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LAKE TEGANO -- AN ENCLOSED ISOLATED
ECOSYSTEM, AND THE ENVIRONMENTAL IMPACT OF
TILAPIA INTRODUCTION

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ABSTRACT

Rennell Island is a Polynesian outlier in the Solomon Islands. It is a raised atoll, and has the largest lake in the Pacific, Lake Tegano, a brackish water lake, 4-5 meters above sea level, non-tidal, but connected to the ocean through seepage crevices in the porous limestone. It contains three species of sea snakes, one species of eel, goby and prawn. In 1957 an African Tilapia species, Sarotherodon mossambica, was introduced to supplement the native diet, and has since proliferated extensively. Based on interviews with fishermen, officials and native informants, as well as direct observations, this new species has not had a significant impact on either the number or distribution of the native aquatic species. Some of the factors controlling over abundance are, predation by the islands rich bird life, as well as fishing by spear and net by the lake-shore population.

TABLE OF CONTENTS

	page
Introduction	1
Description	3
The Lake	5
Fish Fauna	8
Predation	11
People	12
Fishing Methods	14
Future	15
Acknowledgement	18
References	

TABLE OF ILLUSTRATIONS

Map 1: Solomon Islands, showing borders & provinces	2a.
Map 2: Rennell Island (redrawn from Wolff, 1958:12)	2a.
Table 1: Fluctuations of lake water level at Tegano	6
Table 2: Fluctuations of lake and cave water level at Hutuna	6
Fig. 1: Diagrammatic representation of lake floor	7
Fig. 2: Introduction of tilapias outside Africa (Pullin & Lowe-McConnell, 1982:27)	9a.
Table 3: Fishing Expeditions participated in	10a.
Map 3: East Rennell showing sites for above observations on fishing.	10a.
Table 4: Rennellese names of animals mentioned in this paper.	11a.
Fig. 3: Simplified food web for Lake Tegano	12
Fig. 4: Illustrations of Canoes and fishing implements.	14a.

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INTRODUCTION

The Solomon Islands in Melanesia, contain several outlying islands, Ontong Java, Sikaiana, Tikopia, Anuta, Rennell and Bellona, inhabited by Polynesian people. These islands were settled by small groups of seafarers from the Polynesian heartland, and remained isolated from the major Polynesian cultures which evolved on the larger island groups to the east. (Carter, 1981:393). The Polynesian population of the outlier, Rennell Island, south of the Solomon Islands, have retained their way of life to a greater degree than other more urbanized groups. Their dependency on subsistence agriculture and fishing is modified by a unique natural feature of the island, the great brackish lake Tegano, the largest in the Pacific. This brackish-water lake, surrounded by a raised coral limestone wall and dotted by numerous islets, is land-locked and hence a unique closed ecosystem (Elbert & Monberg, 1965:4). Because of the geographic isolation and peculiar environment of the lake, specialized and unique native species have evolved which occupy certain ecological niches within the island and lake environment. A species of fresh-water eel (Anguilla obscura) and goby (Eleotris fusca) inhabit the lake, along with two, possibly three species of sea snakes (Laticauda colubrina, L. laticaudata wolffi and/or L. crockeri -- taxonomic discrepancy yet to be resolved) (McCoy, 1980:35-38, Bruun & Nielsen, 1958:221-226).

Several scientific expeditions have visited Rennell Island, one of the first was the Templeton Crocker Expedition in 1933. However, an extensive study of the fauna and flora was not undertaken until 1951, when the Danish Rennell Expedition Round the World, 1950-52. This was followed two years later by the British Museum (Natural History) Expedition 1953, and its findings combined with the findings of the Danish Expeditions on a co-operative basis (Wolff, 1958:7).

In 1957 a species of Cichlidea (Tilapia sp.) was introduced into the lake to supplement the native diet (Elbert, 1982: personal com.). This introduced species has since proliferated,

and in 1962, "was so common that nine or ten large ones could be speared in an hour." (Elbert & Monberg, 1965:5).

Throughout the Pacific islands, delicate ecosystems have been upset radically by such introductions of extrinsic species, often resulting in irreversible environmental changes and the extinction of native species. While this sort of introduction has been studied extensively in Hawaii, and other large islands, there does not seem to be any published studies or surveys of the current status of the lake fauna of Rennell. The need for a study in Rennell was made more urgent by the projected large-scale bauxite-mining, which would alter the island's current isolated condition beyond recognition.

During the months of February and March of 1983, my husband and I visited Rennell island to examine the environmental impact, if any, of this extrinsic species on the unique lake ecosystem, and to observe and describe any changes in the number and distribution of the native species. The interaction of the people with the ocean and the lake, and the role of marine production in their subsistence economy was also observed, as well as traditional conservation measures such as maintaining fish stocks, and other aspects of local marine technology.

The principal methods of collecting information on the present prevalence of the lake fauna was through personal interviews with knowledgeable individuals such as fishermen, village elders and chiefs, as well as through direct observation of the target fauna and participation in fishing activities. Though an attempt was made to acquire an elementary conversational vocabulary of the Rennellese language, translators were used where necessary for accurate understanding. The former endeavour was assisted by Dr. Samuel Elbert, retired professor of Linguistics at the University of Hawaii, the world authority on the Rennellese language. Consideration is given to the fishing methods used and their effectiveness, fishing intensities in different parts of the lake, and any preferences to particular species, size or age of fish. Comparative analysis is attempted where possible to determine changes in technique which could be attributed to westernization, such as the loss of traditional

native skills in the face of modern technology, e.g. outboard engines, nylon fishing nets, etc. Direct participation in fishing expeditions and other village activities related to the freshwater and marine fauna, enabled us to get a fuller understanding of the relationship of such activities to the environment. First-hand surveys of the lake and adjacent environment, and the description of their physical conditions was made through skin diving and explorations by canoe. Due to limited or non-existent facilities, scuba was impractical and observations were limited to estuaries and shallow waters (20' max. depth), while the topographical harshness limited the transportation of equipment. The effect of seasonality on the fauna of the lake, and whether this influenced the distribution and number of different species was determined through interviews only. Because of the short stay it was not possible otherwise, (previously available scientific descriptions have not yet analysed seasonal cycles in the lake environment).

