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C O N T E N T S

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SOUTH PACIFIC ISLANDS FISHERIES DEVELOPMENT
AGENCY

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EDITORIAL

Professor Doumenge has now returned to France, and this is the last SPIFDA Newsletter. As mentioned in the Editorial of Newsletter no.9, SPC will, at the request of delegates to the 6th Technical Meeting on Fisheries, continue to produce a Newsletter which will be distributed to the present recipients of the SPIFDA Newsletter.

Sometime in 1974, the South Pacific Commission will have an offset printing press at Headquarters in Noumea. This will undoubtedly improve the presentation of the Newsletter. We sincerely hope that the content will live up to the improved presentation.

At the South Pacific Commission conference in Guam in September, the SPC's Special Fisheries Projects (see pp. 2-3-4 for summaries) were approved in total. These projects were made possible by special voluntary contributions from Australia and New Zealand, with supplementary funding made by France at the conference.

Three of the papers in this present Newsletter show the exciting possibilities of fisheries developments outside the reefs:

- Deep water Fishing, by P. Fourmanoir ;
- The Development of Tuna and Skipjack Fishing in French Polynesia ;
- Exploratory Shrimp Trapping, by P. Struhsaker and D. Aasted.

The shrimp farming experiments show promise for the future, but will inevitably be a high cost, advanced technology operation for some time. Farming of molluscs can add to both protein and cash income in many areas. Turtle farming has promise and the transplantation and "seeding" of Trochus in Tahiti, demonstrates that the introduction of exotic species can so produce good economic returns.

R.H. Baird

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SPECIAL PROJECT ON OUTER REEF ARTISANAL FISHING

S U M M A R Y

The primary goal of fisheries development programmes in the South Pacific should be satisfaction of local fresh fish demand, thus providing protein at reasonable cost. Surplus catches can be sold to foreign markets as a source of foreign exchange. Initial development can be based on indigenous crews working from relatively small craft. The American Samoa Dory Project has demonstrated the pratical potential of this approach.

It is proposed that SPC undertake an artisanal experimental and demonstration fishing project in those territories which are not able, at present, to test and develop their local fisheries potential. The objectives of the project are to assess territorial resources, determine and demonstrate successful fishing techniques, prepare an economic investment prospectus, train a limited number of fishermen, and compare the cost effectiveness of two different types of fishing craft.

The project will be substantially self-contained, with provision for boats, fishing gear, refrigeration and personnel. The two boat types will be the petrol-powered 24' plywood "Samoan dory" and an aluminium boat with diesel power. A variety of fishing techniques will be used. Personnel will include a Project Manager, master fisherman and four volunteers. Trainee crews will come from the territories in which the project operates.

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SPECIAL PROJECT ON INSHORE FISHERIES DEVELOPMENT

(Reef and lagoon)

Introduction

With the increase in population of many of the Pacific islands and with consequent increase in pollution and in fishing pressure, in many cases the island populations can no longer maintain their fish requirements from lagoon sources, particularly not in areas close to centres of population. This is the reason for the SPC's emphasis on outer reef artisanal fishing developments.

However, there still are many possibilities for reef and lagoon fisheries developments.

Lobster (Panulirus spp.)

There is some considerable body of evidence that commercially exploitable stocks of lobsters are found on the reefs of most Pacific islands. Remarkably little is known of the vital population parameters such as growth rate, mortality, stocks and in consequence, optimum yield. Knowledge of all these is required in the long term in order to maintain maximum sustained yield.

However, it is known that there are many, at present unexploited or under-exploited stocks. The main difficulty is that of logistics. Widely scattered archipelagos, with remote islands with exploitable stocks of lobsters, are unable at present to market lobsters because of the irregularity of collection. One immediate, and fairly inexpensive partial solution of this problem would be live storage at island sites. Live storage of lobsters is practised extensively in Central America, Europe and Africa of Panulirus spp. and also Homarus spp. in N. America and Europe. There seems to be no reason why Panulirus spp. should not also be successfully stored alive on island sites in the Pacific. If this were possible pending collection for processing and marketing, it could make a substantial contribution to the cash income of many remote island villages.

