut, as opposed to coconut "cream", expressed from grated coconut). These proportions can be varied quite considerably, and on other occasions I have even used equal amounts of sea water and coconut milk, with very good results both regarding taste and keeping quality.

The fish were allowed to cook for exactly 30 minutes at 100°C, then taken out of the pot and placed on a steel plate resting on drums, three feet from the ground. All bones were removed and fed to the pigs. The flesh was broken up into flakes 1-2 ins. long. A very small fire of coconut husks was kept burning under the plate for 24 hours, the fish flakes being turned over from time to time. The plate must be at such a temperature that one can keep one's hand on it comfortably.

On one occasion, when it rained, the drying was carried out in a shelter consisting of three walls and a roof made of sticks and coconut leaves. There is advantage in using such a shelter, since it traps a little smoke which keeps the flies away, and it protects the flakes from the rain.

The finished product appears as ¼-inch to ½-inch yellow-brown flakes with a very slight smoke flavour. On one island, the audience consumed about two-thirds of the flakes without further preparation and found the product to their taste. However, the flakes can be eaten with coconut cream (a favourite with many South Sea Islanders), or used in soups; they can be mixed with flour and made into fish cakes, or used to relieve a dish of rice, where this cereal is the staple.

Fish flakes prepared in that fashion can be kept for long periods in airtight containers such as bottles (in some localities many of these are thrown away), jars, tins, bamboo tubes or even paper bags or sacks. At the time of writing, I have some fish flakes which have been kept for two months in a glass jar and are still in very good condition, although the container has been opened many times for testing the contents, in a humid climate. Such methods of storage will offer no difficulty, since the people of the areas where the demonstrations were made are already used to keeping foodstuffs and drinking water in bamboo containers.

Fish flakes offer the following advantages:

(1) They keep well.

(2) They offer a simple means of preserving surpluses of fish.

(3) They constitute an insurance against periods of low catches.

(4) The product is easy to transport even over long distances. The people from the interior of the islands have to travel far in order to buy fish and often come home with their load in poor condition.

(5) Restorative foods are seldom available in the Protectorate and fish flakes may offer a satisfactory substitute.

An analysis of fish flakes cooked in 60% of sea water and 40% of coconut milk gave the following composition(1) :

	%		%
Water	7.0	Ash	10.0
Fat	7.0	Sodium chloride	2.23
Nitrogen	9.0	Calcium	0.20
Protein (N x 6.25)	56.3	Phosphorus	0.26
Soluble sugars	1.0	Phosphate (P_2O_2)	1.2
Fibre	1.5	Undetermined	5.0

(1) This analysis was carried out by Mr. F.E. Peters, South Pacific Commission Biochemist, in the Commission's laboratory, Nouméa.

If a salt taste is desired, the flakes can be prepared by cooking in sea water only.

Fishing gear

Bottom traps:

During my stay in the Solomon Islands, I have not seen a single bottom fish trap (see Annex 1). These are used to catch a number of bottom species in tropical countries. They can be set in depths of 3 - 20 fathoms for commercial purposes. However, I have even used them in places where there was only one fathom of water at low tide. In depths of 8 fathoms or more, a line and float are usually attached to the trap; in lesser depths, the trap can be lifted with a grapnel hook and a line. The large fishing proas can be used for operating these traps.

Traps should be lifted every second day and can be reset immediately. They can safely be left unvisited during periods of bad weather. Once a month they should be brought ashore for drying and cleaning. In many countries, they are used for commercial fishing. They may be of many different shapes and may have several entrances. Crabs, pieces of fish, cassava roots or pawpaw leaves may be used for bait, although this is not always necessary; I personally have always used unbaited traps in Indonesia and West Africa with good results.

Traps can be made of a wooden or metal frame covered with chicken wire, or of split bamboo. The wire mesh should be about 2 in. and if the trap is made of bamboo the strips should also be woven with 2-inch intervals. Cylindrical traps can also be made but should be fixed onto a rectangular bottom frame made of sticks to prevent them from rolling. When the trap is new, this frame is normally weighted with rocks to keep it from floating. Traps can be placed on flat or sloping bottoms.

Fixed shore wingtraps:

I have not observed this type of trap in the Protectorate, although they are commonly used in a number of tropical countries, including several South Pacific territories. I have myself seen them in Guam, Tonga, Fiji and Papua. They can be built of different shapes in different depths of water, and from a variety of materials. Many species of fish, as well as turtles and squids, can be caught in these traps.

Wingtraps are generally placed near beaches or shoals, in areas sheltered from the seas, with a maximum current of one knot. Some can stand stronger currents, but require skilled fishermen. The end of the wing is in shallow water and the wing itself is set at about right angles with the coastline. When they come up against it, fish swimming parallel with the shore always tend to seek an opening in deeper water and follow the wing away from shore. Thus they are led into the wingroom, then into the fishroom and finally into the trap proper. With a tide current of $\frac{1}{2}$ to 1 knot, and a trap of the type shown in B, Annex 2, the fish will swim into the trap that is upstream at the time. The two traps therefore ensure continuous fishing. The type shown in A is adequate for slow current and for catching the fish moving with the fall of the tide.

In the case of fishermen who have never had experience with these traps, I would advise building them where there is a maximum depth of 7 ft. at high water, springtide. If the bottom is sloping at an angle of 4^{0}, as shown in Annex 2, the maximum possible length of wing will be 52 ft.. With a lesser degree of slope, the wing can be made longer.