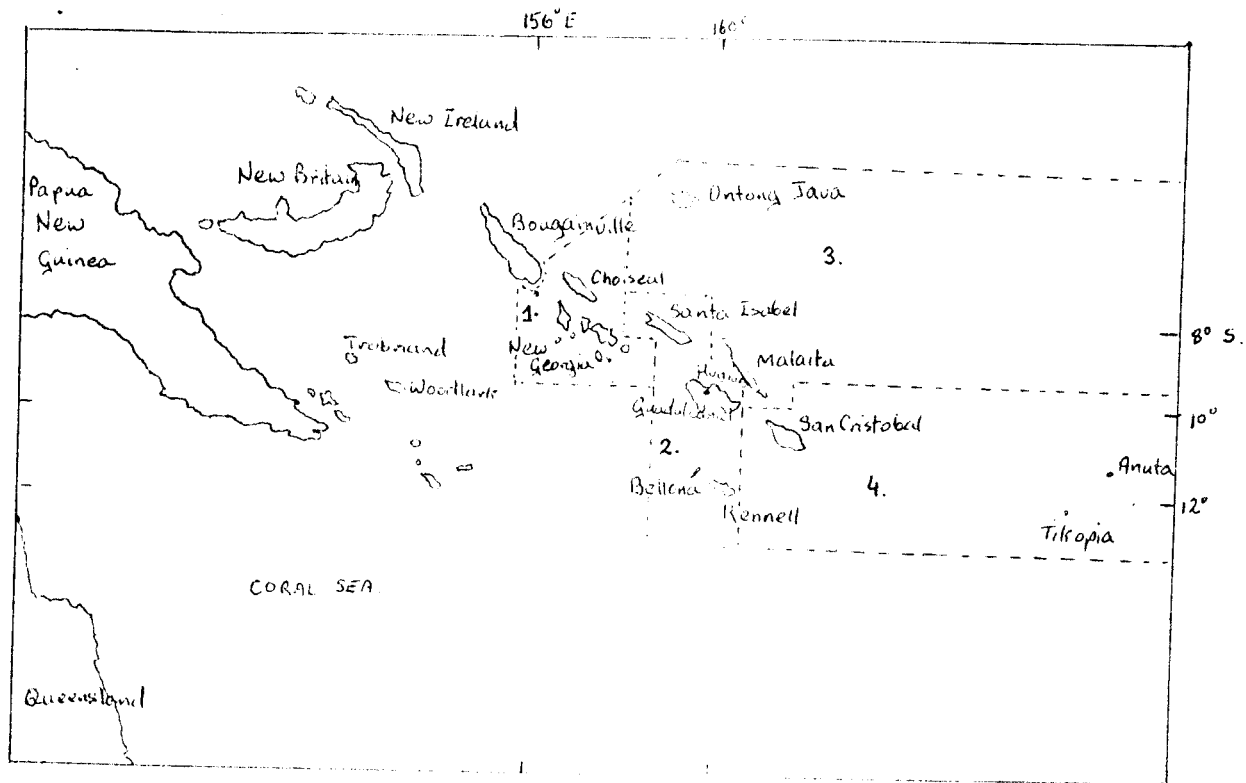
Because of the new government's policy and because of previous abuse of research and visiting permits, we were unable to obtain research permits as such, however, we were given permission to observe as much as we liked without offending or interfering with the people or their lifestyles. We participated as much as possible with village life and our limited knowledge of the Kenelese language as well as having given advanced notice of our coming, made us more readily acceptable to the people. During our stay we made available our medical services (as doctor and nurse respectively) for which we had obtained Solomon Islands licenses prior to coming. My husband and I also carried out a Malaria Survey on Rennell on behalf of the Solomon Islands Health Department.

DESCRIPTION

Though based at Hutuna, our work sites included the villages of Tegano (pronounced Tengano), Nipani, Tevatahe (pronounced Tevatahe) and the now deserted Teaba, one of the many abandoned villages on the north-east coast of the lake. (see map?). Hutuna's location enabled closest access to the sea via an hours strenuous hike over moss covered, jagged, lime-

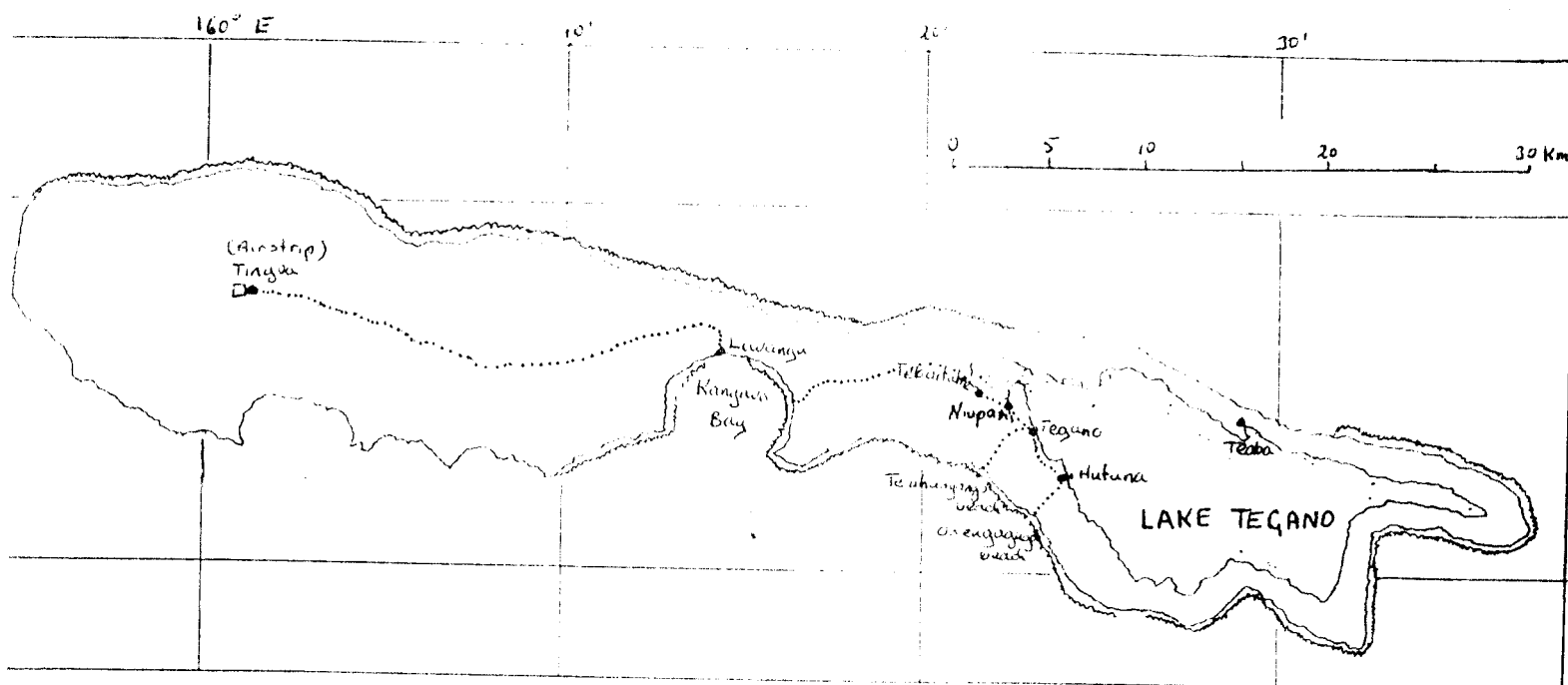
stone trails, through thick, wet, tropical jungles, and finally over a steep ridge and down the face of a cliff on the other side. Although the exact geological age of Rennell is not known, it is believed that during the Pleistocene glacial age the Pacific Basin floor rose about 1,000 feet, elevating old coral reef and limestone atolls. Thus Rennell, and possibly better known raised coral islands such as Nauru, Ocean Is., Niue and Makatea were formed (Oliver, 1975:5,12). Rennell island is the largest raised atoll in the world, and the lake, occupying over a third of the island, represents the former lagoon now surrounded by tall, jagged, coral-limestone cliffs. There are only three known sand beaches around the coast, only one of which is inhabited, Lavangu, the remainder of the island is marked by sheer cliffs (400 ft. high) which meet the crashing surf with little to no gradation. On the ocean side, the island is surrounded by a shoreline lagoon of clear blue-green water, bordered by an exposed fringing reef which separates it from the deeper blue oceanic waters.