Recommandations have already been made in reports to the Administrations of both the British Solomon Islands Protectorate and the New Hebrides, that this problem should be looked into and guide lines have been given for the initial approach. However, neither of these territories has the resources of personnel to conduct reasonable long-term experiments in depth. As the problem is one common to nearly all the territories of the Pacific, who would all stand to gain from a definitive answer, it would be desirable for the Commission to finance one or two years work into the solution of this problem.

Bêche-de-mer (Holothurians)

There is at present a big demand at a good price for Bêche-de-mer. Many territories are at present exploiting this resource. A handbook prepared by the FAO Consultant to SPIFDA, Mr. Sachithananthan, on Bêche-de-mer is suffering some considerable delays in production due to doubts about identification of some species.

As with lobsters, little is known about growth rates, stocks and recruitment. Identification of the main commercial species is frequently a problem for out islanders. The volunteer working on lobsters

above would often be working on an area of Bêche-de-mer. He could, incidentally, begin to make a study of stocks and methods of preservation (formalin injection) that would allow the main commercial species to be preserved in a recognisable form and distributed for species identification.

Turtle Farming

In areas where nesting turtles occur, turtle farming by means of hatcheries and rearing has been shown to be a congenial and effective operation at the village level, producing both protein food and cash, while at the same time contributing substantially to conservation of turtle stocks.

An investigation of the feasibility of this operation in one or two Pacific islands is considered a well worthwhile low cost project. A reasonably successful farming operation could be used as a demonstration centre and a substantial industry could be built up in the Pacific area for turtle products.

Turtles have the advantage, like Bêche-de-mer and possibly lobsters, of being able to be held in remote areas awaiting collection for processing and marketing without the need for high cost freezing equipment.

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INITIAL ORGANIZATIONAL WORK FOR FARMING PENAEID SHRIMPS IN ST. VINCENT'S BAY (NEW CALEDONIA)

by Professor François Doumenge
Project Manager, SPIFDA

I. Natural population for stocking the farm

A natural population is present, of which juveniles and young specimens that have not yet reached adult size keep to the mangrove channels and the mud-sand floor of the coastal strip. In order to stock the pond, live shrimps 2 to 5 gr in weight may be caught without any great difficulty by means of fixed nets which act as traps. These fyke nets, called capetchades, are used by fishermen in the lagoon and salt-water pools along the French Mediterranean Coast. Capetchades, which consist of a barrier 50 or 100 m long leading into an enclosure surrounded by 3 trap nets, keep alive the fish and shell-fish which get into them. Setting up a complete capetchade using 6 poles for the barrier and 7 for the enclosure and trap nets, takes about an hour. Once in position, the capetchade may be left in the same spot for one or two weeks. The nets in the trap should be inspected twice a day - this involving in all between 15 and 20 minutes - so that specimens caught may be removed and the trap nets put back into position. The contents of the nets are spread out on wet sacks placed in the bottom of the fishing boat. Live shrimps are immediately sorted by hand and put into a plastic tub full of sea water that is stirred and constantly changed. If more than 10 or 15 minutes are spent between the time the live shrimps are caught and their release into the rearing pond, a battery-operated portable oxygen-bubble generator should be used.

The shrimps are mixed with other shell-fish and fish, which also, are immediately sorted. All juveniles and young specimens not used are returned alive to the sea once sorting is completed by washing and rinsing the bags. With trained staff on the job, this takes only a few minutes. The whole thing can be managed by two persons, though it is most useful to have a third person on hand to speed up the manual processes. Hitherto, shrimp catches have consisted almost exclusively of Penaeus merguensis (banana prawn), which are very delicate, having to be handled with great care and swiftness if a high mortality rate is to be avoided. When the experiment was initiated, there was less than 20% survival. Improved organization, with the benefits of daily training, then raised this figure to a very satisfactory 80 to 85% survival. A capetchade set-up can easily provide 100 to 300 live shrimps per day; and this was the case in a season characterized by a pronounced drought which made it impossible for the nets to be used at a time when masses of shrimp concentrated on the coastal fringe following a period of heavy rain.