In the sketch, the posts have been spaced in most cases at about $6\frac{1}{2}$ ft.. They are connected by horizontal stringers near the top. A screen made of chicken wire, mats, woven bamboo strips or branches is fixed on this wooden frame. This screen must extend from the bottom up to high water level, springtide. The trap proper (see Annex 2, 8) must be made of strong material, to prevent the fish from escaping. The traps must be cleaned periodically, at intervals dictated chiefly by their location; for instance, a trap set in sea water will be covered with molluscs or weeds after five weeks.

Numbers of suitable locations can be found for such traps: sites near mangroves in the vicinity of freshwater streams or rivermouths, side arms of estuaries, sheltered areas, etc.. I have observed appropriate conditions in Marau Sound (Guadalcanal), Star Harbour (San Cristobal), the lagoons at Lau and Langa Langa, Port Adam, Maramasike Passage, Sinerangu Harbour, Malu'u, Auki Harbour (all in Malaita), Tulagi Harbour, Utuka Passage and Sandfly Passage in the Florida Group, to mention only a very few places.

Drift gillnets

In areas where there is a current and the water is over three fathoms deep and not too clear, drift nets used with a local proa will prove efficient gear for night fishing. A 20 fathoms net, 2 fathoms deep, with $2\frac{1}{4}$-inch mesh of cotton No. 30/6 or the equivalent, or of nylon denier 250 x 2 x 2, would be a good fishing unit for two fishermen. Wooden floats placed one foot apart along the cork rope and small shells or pieces of lead tied every fathom along the leadrope will be adequate.

All the deeper parts of the lagoons and passages and the sheltered places where the above conditions are found will be good.

Bottom gillnets

In places 4 to 30 ft. deep, with a slow current and a clean sand or mud bottom, bottom gillnets can be used to good account with a local proa at night, or even in the daytime if the water is turbid. A 60 fathoms net, 3 feet deep, with three inch mesh, made of cotton No.30/9 or the equivalent, or of nylon denier 250 x 2 x 3, would be a good fishing unit for two fishermen. Wooden floats spaced every three feet along the cork rope and small shells or lead weights spaced every foot along the leadrope will be adequate.

Cast net:

I did not see any castnets in the Protectorate, but I observed quantities of fish in shallow water, either along the beaches or in places where a cast net could be operated from a proa. A 5 ft. net (stretched) with 1-inch mesh made of 30/6 cotton or the equivalent would be adequate.

Longline

The large local proas can fish for tuna, shark and marlin with a longline using sardines, mullet or shads for bait. A line made up of four baskets of 90 fathoms each (see Annex 3, B) could be made, with a 12 fathoms float line every 45 fathoms. Floats could be either glass (many such floats, lost by Japanese longliners, are available) or bamboo. Droppers should be 3 fathoms long, set every 9 fathoms, with a 3 ft. wire leader and a strong 3-inch hook.

Local materials could be used. The Dadalo rope made by the people of Falalei island, in the vicinity of Port Adam, is strong and would be adequate for a longline. It should be made in $\frac{1}{4}$ in. diameter for that purpose.

There are sardines in the area; at the time of my visit one man caught 40 - 50 sardines in $1\frac{1}{2}$ hours with a la'a (liftnet).

Mr. Kuper, of Santa Ana, tried one basket of longline 180 fathoms long, and caught yellowfin tuna and shark, after reading about this method in the S.P.C. Quarterly Bulletin. This method has a good chance of success, weather permitting, when bait is available.

Lift net and lamp

There are in the Protectorate many sheltered places, with clear water, where fish could be attracted with a lamp 300-500 candlepower on dark nights. Scad, mackerel and sardine will come to such lights. A kerosene pressure lamp with the glass globe at the bottom is preferable to other types.

The smallest type of proa (23 ft.) and of net (15 ft. square) which can be used in this way are shown in Annex A, 3. Many proas this size and larger are available in the Protectorate; they only have to be fitted with outriggers, preferably with bamboos as floats on each side. The proa should be anchored in depths from 5 to 20 fathoms, away from strong currents. The net is let down to the bottom if there is less than 50 ft. of water and if the bottom is clean; otherwise the net is kept hanging. As soon as it is dark, the lamp is lit and the crew waits for fish. When a sufficient quantity of fish has been attracted, a screen of red material is lowered round the lamp, leaving the lower side unshaded. This has the effect of concentrating the fish under the lamp, and the net is lifted. In general, a net can be lifted two or three times each night. As soon as the moon comes up, fishing should be stopped, as the lamp can no longer attract enough fish.

The liftnet can be square or rectangular, provided it is shaped like a bag or like a box. The former shape can be obtained by allowing plenty of netting inside when attaching the edge ropes, the latter by using a square or rectangular piece of netting for the bottom and sewing a vertical edge, 2 ft. high, around the edges. A $\frac{1}{4}$-inch line is connected to the top edge.

Four men are needed to lift a net 15 ft. square. In the case of bigger nets, six men are necessary, two of them standing respectively in the bows and in the stern. Fish grouped first around a "Rumpon" can be attracted to a light.

Rumpon or fishlure

There are many places in the Solomon Islands where fishlures could be anchored out in the sea in 10 - 20 fathoms of water in bays or in channels between islands. This method is commonly used in Malaya and Indonesia and I believe it would have good possibilities in the Protectorate.

The requirements for this technique are a maximum current speed of $1\frac{1}{2}$ knots, a clean bottom and, in view of local circumstances, clear water.

The rumpon (see Annex 4, A) is a rope hanging from a bamboo float anchored with rocks and trimmed with leaves. The rope may be of twisted bamboo strips, rattan, liana, etc.., and should be 60% longer than the depth at the place where it is to be set. For instance, in 10 fathoms of water, 16 fathoms of rope are necessary. The leaves are usually coconut fronds chopped into six pieces, one piece being attached every yard from below the float to a point 3 fathoms above the rock anchor. After one month the top leaves are renewed and after 3 months another rumpon is let down on the same place.