The presence of an airstrip on west Rennell gives a false impression of easy access, and though 65 percent of the population live on west Rennell, another 35 percent lives around the lake in the east. To reach them one travels from the airstrip by tractor for three hours over bumpy trails, through dispersed villages, and eventually to Lavangu with its wide sand beach on Kangava bay. A two hour motorized canoe ride takes you across the bay and along the coast to Te-uhungango beach at the base of a cliff. One could also reach the beach more easily via the monthly inter-island boat from Honiara, which stops just outside the reef at Te-uhungango, to load and unload passengers and cargo. From here the hardest part of the journey starts with the 400-ft. climb up the cliff face, in recent years cement steps have been made and are popularly called "Jacob's Ladder," yet the climb is still an almost 90° ascent. It takes one to one-and-a-half hours for someone in good health and relatively athletic condition to make the full trip, reaching the first village on the lake, Tegano (the same name as the lake, which incidentally means -- lake). Everything must be carried by hand and this accounts for the relative scarcity of modern luxuries and facilities such as; outboard motors, cement water tanks, corrugated iron, etc.



Map 1: Rennell Island and Solomon Islands showing borders and Provinces.

Key	
---	borders
1.	Western Islands Province
2.	Central Islands Province
3.	Malaita Province
4.	Eastern Islands Province



Map 2: Map of Rennell Island, redrawn from Wolff's: The Natural History of Rennell Island (p.12).

KEY	
.....	Trails
====	reef
•	village

THE LAKE

The lake has been described as the "world's greatest raised lagoon lake," and its area measures about 130 sq km. (Wolff, Vol.I, 1958:11). Reports of the lake level compared to that of sea level vary from "almost at sea level" to 70 feet above sea level, these have been assessed using hand held altimeters (Wolff, vol.I, 1958:20, Laird & Laird, 1958:69-70). However, more recent estimations made by air photography mapping put the lake water level at "four to five meters higher than that of sea water level" (Tsukahara, 1982).

The water has a brackish character with a salinity of about 4.56 parts per thousand (Wolff, Vol.1, 1958:21) and alkalinity is confirmed by diatom samples found to be alkaliphilous or alkalibionotic. (Foged, 1960:22). Desalting of this raised lagoon may have proceeded over the years by "ground water movement from the lake to the ocean," as well as through dilution by rain, estimated at 3,000 millimeters per year (Foged, 1960:9).

Throughout the island the coral limestone ground is of very porous consistency, and numerous caves and sink holes can be found. Many of these contain fresh water pools which despite continuous use by the natives and fluctuations in weather maintained a relatively constant level. This would suggest that apart from ground seepage, underground springs may be responsible for the water source. Other areas both in the sea and in the lake, were found to have submerged springs visibly releasing water and bubbles into the surrounding water. One such area found on the sea coast at Onengaguga, was only just exposed at low tide. Others in the lake were found mainly concentrated on the western shores of the lake around Tebaitahe, making the water there very much less saline. This variance in salinity is marked, with the western shores presenting almost drinkable water while the eastern shores, especially on the north at Teaba, being extremely saline. At Teaba, we were told, there exist underwater caverns and passages leading to the ocean. Though we could not find and prove these at the time, the local people assured us this was so, citing cases of finding the lake eel (Anguilla obscura) in the stomachs of marine fish. Also, during certain times of the year the eels

congregate in large numbers in the inlet at Teaba, this highly saline region is possibly their spawning ground.

Fluctuations of the lake water level were observed by myself at Hutuna, and by the Japanese Survey Team of 1981 at Tegano village, and found to be negligible, suggesting little to no oceanic affinities to tidal changes.

Date	Nov 7	Nov 13	Nov 14
Time/Hours	Datum level	Datum level	Datum level
7			
8		0.0	
9	0.0	0.0	-0.5
10	+0.25	0.0	-0.5
11	0.0	0.0	-0.5
12	+0.5	0.0	-0.5
13	0.0	0.0	-0.5
14	+0.5	0.0	-0.5
15	0.0	0.0	-0.5
16	+0.75	0.0	+0.5
17	0.0	0.0	+0.5
18	+0.75	0.0	+0.5

Table 1: Fluctuation of lake water level at Tegano. Figures show the water level differences from the Datum level in centimeters every one hour (Tsukahara, 1982: Table 5).

Date	Cave pool	Lake
14	-2 cm	0 cm
15	-1	-2
16	-	-
17	-10	-2
18	-8	-2
19	-9	-2
20	-14	-2

Table 2: Fluctuation of lake and cave water level at Hutuna (own data). Though the cave pool normally has a relatively constant water level, the largest isolated fluctuation observed during a period of low rainfall was 14 cm.