This suggests that if capetchades are used during the season when juveniles come together, they could provide daily several thousand subjects for farming, so that it would be possible to fill a pond in about 10 days of intensive collection. Along with the Penaeus merguiensis, there is also a natural population of Penaeus semisulcatus and Penaeus monodon, but up to now catches have been limited to a few specimens. Further, great numbers of Metapenaeus monoceros are mixed up with the Penaeus merguiensis, but at the juvenile stage it is difficult to distinguish between them.

II. Size-increase in natural stock used

Since August 1972 when the experimental pond was filled, some hundreds of shrimps fished with a cast net and weighing 1 to 3 gr, were put into the tank so that observations could be made of their behaviour, no food being introduced from outside.

These juveniles showed rapid growth and their average weight in mid-December 1972, when they had been in the pond for four months, was 12 gr in the case of males, while the females varied in weight between 20 and 35 gr, depending on their sexual maturity. (See SPIFDA Newsletter No. 7, December 1972, p. 9-12). Subsequently, the small number of specimens remaining continued to grow, even though the salinity level of the pond water remained constant at about 40‰, owing to the protracted and unusually bad drought experienced in this part of New Caledonia.

In March and in the beginning of April 1973, Penaeus merguiensis introduced into the pond 7 months before weighed 40 to 55 gr, which made them identical in size to the large shrimp fished in Australia.

Apart from the few hundred specimens introduced systematically into the pond when it was filled, other shrimps got in through the pumping system, despite the fact that the water was introduced through a coke-filter. It was interesting to note that the larval or post-larval stages of Penaeus semisulcatus, Penaeus monodon and Metapenaeus monoceros entering the tank, developed to the adult stage equally as well as Penaeus merguiensis.

III. Harvesting of the pond-reared specimens of marketable size

Wherever shrimps are found, whether it is in Japan, in Europe or in the United States, one of the problems most difficult of solution lies in harvesting, gradually, the totality of farmed individuals that have attained marketable size, while at the same time endeavouring not to endanger the animal life of the pond as a whole.

The most drastic method, which consists of draining the pond was adopted to observe the effects on animal life and to determine the problems that were likely to come up. The experiment conducted on 18th and 19th April 1973 was far from conclusive and was in fact rather unsuccessful. The shape of the pond and the fact that there is too much mud on the bottom render this procedure totally unsuitable. Losses were very high, the majority of big shrimps remaining buried in the mud, where they died after a few hours.

Another technique has been developed which appears to be quite satisfactory. This consists of using a large fixed pound net with large meshes from 15 to 35 mm square of the Mediterranean "guangui" type. This type of net is used in the channels and salt water pools fisheries along the French Mediterranean coast. The net is fixed by means of 3 poles, its wings and mouth opened to face the direction from which the pumped water comes over the overflow-chute, the cod-end of the net being fixed abreast of the "moine pêcherie", a concrete trap, fitted with sluices. The left wing of the net is fixed with a stake to the edge of the tank. Shrimps of marketable size, i.e. specimens weighing over 10 gr each, are retained in the cod-end of the net. The rate of fishing can be improved

by making the animals in the pond move around, by simultaneously pumping in filtered sea water and partially emptying out water near the bottom by removing a board from the sluices.

This is a simple and labor-saving system since harvesting of the live shrimps in the net can be carried out by a single person. To avoid the accumulation of too many specimens in the cod-end, collection of shrimps caught can be made every 4 or 5 hours. This harvesting method makes for top-quality produce. It has also made it possible to use the first reared specimens to try and build up a controlled breeding-stock.

IV. Transport of farm-reared and natural specimens to Tahiti, to set up a controlled breeding centre

The French Centre for Oceanic Management (CNEXO) has set up in Tahiti a very large laboratory which is to concentrate on experimental large-scale farming of Penaeides.

As natural populations of these species do not exist in the waters of French Polynesia, external sources had to be approached for specimens that could constitute an initial breeding-stock.

CNEXO approached the St Vincent's Bay Demonstration Centre, which is at present the only organization in the Pacific capable of supplying specimens to be used for breeding purposes following controlled growth in a rearing pond.

It is especially satisfactory that the St Vincent's Bay Demonstration Centre could be used in this venture as at present neither conditions nor equipment are suitable for carrying out controlled reproduction experiments.