This lure attracts scad, mackerel, sardine, blue striped runners, dolphin, trevally, herring, etc.. These fish mostly gather up current from the lure at different depths. Concentrations of snappers are often found near the bottom.

Fishing with handlines in the vicinity of the rumpons would be profitable, with a small piece of fish for bait and hooks of a size proportionate to the size of the fish, although very small hooks are required for scad and mackerel. Also, fish attracted first by a lure can be attracted with a fishing lamp and caught with a liftnet.

Remark: Many different types of fishing activities could be undertaken with small motor boats. However, I feel that my recommendations at this stage should not exceed the capacities of existing local fishing craft. It is only later, when the Protectorate has had time to develop further, when the population of Honiara has increased and the need for greater quantities of fish is felt, that consideration can be given to the use of mechanized boats. At the moment, the catch from one single motor boat would be more than Honiara could absorb. More fishing gear and techniques could be suggested, but there would be no point in doing that. The methods listed above are well within the islanders' means and abilities and their introduction will already represent an important step.

Tanning

I have not seen any evidence of nets or lines being preserved in the Protectorate. However, mangroves are fairly common in this territory and their bark is very good for tanning. This should be put to soak for 24 hours in a drum or other vessel in the proportion of one part bark to two parts of fresh water. The whole should be boiled for one hour and the nets or lines can then be put overnight in the solution. After drying the nets, the operation should be repeated. This would increase the life of the equipment. At the present time, some nets are used for 2 - 4 weeks and then put away for long periods. Most of the nets I have seen were in bad condition and it would be of advantage for the fishermen to learn tanning.

Oyster cultivation

Mangrove oysters are present near Vura, in the Florida Group. They may also exist in other places, but perhaps not in great quantities. I have only seen them in that place. It would therefore be worth while trying oyster cultivation.

The Philippines method would be best (see Annex 4, B). In this method the oysters are grown on horizontal and vertical collectors hanging from racks made of bamboo or other wood, such as mangrove wood. The collectors are made of dead shells strung on wire, with spacers made of small sections of bamboo. Lianas or vines can be used instead of wire, but are not as satisfactory. Valves of giant clams and other shells are found everywhere on the beaches and can be used for making collectors.

The length of the collectors may vary. I have seen collectors 2ft.4 ins. long on which 70 oysters had grown to edible size in 8 - 12 months. Longer collectors are also used, as well as other types made of old tins wedged into cleft sticks (the tins can only be used once), or old rubber tyres, although these may give the oysters an unpleasant taste. The oysters served in all the restaurants in Manila come from collectors of one sort or another.

Oysters grow better on collectors than on mangrove roots, because they get more food and also because the spat settles more easily on them. The method is simple and much less expensive than those used in Europe or Australia. I would therefore recommend that it be tried in some place where oysters are already growing spontaneously, preferably in the area where the Vura people collect their mangrove oysters.

Sketch B in Annex 4 shows part of a rack. This can be made as long as desired or built in a double row. If more double rows of racks are added parallel to the first, a lane 4 ft. wide must be left between them, so that the oyster farmer can travel along the racks with a canoe or proa. The collectors are hanging from wire staples driven into the racks.

If the first attempt is successful, trials can be made in other places. Sheltered areas near rivermouths or mangroves, where the salinity is not too high, are excellent, and turbid water is generally very good. However, the speed of the current should not exceed half a knot.

Freshwater fish

Freshwater fish is scarce in the Protectorate. I have observed only three species and a freshwater crayfish (see page 15). There are probably more species of fish in these waters, but the fauna can be considered as poor. It would therefore be advisable to introduce some species which would provide suitable food for the population without harming the present freshwater fauna in any way.

Prolific breeders would be necessary for the natural waters: Tilapia mossambica and Trichogaster pectoralis are two such fish; they are commonly known as Tilapia and Sepat. Tilapia and Gourami (Osphronemus goramy) would be suitable for ponds. The latter is an excellent table fish, but takes much longer to grow to marketable size than the two other species.

Tilapia

This fish can grow in fresh or salt water ponds as well as in swamps, shallow lakes and reservoirs. It is sexually mature at four months and spawning continues for several years. It is a mouth-breeder and a nest builder. The nest is a shallow round depression 8 - 10 inches wide in the bottom. Males grow bigger than females and reach a length of 10 or 12 inches under good conditions. It is more profitable to raise males in ponds and they are easy to select when they reach a length of 3 ins..

Tilapia is omnivorous. It is easy to transplant and transport alive. It can give high yields, depending on the conditions under which it is raised.

Sepat

Sepat can grow in fresh water swamps, rivers, lakes and ponds. It matures at 7 months and spawning continues for some years. A ripe female 7 months old is capable of laying 7,000 eggs, and a 10-inch female can produce 82,000 eggs. It is a nest builder. It can reach a length of 10 ins. and a weight of 230 grammes. It is a vegetarian and feeds mainly on aquatic plants.

This fish is easy to transplant and to transport alive. Yields can be very high under good conditions.

Gourami

This fish will grow in ponds, swamps and shallow lakes. It will even grow in small backyard ponds. It is a first class table fish and therefore a high-priced one. It matures in its third year and at this age it weighs approximately 3 kilogrammes. If kept in ponds for a longer period of time the gourami will grow indefinitely, so long as the environment is favourable. This fish can reach a length of 3 ft.. It is omnivorous, taking at times frogs, insects, worms and many kinds of vegetables. However, it is essentially vegetarian and will eat potatoes, corn, arrowroot, bread and similar foods.