The lake is uneven in depth reaching a maximum of 37 m., with the floor consisting of compressed coral rock with outcroppings throughout the lake. The coral limestone is covered with dark, brown to black, indistinguishable algae, making it slippery to walk on it. Much debris such as coconut fronds, trees, branches and leaves are found around the shores and islets (Motus). Misty layers of sediment which rise and fall on different days, give a false impression of solid ground which is easily disproven by swimming through it and even disappearing in it. Fermentation from decaying vegetable matter is seen by the bubbles of sulphur gas rising from beneath the layers of sediment. This is particularly prominent along the west shore of the lake, which is protected from the winds blowing over the large expanse of water creating fairly rough conditions along the east and south of the lake, and thereby facilitating water circulation. Organic matter is found floating throughout the lake making visibility poor, 0-15 ft. There is no intertidal area as such and terrestrial vegetation will grow in and around the margin of the lake. However, at Teaba, shoreline rocks display a one foot exposure of chlorophytal algae (1", hair-like, yellow-green strands).

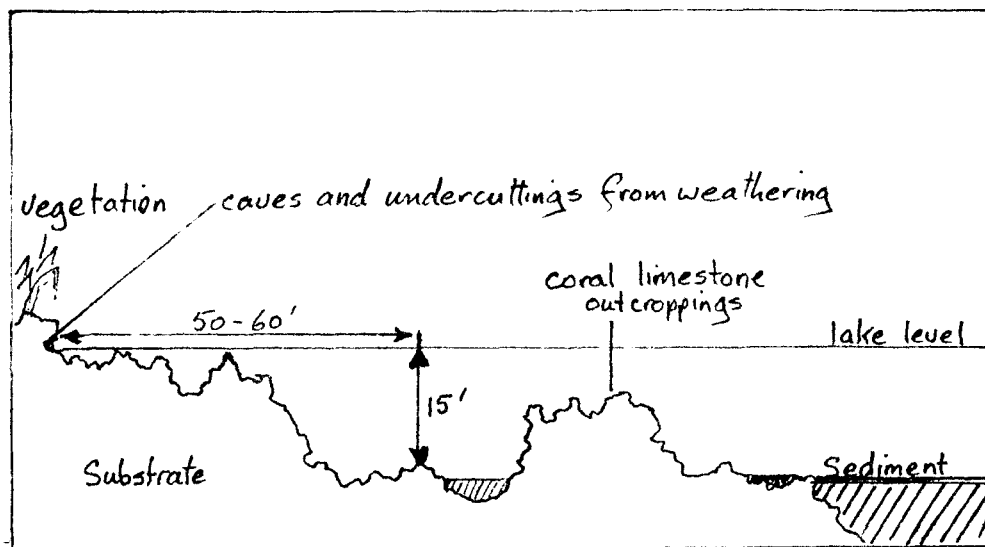


Fig. 1: Diagrammatic representation of the lake floor typical of the south.

FISH FAUNA

The lake fauna consists of two, possibly three species of sea snake -- Laticauda colubrina, L. crockeri, L. laticaudata wolffi. L. laticaudata wolffi is suspected to be a subspecies of L. crockeri and differentiated by mid-body scale count (McCoy, 1980:35-37, Volsoe, 1958:128-131). These species of snakes are known to exist in the sea, but those on Rennell are the only ones recorded to exist in fresh water (Volsoe, 1958:130). They can be seen all over the lake but are mainly concentrated near the west side of the lake where the water is less saline, there is an abundance of other fish and therefore food for them, or possibly there is more habitation for them facilitated by the increased roots, debris and general swampiness on the west. The species which dominated the west was the more distinctly, light and dark banded, possibly L. laticaudata wolffi, while in Hutuna and along the south we saw only the darker L. colubrina or crockeri.

At Tebaitahe, extending along the north to Teaba, the lake eel -- Anguilla obscura is caught in abundance. These do not seem to occur in the south, and as mentioned before seasonally appear at Teaba, possibly spawning. Also mentioned before, Teaba has a higher salinity, and the young leptocephalus larva being catadromous, may have originally come from the oceans and populated the lake either when it was still a lagoon or more recently through underground tunnels connecting the sea with the lake. Reports of this type of migration, from salt to fresh water, with spawning carried out in the salt water environment, has also been observed in the Atlantic eel (Anguilla sp.) (Schmidt, 1922:179-208). While we were there we saw one specimen measuring 38" long, with a 3" body diameter and the mouth contained several rows of small fine teeth arranged file-like, 1 cm. in from the lip.

The only other fish ever recorded, was the goby -- Eleotris fusca, which inhabits the shoreline of the lake and measures up to 12 cm. in length, dark, elongated and tiger-striped. In addition to the fish, one or two species of freshwater prawns exist -- Macrobrachium sp. (Elbert, 1975:221), Palaemon sp. (Wolff, 1958:62) and are found along the shores. A larger edible prawn Pae bago is said to exist in Tebaitane, though this was not seen

by us it is reported to reach 7" in size (Max, pers. com.).

Another fish reported by natives to exist in the lake, again mainly around Teaba and the north shore, is the Bangiatsu. Described as "rounder -- not flat like Tilapia," reaching 12-15" in length, silver with large scales and a lunate tail. This last aspect would suggest a strong swimming fish, possibly one adapted to a more rough sea environment as opposed to the fairly calm lake. Many young people of Rennell have never seen the fish, though this does not necessarily mean that the fish no longer exists, since few people venture to Teaba these days.

In 1957 a Tilapia species was introduced into the lake by the Rennellese chief Jotham Togaka, with the help of the S.I. Agriculture Department (Tonaika, pers. com.). Reportedly the introduction consisted of eight fingerlings which were unceremoniously dumped into the lake when the bucket in which they were carried over the cliff was needed during a hurricane (McCoy, pers. com.). No official records were kept of the event and to this day the species is only speculated to be the East African Sarotherodon mossambica species, probably taken from Bougainville or Fiji (pers. com. McCoy & Blakey-Marshall).

This species was the first to be introduced outside of Africa, probably accidentally, prior to 1939 (refer to Fig.2). Individuals were caught in the Serang River, Java, and from there the species was introduced to various countries, including Fiji and Australia (Pullin & Lowe-McConnell, 1982:25). This species "is a secondary fresh water fish and can thrive in brackish and salt waters" (Chen, 1978:56). It is very tolerant to salinity, low dissolved oxygen levels, high CO₂ levels and 12-30°C water temperature changes (Pullin & Lowe-McConnell, 1982:40). Species of the genus Sarotherodon are basically microphagous, mouth-brooders, and, though mainly herbivorous, they are equally macrophagous and omnivorous depending on where they are found. Those found in the limnetic zones (open waters) will capture aerial insects (Pullin & Lowe-McConnell, 1982:16,27,41-42). As with most fishes, the larvae, fry and early juvenile Tilapia may feed on invertebrates such as crustaceans, as well as the larvae and fry of other fish (Pullin & Lowe-McConnell, 1982:144).