Five batches were sent by plane (one in December 1972, one in January 1973, two in February 1973 and one in March 1973), comprising about 200 shrimps in all from the rearing-pond population. The method of conditioning consisted of lowering the water temperature and releasing oxygen into plastic or glass bottles. The method was gradually improved until the in-flight mortality rate was reduced from 75/80% to only 25/30%.

With a view to increasing the breeding-stock in Tahiti, two batches were sent on 18th and 25th May 1973, involving 462 shrimps from a natural habitat, 343 of which were found to be alive upon arrival. In the course of April 1973, another experiment was carried out involving the transport by sea in the "Coriolis" of 37 juvenile shrimps. Nine of these reached Tahiti alive after 17 days on the ship.

Finally at a more recent date, 122 shrimps from natural stocks and 75 from the tank were sent by air on 23rd June and 10th August respectively. A shipment of about 81 shrimps was made on the 25th August 1973.

Very satisfactory growth-rates were obtained in Tahiti with the use of a locally-produced food, based on a mixture trochus flesh (Trochus niloticus) and skipjack (Katsuwonus pelamis) meat, improved by the incorporation of vitamins and minerals.

In mid-July 1973, the following were under observation in the CNEXO laboratory in Vairao (Tahiti) from among the specimens transported from St Vincent's Bay:

Penaeus merguensis:	400 individuals between 4 and 9 gr in weight plus some specimens weighing between 13 and 16 gr.
Metapenaeus monoceros:	about 35 specimens, females from 14 to 20 gr, males from 9 to 12 gr in weight.
Penaeus semisulcatus:	5 individuals, including a female weighing 51 gr.
Penaeus monodon:	1 male 75 gr in weight.

20 males and 20 females of the species P. merguiensis kept in a fibreglass tank (500 litres) are weighed regularly to determine the growth pattern in captivity. The other individuals are reared in two tanks of 12 m^3, made of flexible plastic sheeting.

The presence of mature females in the last batch to arrive (25th August), made it possible to initiate larval and post-larval tests in the beginning of September, with the technique normally practised in artificial hatcheries.

V. Stocking the rearing-pond

The pond was drained for the first time in mid-April 1973. Routine treatment was given, such as ploughing the bottom when dry. The pond was ready for refilling by the 20th May 1973, 150 kg of phosphated fertilizer being added. The object of the current experiment is to study the behaviour and growth of Penaeid and Metapenaeid shrimps at a density of about one individual per m^2.

This experiment is expected to last 6 or 7 months and should, if successful, make it possible to obtain in mid-December 1973 a few hundred kilos of specimens having reached a sub-adult stage, very close to being reproductive. Initially, between 25th May and 9th July, 5363 shrimps were placed in the pond. This population came from catches made with two capetchades, placed very close to the farm, one on the muddy zone in front of the mangrove swamp shielding the wall of the dam, and the other also in a mangrove swamp within a small adjoining bay, at a distance of about 400 m. This sort of location has made it possible to solve transportation and survival problems in a satisfactory manner.

The juvenile shrimps are mainly of the species Penaeus merguensis (banana prawn). An analysis of the catches shows clearly how plentiful they were, considering the limited number of days when conditions were favourable. In one single day, 14th June, 687 specimens were collected; and the six best days (6th June, 10th June, 14th June, 18th June, 19th June and 30th June) between them accounted for over 40% (2244) of the shrimps collected. For the time being, it is not possible to correlate the catches made with the phases of the moon or tidal flow, as too many external factors interfered with the effects of natural conditions, for instance losses due to the improper use of nets, yields affected by the fact that it was not at first possible to inspect the nets regularly or as only one capetchade was at the time suitable for fishing.

The breakdown of live shrimps collected to stock the pond was as follows:

394	specimens	from 25th to 31st May
692	"	from 1st to 7th June
1604	"	from 8th to 14th June
1161	"	from 15th to 21st June
589	"	from 24th to 30th June (1)
923	"	from 1st to 9th July.

(1) All shrimps caught from 22nd to 23rd June were sent to Tahiti. These are not mentioned in this table.