Gourami spawns throughout the year in the Philippines. On spawning they pair off, each pair selecting a suitable place wherein they construct a crude nest. When the nest is completed, the female deposits the eggs. A moderate size female may yield from 800 to 1,000 eggs. From the time the eggs are deposited and fecundated until they are hatched, the parents remain nearby, zealously guarding them. It is easy to transport this fish alive, but for a transplantation it is advisable to select specimens at least 3 ins. long.

All three species mentioned here are available in the Philippines, from the Bureau of Fisheries, Manila. Tilapia is also available at Port Moresby, from the Fisheries Department. Officers of the Protectorate Administration passing through Port Moresby could take some tilapia with them in large tins; no oxygenation system is necessary. An oblong 4 gallon kerosene tin lying on its side and fitted with a circular opening 5 ins. wide and a perforated lid will make a suitable container. The tin should not be filled to the top; 2½ gallons of water will be enough to keep 30 young tilapia 1 in. long for a few days. Over a short journey like this one, the water should be changed twice a day, in the morning and in the evening, by removing about two gallons from the tin and replacing this water very slowly. During transport, the fish should not be fed.

The tins should be carried in the cabin of the plane.

Stocking of natural waters and building of ponds

Lakes

There are two freshwater lakes in Santa Ana island and the headman of the island was very eager to stock them with fish. One of these, the Waipiapia Lake, is quite suitable for fish raising, while the other, Wairafa Lake, is too deep to give really outstanding results.

Waipiapia Lake is oval, approximately 400 yds. long and 300 yds. wide. The surface would be about 18 acres. The lake is 2 - 4 ft. deep in most places, with a maximum of 6 ft. in one area. There is an abundance of aquatic plant life, including algae. At the time of my visit, the temperature of the water was 83°F.

This lake is 45 minutes walk from the main village of the island and it appears that it never dries. It would be worth while stocking it with tilapia or sepat.

Swamps

With the heavy rainfall prevailing in this territory, there must be many swamps and natural ponds in these large islands. I unfortunately had no time to investigate them. However, such bodies of water can be stocked with tilapia and sepat. These fish will also migrate into any connected streams.

Ponds

The fields of the King Edward VII School (Malaita) and of the Pawa School (Ugi Island), as well as many other places where a continuous water supply is available, offer good possibilities for fish farming.

The soil from which the bottom of the pond is made should not be porous. Clayey soil is best for ponds, and it is preferable to use top soil for the bottom. A depth of two to three feet is good. The water must be kept stagnant, in order to allow the plankton and algae on which the fish feed to develop and flourish. Fertilising with organic manure will increase the production of such food and, of course, promotes a higher yield in fish. In many places, the water supply comes from a place noticeably high above the site of the pond, so that the latter can be made by just building a dyke up from the ground level. A ditch can be dug around the dyke to prevent the pond being flooded by heavy rains. The soil removed from this ditch can be used for the dykes. Under ideal conditions, it should be possible to fill or drain the pond at any time.

Annex 5 is a sketch of two ponds 2 ft. deep built on a 3° slope. Of course, many more ponds could be connected with these. On flat ground, larger ponds can be constructed, but the bottom of the drainage ditch at the sluice gate must be on a level with the bottom of the pond near the sluice, and must slope away from the pond, otherwise it is impossible to drain the pond without a siphon or a pump. The size of the ponds is chiefly limited by the shape and size of the available site. For commercial fish farming, some small breeding and nursery ponds must be added to the large rearing ponds, in order that selection and other operations may be undertaken to ensure maximum yields. In this connection, Annex 6 gives a suggested layout for a 1½ hectare freshwater fish farm.

Both tilapia and gourami can profitably be raised in ponds, but the former will reach its maximum economic size in one year, while the latter usually must be kept three years in the pond. Indeed, gourami reach a marketable size in one year, but they have not reproduced at that age and it is preferable to keep them, unless a special breeding stock is kept and two-year-old fish can be sold.

Fertilisation of the pond water can be effected in many ways. Sometimes the effluent from a pigsty or other animal pen is used. When no pigsty or pen is available, a perforated tin containing animal manure can be placed in the pond for one week, after which the remaining solid matter must be taken out. Nine gallons of manure are required for 1,500 square feet of pond. Fertile water takes a greenish colour; when this colour fades, more effluent or more manure should be brought in. When ready for the market, the fish can be put into clean fresh water for two days, if people do not like the idea of eating fish coming straight from a fertilised pond.

Fisheries Assistants for extension and conservation work

It would be advisable to send two Solomon Islanders acquainted with fisheries and having a good elementary education to the S.P.C.-F.A.O. Fisheries Training Course opening in Nouméa on or about November 19, 1956, for training as Assistant Fisheries Officers. The curriculum of the Training Course will cover most of the subjects mentioned in this report. In my opinion, one of these men should be stationed in Auki and should cover the Malaita district; the other one should be stationed in Honiara and would cover the other islands. The Administration of the Protectorate has a number of motor boats which the Fisheries Assistants could use for their travels.

SUMMARY OF RECOMMENDATIONS

I. Trochus

(a) Minimum size should be increased from $2\frac{1}{2}$ in. to 3 in..

(b) Trochus fishing should only be open six months of the year.

II. Preservation of Fish

(a) By salting and smoking

(i) Large fish should be salted for 6 hours in saturated brine and smoked for 48 hours.

(ii) Small fish should be salted for 2 hours in saturated brine and smoked for 24 hours.

(iii) If a strong salt and smoke flavour is appreciated, or if protection from flies is sought, large fish should be salted in saturated brine for 12 hours, and smoked for 48 hours; small fish should be salted for 4 hours and smoked for 24 hours.