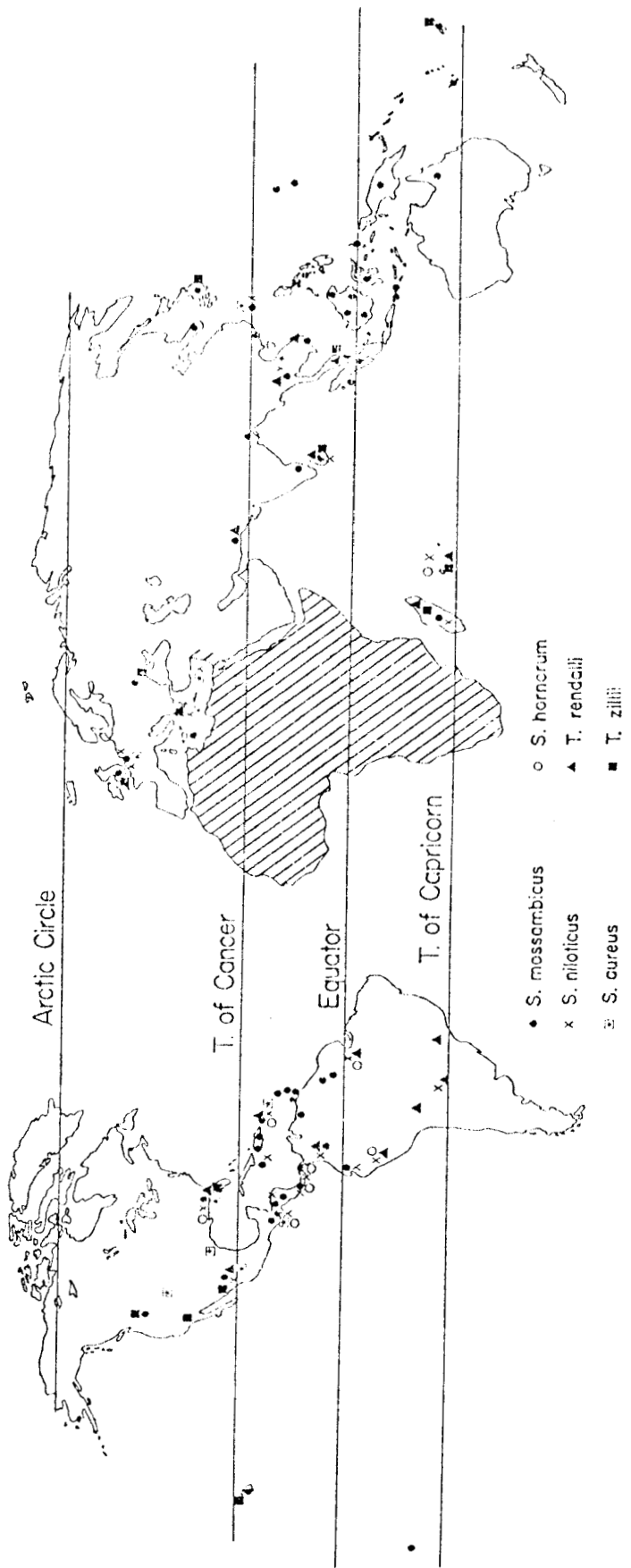
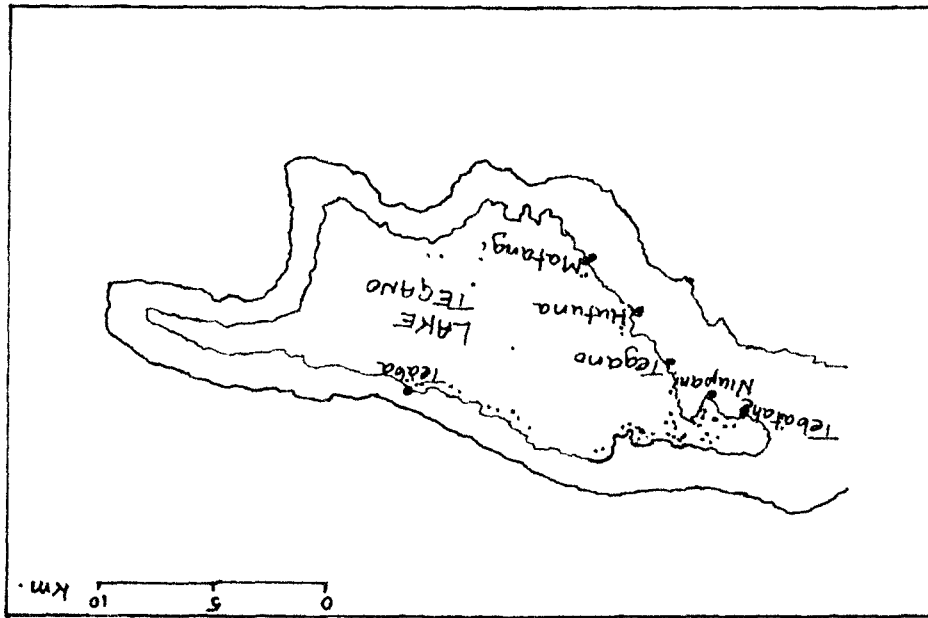


Figure 2. Introductions of tilapias (six principal species) outside Africa (PULLIN + LOWE-MCCONNELL) 1982: 27

In Africa, *S. mossambica* reaches a total length of 360 mm. (Chen, 1976:56). Those caught on the lake of Rennell were observed to range from 5-10 inches T.L. (Total Length) on the south where they are not as profuse, and from all sizes up to 14-18 inches T.L. in the north west. The tilapia can occasionally be seen in large schools though most of the time they are quite dispersed, moving like shadows, seeking shelter in the coralline outcroppings and branched debris. They were noted to be extremely shy on the south shore, where they are speared -- the average catch yielding 10-15 fish in one hour, while in the north and west shores they are netted, yielding a catch of about 30-50 (estimates from own observations). In the south there was seen a distinct absence of juvenile tilapia, though fry were occasionally seen in small schools. This absence in the south was apparently balanced in the west by large numbers of tilapia at all stages of maturity (refer to Table 3). Exposed areas in the sediment revealing the white limestone substrate were seen at Tebaitahe. These could possibly have been depressions in which the eggs and sperm are deposited before being picked up by the female in her mouth (Chen, 1976:56-57).