A summary check was made on how the natural stock was made up, the sizes of shrimps in certain batches being measured before they were released into the farming pond. The distribution indicates that the population of juveniles is fairly homogeneous.

Of the shrimps concerned, 50 to 70% (overall average 62.5%), were in the 7 to 8 cm size-bracket, 21% of the total collected being more than 8 cm, and 16.5% less than 7cm in length.

Size in cm	1st June	3rd June	5th June	11th June
4	-	4	2	-
5	10	7	8	2
6	14	5	7	4
7	19	25	18	50
8	30	23	20	59
9	16	11	9	35
10	2	1	1	8
	91	76	65	158

Later on, in early July, two large batches of specimens which were found dead in the pocket of the capetchade nets were measured for size and preserved as controls for checking the state of the natural stock upon completion of the first stocking period. There was hardly any difference between their sizes in early July and those recorded in June, confirming the structure of the population being fished.

Of the shrimps collected, 69.7% were in the 7 to 8 cm group, 9.8% of them being larger and 20.5% smaller.

Sample batches - shrimp sizes

cm	3rd July	4th July
5	4	5
6	24	48
7	80	98
8	58	72
9	32	10
10	-	1
Total	208	234

In the case of these sample batches, the average weights were determined on 3rd July. The 234 shrimps weighed 721 gr, so that the average weight was 3.08 gr. The 193 shrimps collected on 4th July weighed 605 gr, giving an average weight of 3.15 gr per individual.

The average weight of specimens introduced into the pond may thus be estimated at about 3.10 gr each, which would make for a total live weight of just over 16 kg.

VI. Observing the first growing period

In connection with the first shipment of shrimps to the CNEXO laboratory in Tahiti, a check was made on 10th August 1973 on the growth pattern after they had been reared in the pond for an average of six weeks. 447 shrimps were studied, representing about 8% of the specimens introduced between 25th May and 9 July. A considerable increase in size could be noted, the 9-10 cm group being the most numerous (70% or 312 individuals) against 7.2% that were smaller (33) and 22.8% (102) larger in size. This sample check made it possible to establish a size/weight ratio that can be used in assessing the live-weight of shrimps stocked in the tank.

Panaeus merguiensis - batch of 10th August 1973

Weight in grams	Total length in centimetres
3.00	7.5
4.00	8.8
8.00	10.2
10.00	11.2
13.00	12.1

After sorting was completed, it was possible to classify 217 male specimens weighing 1,454 gr in all, with an average weight per individual of 6.7 gr, and 222 females with a total weight of 1.936 gr and an average individual weight of 8.17 gr. The average weight of this population, which appears to be evenly balanced, is thus 7.7 gr per shrimp. It may thus be assumed that on 9th August 1973 the pond must have contained about 40 kg of live-weight in shrimps, leaving all mortality factors out of the reckoning.

Adjustment of these figures taking into account natural mortality can only be made after harvesting. Up to the present moment, no accidental mortality has been noted.

VII. Rearing tank: hydrological characteristics and water displacement

The water supply to the tank consists of pumped sea water filtered through a coke ring about 80 cm thick. The rate of flow varies between 500 m^3 and 800 m^3 per hour, depending on tidal conditions and the power adjustment. Pumping initially carried out over a total of 10 hours between 25th and 30th May made it possible to cover the muddy bottom of the pond with a 30-40 cm layer of sea water. This ensured the disappearance of bacterial and planktonic flora and facilitated the onset of curing so that the bottom could be covered with algae. The sea water pumped in had a mean temperature of 23.5° and its salinity was 36°/oo.

Owing to a particularly bad drought (4 mm of rainfall between 25th May and 5th June) and heat that was quite unusual for that time of the year (the maximum air temperature in the shade varied between 26° and 27°C from 25th to 31st May and 29° and 30°C between 1st and 5th June) the water temperature in the tank rose sharply to 27.4° on 5th June, the salinity shooting up to 41.49°/oo.

It should be pointed out that the first shrimps placed in pens during this period seemed to adjust perfectly to these extreme conditions.