(iv) Smoke houses or kilns can be built of poles, coconut fronds and coral blocks.

(b) By salting and drying

The fish should be salted for 12 hours, then dried in the sun or artificially.

(c) By cooking and drying

In the event of an overabundance of fish at a time when no salt is available, "fish flakes" can be made by cooking and boning the fish, after which the flesh is dried over a slow fire.

III. New Fishing Gear

(a) Bottom traps

(b) Fixed shore wing traps

(c) Drift gillnets

(d) Bottom gillnets

(e) Cast nets

(f) Longline

(g) Liftnet with lamp attraction

(h) Rumpon or fishlure

IV. Preservation of Gear

Preservation of nets and lines by tanning in a decoction of mangrove bark.

V. Oyster Cultivation

Cultivation of edible oysters on collectors along the methods used in the Philippines.

VI. Improvement of Freshwater Resources

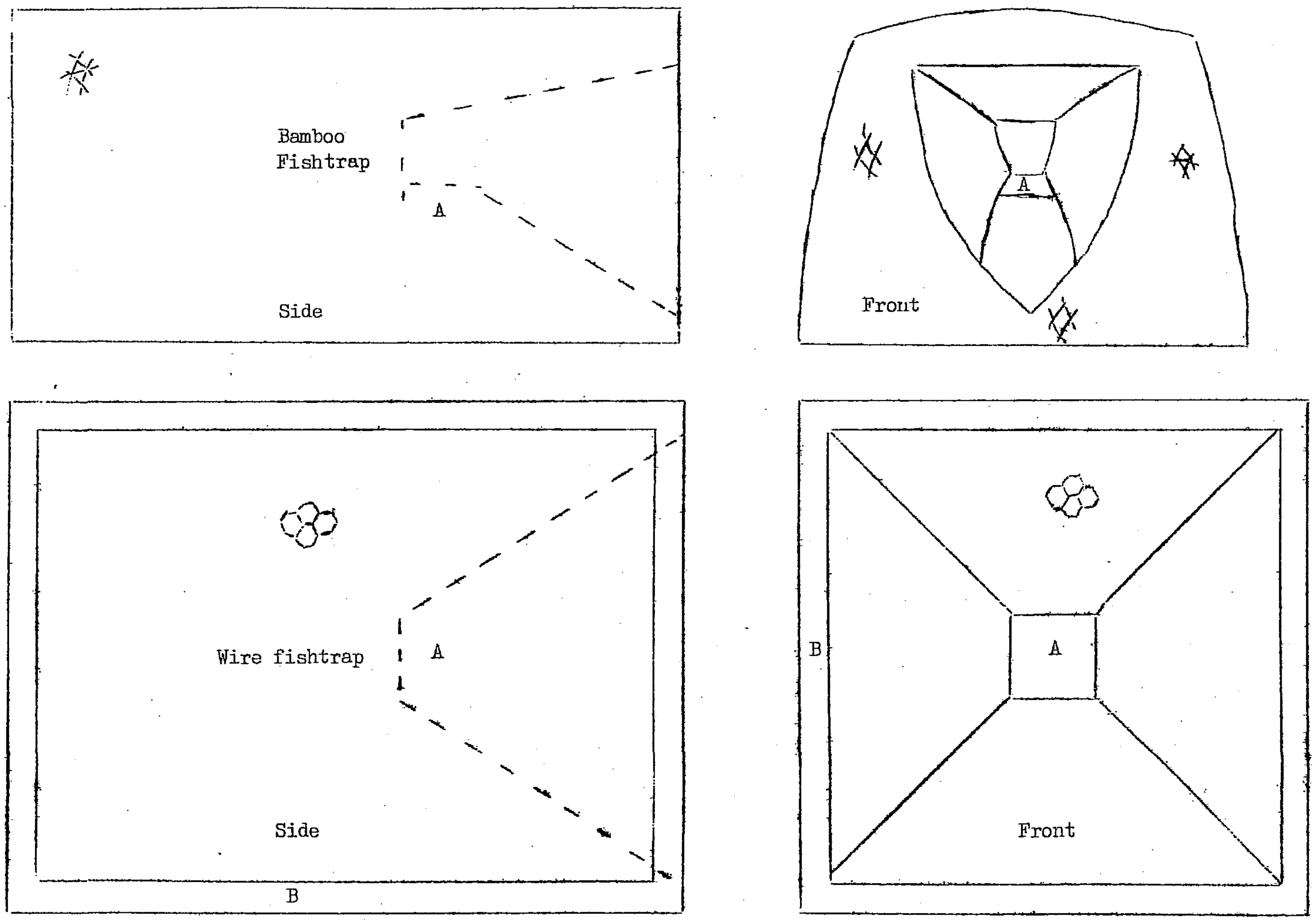
(a) By stocking natural waters

(b) By fish cultivation in ponds

VII. Fisheries Assistants

Two Solomon Islanders should be sent to the Fisheries Training Course and should then be employed in doing extension and conservation work.