Occasionally dead tilapia are seen floating in the lake. Explanations for this could include 1) the possibility of pollution, 2) death from natural causes such as old age, 3) overpopulation and/or disease. Their lengths vary and one explanation offered by the people of Rennell, is "too much grease" by Hutuna people, or "not enough grease" by Tebaitahe people. Where the catch from netting is immediately "sorted" and gutted, fish with no "grease" are discarded, often dead or mutilated by the children. The "grease" is seen on the intestines which appear transparent and oedematous, with the mesentery containing much fat, and the local experts can tell these fish apart without gutting them, and a catch is thus reduced to half.

Another explanation for the deaths, which often occur after storms, is that poisonous sediments and minerals are stirred up by the storm and heavy rains. These dead tilapia are often collected by the local people and eaten with no ill effects. Torben Wolff (?) on a second expedition examined these fish and found burn spots on the "lungs" (swimbladder?) (Mana, pers. com.).



Map 3: East Kennell showing fishing sites for above observations on fishing. (Matangi = area east of Hutuna, meaning windward or upwind.)

* Average No. of fish caught per person per hour is five to the skill of the fisherman. However, it should be noted that this varied according to the skill of the fisherman.

** the count for all nettings were estimated.

*** Observations at Hutuna were based on 100 ft. coastline survey, and at Debaltane covering a 6 ft. square.

Date	Location	Method	No. of fish	No. of fishermen
16	W. Hutuna	spear*	15	3
20	Matangi	spear	10	2
23	Hutuna	observed**	6	1
25	Nupani	overnight	50***	-
27	Matangi	spear	21	5
28	Debaltane	fism-arive	30-40	4
	"	netting	15	1
1	"	overnight	50	-
13	Teaba	spear	4	1

Table 3: Fishing Expeditions participated in.

Though S. mossambica can tolerate the gases (NH_3 , H_2S) originating from the decomposition of organic matter, "massive fish kills involving tilapia do occur, however, in deep lakes in cases where the seasonal turnover of water brings the deoxygenated deep water to the surface, and in shallow lakes where violent storms mix the well oxygenated surface waters with deoxygenated bottom waters, and stir up anoxic and toxic bottom mud (containing H_2S , NH_3 , + CO_2)" (Pullin & Lowe-McConnell, 1982:40).

PREDATION

The lake is inhabited by numerous sea birds, those both resident and en route on seasonal migrations. In the former category are found the cormorants (Phalacrocorax melanoleucus -- white bellied), (brown with white neck) and (totally black with white eyes); Kingfisher (Halcyon chloris amoena); Frigate or Least Man-o-war (Fregata ariel) which though seen all year round doesn't nest on Rennell, instead it migrates to Ontong Java and Tikopia during breeding season. A common stylistic tattoo of the bird found on both the male and female population of Rennell was apparently taught to the Rennellese by the Tikopians (Elbert, 1975:122). Other migratory birds found on the lake are, the Australian dabchick (Podiceps novaehollandiae rennellianus) which spends much time on the lake throughout the year, and the terns which stay mainly on the ocean side though an occasional one is seen roosting at sunset on one of the many exposed plane wrecks in the lake. Occasionally seagulls, boobies and other birds swoop in but these rarely stay long.

In addition to man, these birds are the key predatory factor on the lake fish. Birds, such as the Cormorant that nest on the islets in the south and east of the lake may spend many hours actively fishing, and though stomach contents of these birds were not examined they have been observed to catch tilapia. The fish themselves may prey on each other, especially in the juvenile stages. As mentioned before, young tilapia are carnivorous and may effect the goby population. However, the goby in turn is omnivorous throughout its lifetime and may effect the tilapia pop-

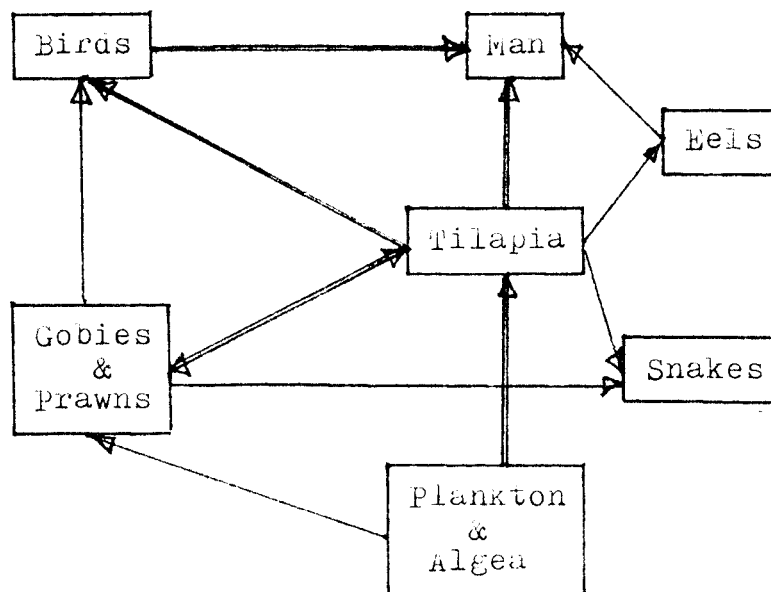
Table 4: RENNELLESE NAMES ANIMALS MENTIONED IN THIS PAPER

<u>ENGLISH</u>	<u>LATIN</u>	<u>RENNELLESE</u>
Banded sea-snake	<u>Laticauda colubrina</u> <u>L. crockeri</u> <u>L. laticaudata wolffi</u>	Tugihonu
Freshwater eel	<u>Anguilla obscura</u>	Upo
Goby	<u>Eleotris fusca</u>	Paghabu
Tilapia	<u>Sarotherodon mossambica</u>	Tilapi
Freshwater prawn	<u>Macrobrachium</u> sp. <u>Palaemon</u> sp.	Pae
* ?	?	Bangiatsu
Coconut crab	<u>Birgus iatro</u>	Akui
Pied cormorant	<u>Phalacrocorax melanoleucus</u>	Manukitai
Australian dabchick	<u>Podiceps novaehollandiae</u> <u>rennellianus</u>	Manusigi
Frigate	<u>Fregata ariel</u>	Kataha
Kingfisher	<u>Halcyon chloris amoena</u>	Ligho
Tern	<u>Sterna albifrons</u> (?) <u>Sterna sumatrana</u>	Gopiti

* Bangiatsu is as yet unidentified.

ulation (stomach contents often reveal one or two prawns and sometimes alsal mud, and they supposedly eat taro thrown in by the locals). The eels and snakes may possibly also have an effect on the over-prolific tilapia by feeding on the young. Apart from the increased juvenile population at Tebaitane, no further observations were made on the life processes or seasonal cycles due to the limited time spent on Rennell.