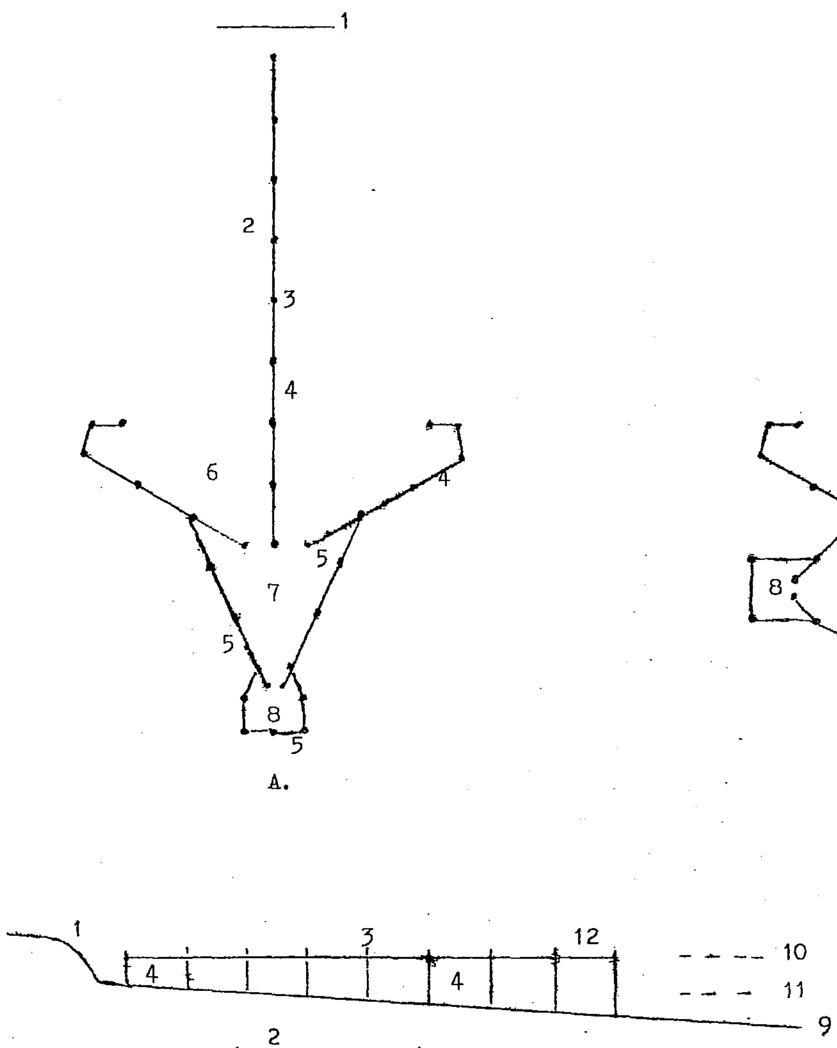
ANNEX 1.



A. Entrance
B. Wooden frame

TWO BOTTOM FISHTRAPS

ANNEX 2.



A.

B.

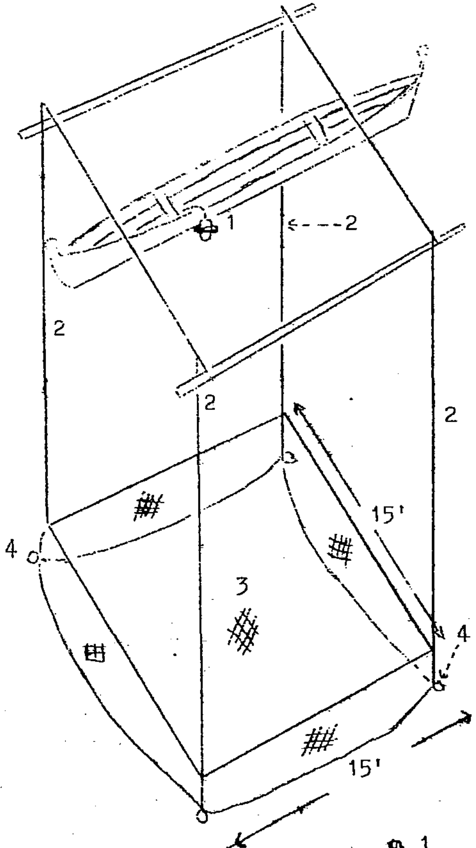
C.(side elevation).

1. Shore or shoal
2. Wing or leader
3. Stick or bamboo pole
4. Bamboo, chickenwire or bough screen
5. Bamboo or chickenwire screen
6. Wing-room
7. Fish-room
8. Trap
9. Bottom
10. High water level
11. Low water level
12. Stringer

SHORE WING TRAPS

Scale $\pm$ 1 = 200

ANNEX 3.



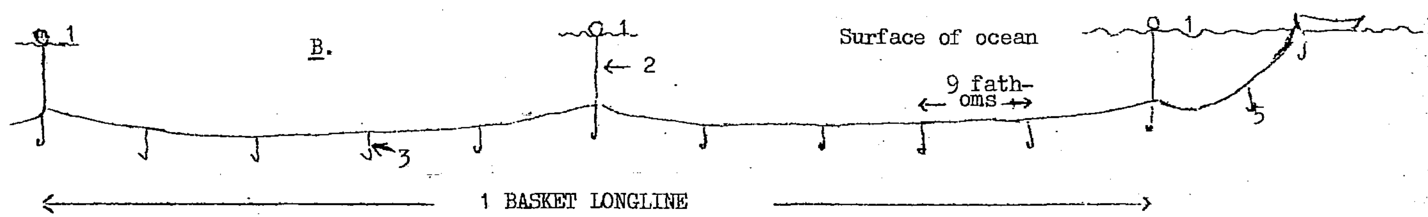
A.

A. OUTRIGGER PROA WITH LIFTNET

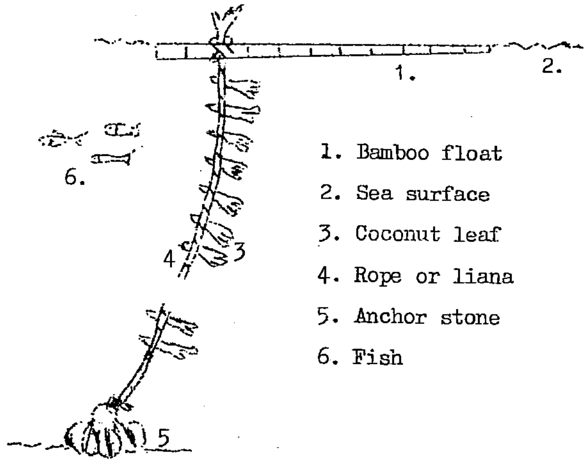
1. Kerosene lamp
2. Lift line 50'
3. Lift net 15' square, mesh 1", Cotton No. 30/9
4. Stone

B. PROA WITH LONGLINE

1. Float
2. 12 Fathoms floatline
3. $3\frac{1}{2}$ Fathoms dropper
4. Fish hook

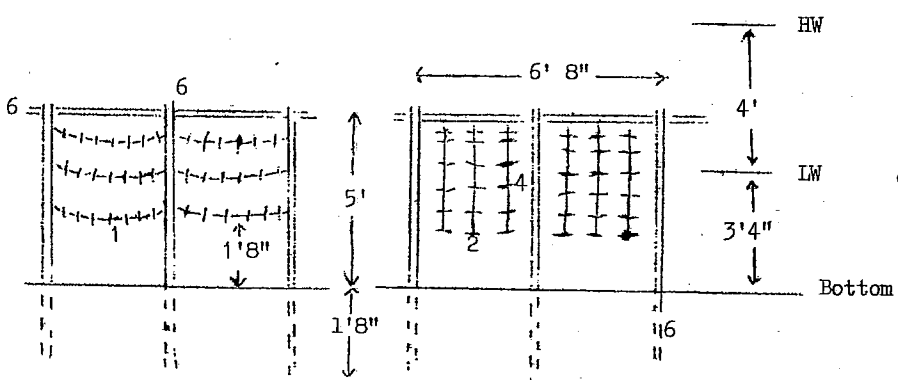


ANNEX 4.

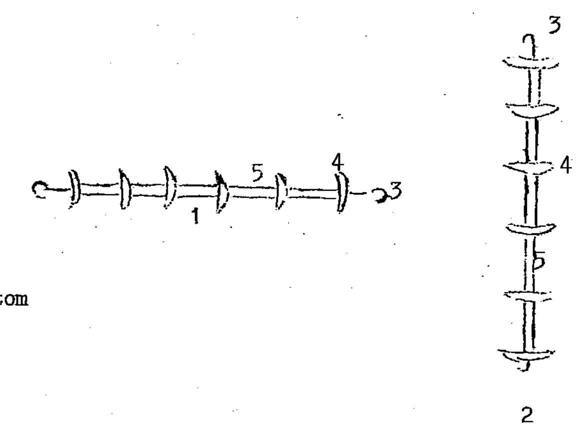


1. Bamboo float
2. Sea surface
3. Coconut leaf
4. Rope or liana
5. Anchor stone
6. Fish

A. RUMPON OR FISH LURE

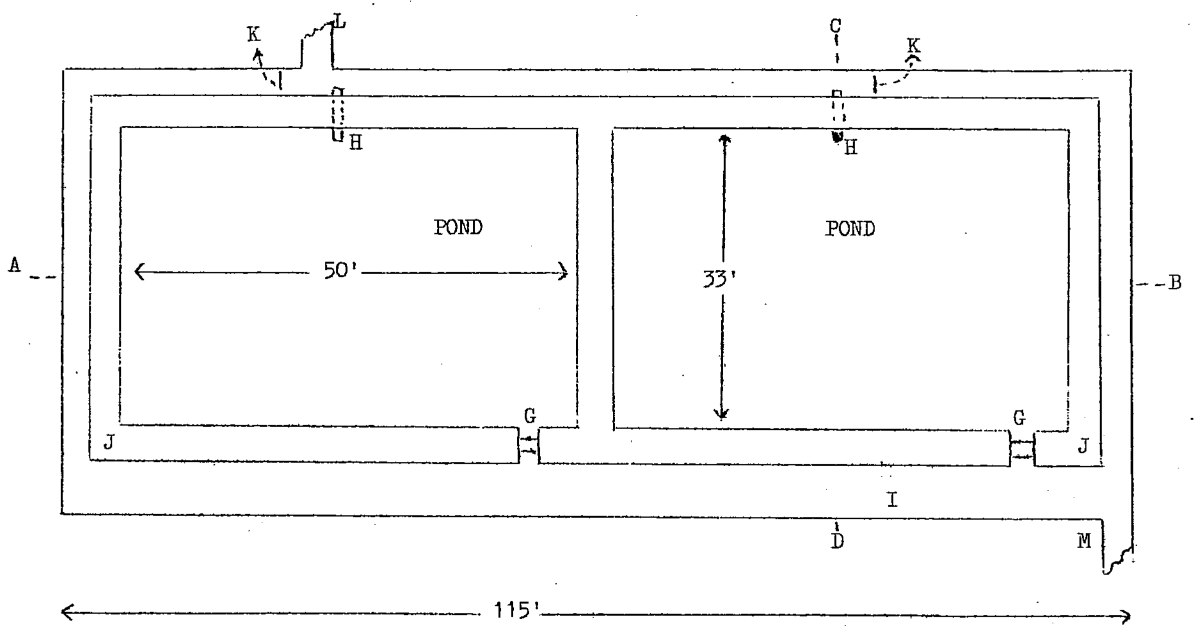


B. RACKS WITH OYSTER COLLECTORS



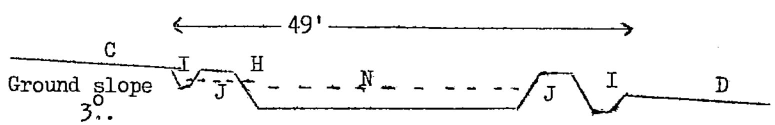
1. Horizontal collector
2. Vertical collector
3. Galvanized iron wire
4. 4"-6" Shell valves
5. $\frac{3}{4}$" Ø Bamboo tube 4"-5" long
6. Bamboo, mangrove or other strong stick.