Fig. 3: SIMPLIFIED FOOD WEB FOR LAKE TEGANO



PEOPLE

Rennell island was declared a British protectorate in 1898, and became a closed district around 1936 when it was recognized that restriction of visits was necessary "as long isolation had rendered the Polynesian inhabitants extremely susceptible to introduced diseases" (Laird & Laird, 1958:65). Despite increased contact with the western world via Honiara, Rennell is still severely isolated from many material things, since the seven-seater Britten Norman Islander plane is limited in what it can bring. The people of the lake are even more deprived of modern equipment, as things brought by the interisland ship must be carried on foot over the steep cliffs. For this reason, plus the fact that there is no significant cash economy few out-board motors, corrugated iron roofs, water tanks, cement structures

are seen. The people build their homes in traditional style, raised on stilts with pandanas thatching for walls and roof. Canoes are also still build according to the traditional styles (though it may be debated where the patterns originated), using whole trunks of isi and megu trees, digging out the centre and fashioning the sides. Both single canoes (baka) and outrigger canoes (baka hakaama) are used on the lake, with small platforms often built onto the outriggers for transporting produce across the lake. Sails of coconut leaves are occasionally used, though these are increasingly replaced by calico sails when sufficient calico can be found, but are only of temporary use and discarded. This, plus the name for sailing canoe -- baka selo -- suggests a possibly English adaptation, indicating a more recent rather than traditional useage. Also interesting is the segregation of the types of canoes on the lake, with Niupani and Tebaitane using the slower but more stable outrigger canoes, while Tegano and Hutuna use the faster single canoes. The reason for this could be explained by the fact that most of the gardens of the Niupani and Tebaitane people are on motus (islets) and so a more stable craft is needed to carry produce over the short but deep distances of the lake. The gardens of the Hutuna and Tegano people are spread out along the shores and so a faster craft is needed to travel the far distances between the villages and the gardens. On the ocean side only outriggers are used, these are hung on the cliffs to be used by the owner and relatives or friends whenever needed.

The people living in the four villages around the lake are largely dependent on agriculture. Their crops of taro, sweet potato, yams (numerous varieties), wild fern (lelehu), kookona (also called "cabbage"), papayas, bananas, pumpkin, lime and oranges, wild fruits such as bii and ubo, as well as a variety of nuts and of course coconuts, make up the primarily vegetarian diet. Prior to the introduction of tilapia, the only other source of protein, apart from marine fish, was the goby and eel (and bangiatu?) of the lake, (snakes were never eaten) as well as the birds, lizards, bats and other wild-life found in the jungles. When Christianity invaded the islands in 1930, the four villages divided into two sects -- Niupani and Tebaitane followed the South

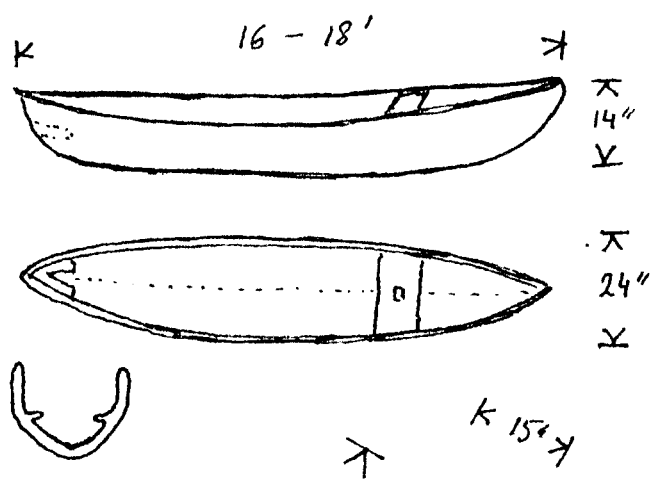
Seas Evangelical Church, while Hutuna and Tegano followed the more restrictive Seventh Day Adventist mission which forbade, amongst other things, the eating of pig, wild birds, scaleless fish (eel) and coconut crab (Birgus latro), which are very abundant and easily caught on Rennell.

FISHING METHODS

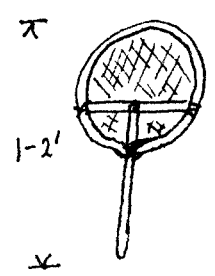
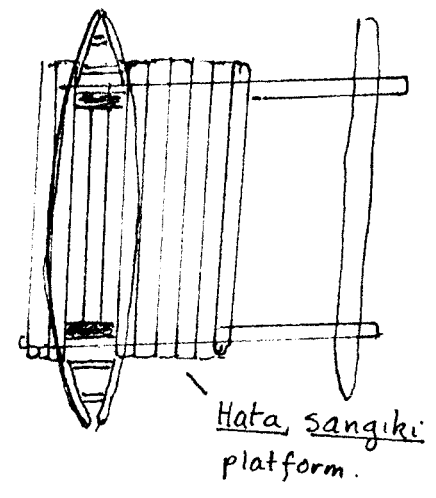
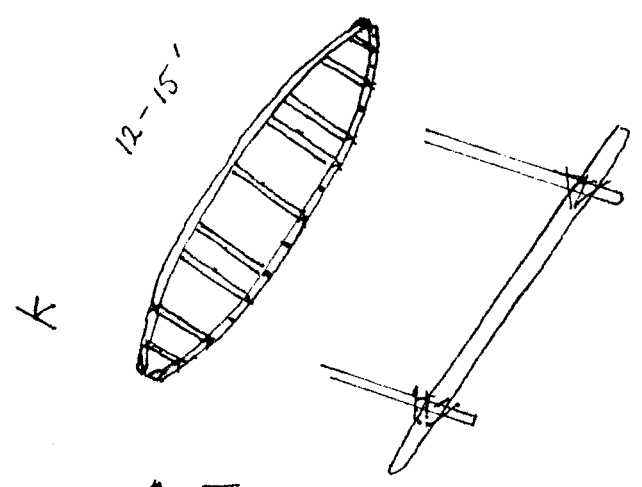
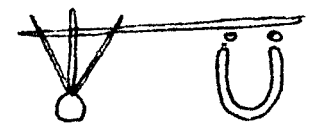
Ocean fishing is not undertaken very often, given the strenuous hike plus the lack of facilities to store fish (drying is impractical because of the constantly wet and humid conditions). Tilapia is therefore very popular given its prolific abundance and easy accessibility. Fishing methods vary according to location and therefore the behaviour of the fish and its dispersion. As mentioned before the tilapia are very dispersed and reduced in number on the south and east, and so netting is not chosen by the natives to catch these fish, instead spearfishing is practiced with homemade spears consisting so simple wooden frames and trigger mechanisms, with steel rods attached to the frames via rubber thongs (see Fig.4). Simple goggles (gasi) are used to see underwater, and a reasonable catch of up to 15 can be caught by an individual within an hour. This varies of course with the skill of the spearer. All fish are accepted, that is, there is no sorting done, and juveniles are not caught since they do not occur there. At Tebaitahe and Niupani, netting is used to capture the tilapia and spearing is only done by young boys or to get eels. The nets are made of nylon with limestone rocks attached as sinkers and coconut husks as floats. These nets are placed at certain locations, especially between motus and left overnight. Different locations are used each time so not to condition the fish into avoiding that area. Fish are not seen from the surface because of the murky water, however, their feeding activities can be seen by the debris floating on the surface. The nets are then strung out in a straight line and the fish are surrounded by children or adults, splashing and swimming towards the net. When leaving the net overnight, not more than 12 hours are allowed to elapse as the fish die and putrefication may start making the fish inedible.