ANNEX 5.

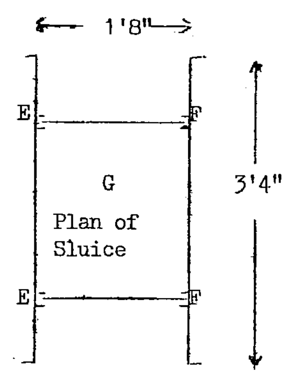


G. Drain sluice
H. Water supply pipe, Ø 4"
I. Ditch
J. Dyke
K. Slideboard
L. Water supply inlet
M. Drainage ditch
N. Water level - depth 2'

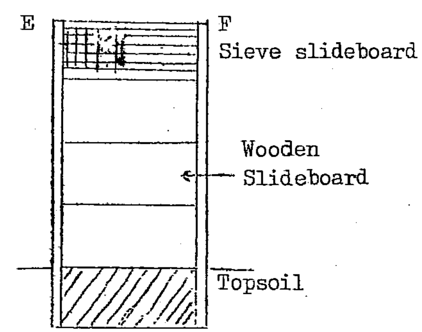
CROSS SECTION A-B.



CROSS SECTION C-D.

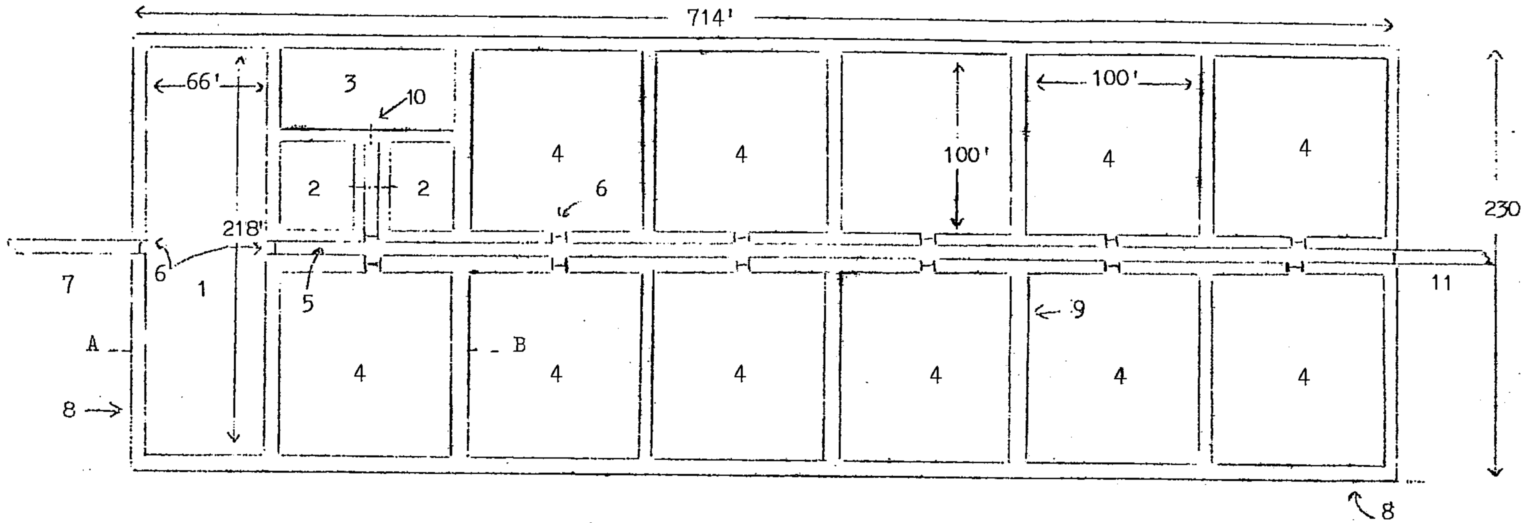


Cross section E-F
Sluice

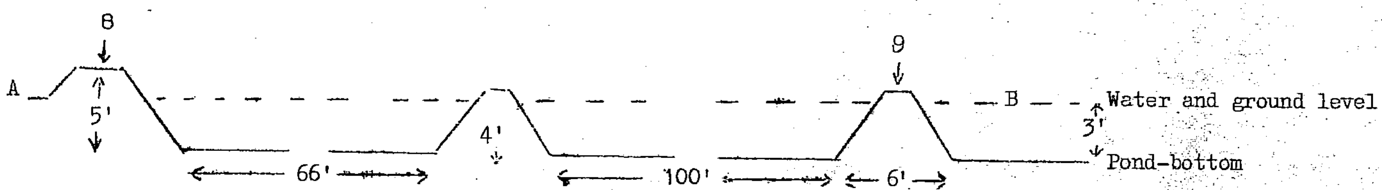


FISHPONDS COMPLEX

ANNEX 6.



SKETCH OF 1½ HECTARE FRESH-WATER FISH FARM



PROFILE OF RESERVOIR AND REARING-POND

1. Reservoir
2. Breeding-pond
3. Nursery pond
4. Rearing-pond
5. Canal
6. Gate
7. Supply canal
8. Main dyke
9. Secondary dyke
10. Supply and drainage pipe
11. Drainage canal