Fig. 4

B. a - dugout canoe

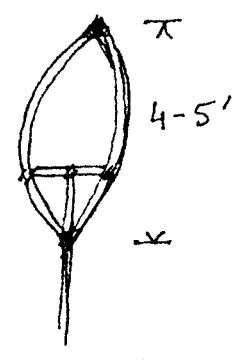


Baka hakaama
outrigger canoe

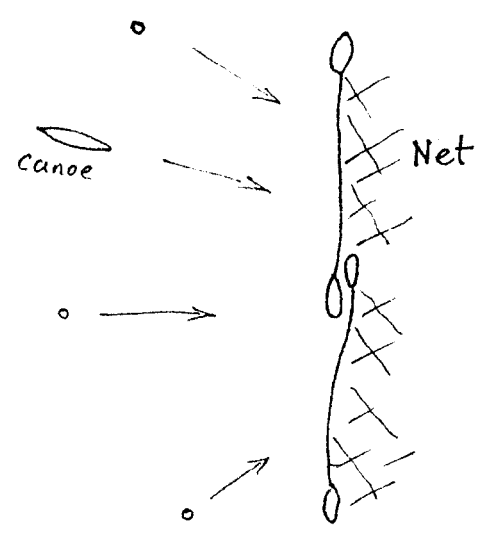
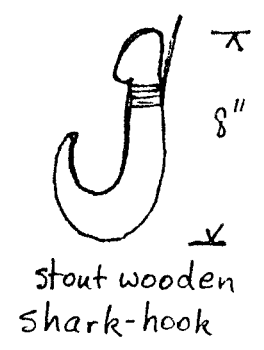


Nets for Goby

more modern
made of bamboo
+ nylon mesh



traditional net
no longer used.



Fish-Drive Netting using people (o)
+ canoe (o) to drive fish into net.

Fish caught are immediately sorted and gutted and shared amongst the participants and family. The goby are no longer caught as food, and their numbers have supposedly increased, this leaves many of the hand-held scoop nets unattended and rotting. The traditional seine nets are also no longer used or made. Ocean fishing is carried out in a variety of ways using hook and line, poisons and spearing. Traditionally, hooks were made from pearlshell or Tridacna shell to catch bonito and other deep water fish, these are being replaced by modern metal hooks and nylon lines. Stout wooden hooks are still used for sharks though these are rarely caught these days because of the religious prohibition against scaleless fish. Poisons such as luba (Derris heterophylla) a vine which is pounded and bound to the end of a stick and inserted into crevices to stun fish, are also used (Elbert, 1975:147, Tohaika, pers. com.). Flying fish are caught at night using a torch of coconut fronds or kerosene wood (today kerosene lanterns are used) to attract the fish which are scooped into the boat. If they do not come they may be called with a certain long incantation (Tohaika, pers. com.). Turtles and dolphins contribute to the diet of the Lavangu people, since these will often enter the bay. The dolphins are driven to shore and stranded, here only enough are killed as needed for food. Rennellese have often remarked on how "stupid" these fish are staying close to shore where others have just been caught.

FUTURE

A few years ago a Japanese survey team investigated the possibility of bauxite mining in the lake, said to contain rich deposits. These however, proved not to be commercially viable, given the "limited areal extent and quality of the bauxite gray clay" (Tsukahara, 1982).

The only source of income on the lake is that acquired from the sale of carvings such as clubs, spears and kumetes (bowls) along with innovations from the Peace Corps people such as walking sticks and various fish and animals similar to those made in the Philippines today. The women weave fine handbags (kete) and

sleeping mats (malikope) of Pandanas. Another source of cash for the Rennellese is the sale of fish, crayfish, coconut crabs, taro and coconuts (the largest and sweetest in the Solomon Islands) occasionally sent to Honiara by the monthly ship. The Fisheries Department is proposing to set up a fisheries centre possibly at Lavangu with freezer facilities for fish catches, both marine and tilapia. This year saw the first two shipments (200 kg. maximum per shipment) of Tilapia from Rennell to Honiara and it is hoped that a market can be secured to provide an income for the Rennellese people (Blakey-Marshall, pers. com.).

Based on observations and native informants, the introduction of tilapia into Lake Tegano on Rennell has not had any major discernible effects on either numbers or distribution of endemic native fauna. This is fortunate, especially since no apparent consideration was given to environmental impact at the time of the introduction. Supposedly the tilapia have had a positive effect on the lake ecology, in that the gobies have replenished in number as they are no longer fished (pers. com.). Because of insufficient records on the lake's ecosystem prior and post to the introduction of the tilapia, comparisons are made through interview with the Rennellese people themselves. The tilapia are presently flourishing, maintaining a maximum healthy length of 14 inches, indicating that overpopulation has not occurred, nor overfishing by the people (Chen, 1976:56). However, it would be somewhat inaccurate and premature to suggest that the introduction has had no negative effect, since no survey is available for comparison, and though the tilapia have proliferated well, they may not as yet have reached the maximum carrying capacity of the lake. This, when reached, may drastically alter the ecology of the lake by changing the population and distribution of the fish through competition for food, nesting space, and shelter. On the other hand, they may become overfished, in which case new introductions may be warranted and calculations made to balance population growth with fishing yields. One possible major impact of the tilapia has been an apparent reduction in the number of malaria-bearing Anopheles mosquitoes that used to breed in the lake inlets (Mana, pers. com.). This beneficial

effect was perhaps unforeseen at the time these fish were introduced, primarily as food, but tilapia have been used as mosquito-eating fish (larvivorous) in other malarial areas of the world (Coykendall, 1980:A-1).

Though this report may be very general, the implications are that this be taken as a preliminary to further research the lake ecology and environment.

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