From the 6th June onwards, after superficial ploughing of the area not covered by the water of the first pumping, pumping was resumed so as to bring the water-level in the tank to the mean mark, i.e. 1.40 metres in the "moine pêcherie", the effect of evaporation being compensated for. For a month, from 6th June to 5th July, pumping was carried out almost daily for 1 to 5 hours per day, depending on the tidal level and the effect of evaporation. In the course of these 30 days, pumping went on for a total of 60 hours, so that the salinity of the water in the pond could gradually be brought down from over 41°/oo between 5th and 9th June to 40.19°/oo on 10th June, 39.2°/oo on 12th June, 38.4°/oo on 15th June, to hold steady between 38.5°/oo and 39.5°/oo from 16th to 28th June. It returned to 38.4°/oo on 29th June, 37.58°/oo on 4th July and 37.35°/oo on 5th July. During the period from 6th June to 4th July, drought conditions continued to be extreme and only 9.6 mm of rainfall was recorded. The effect of a pronounced drop in air temperature (maximum between 24° and 26°C and minimum between 12° and 15°C) soon made itself felt, and the temperature in the pond dropped almost throughout this period to 20° and 23°C. On 5th July at 7.15 a.m., when the first period of drought came to an end, the sea temperature was 20.55°C and the salinity 35°/oo, while in the pond a temperature of 21.2°C was recorded, the salinity being 37.35°/oo.

There followed, between 5th and 20th July, a relatively cold (maximum temperature between 21° and 24°C) and rainy (150 mm) spell which did a certain amount of damage. Following heavy rain on 7th, 8th and 9th July, when over 90 mm of rainfall were recorded, salinity in the tank fell to 32.10°/oo. Pumping was then reduced to a minimum just so as to mingle the surface water and avoid stratification. Between 5th and 20th July, water was pumped in only 5 times for a total duration of 11 hours. At 7.15 a.m. on 17th July, the water in the sea (33.39°/oo, 18°C) and that in the pond (33.80°/oo and 19.65°C) showed very similar characteristics.

There was drought again between 21st July and 20th August (3 mm of rainfall), but there was less evaporation as the temperatures were lower (minimum usually between 10° and 15°C and maximum temperature between 24° and 26°C). 14 pumpings over a total period of 30 hours were enough to keep the temperature very close to that of sea water (average 20°C) and the salinity a little higher (at 7.15 a.m. on 15th August, 34.8°/oo in the sea to 36.00°/oo in the tank).

On 20th and 21st August, 15 mm of rainfall cooled the weather down sharply, salinity dropping considerably. On 22nd August at 8.00 a.m., the temperature in the tank was 16.5°C and the salinity 33.7°/oo.

From 22nd August to 25th September, the weather remained cool and often cloudy, but rainfall continued to be low (less than 15 mm) and both the temperature and the salinity of the pond gradually increased. The salinity recorded on 10th September was over 36°/oo and on 25th September at 7.10 a.m., the readings taken in the tank were 23°C and 38.1°/oo. To compensate for loss due to evaporation and in order to maintain fair physico-chemical stability in the pond, pumping was effected for 14 hours between 22nd August and 9th September, and 18 hours between 9th and 25th September.

On 22nd September at 7.10 a.m., sea water in the vicinity of the pumping station had a temperature of 18.5°C and a salinity of 35.3°/oo, while the corresponding readings for the pond water were 19.5°C and 37°/oo. Between 25th and 30th September, a brief wet spell brought with it 28 mm of rainfall, so that the salinity was maintained below 37°/oo, but owing to persistent winds and the fact that day temperatures were between 25° and 27°C, there was considerable evaporation.

Thus, despite climatic conditions that were particularly unfavourable (long periods of drought interrupted by a few days of very heavy rain), the existing facilities and water-control methods practised proved adequate in maintaining certain hydrological characteristics in the farming of Penaeid shrimps; and there is every likelihood of success.

VIII. Pond water-supply and fauna equilibrium

Low density stocking enables the use of the natural productivity of the water channelled through a coke-filter, during the pumping process.

It is worth noting that, during the period under review (end of May 1973 to beginning of October 1973), only planktonic forms developed in the pond, and, in particular, that there was no invasion of predatory crustacea or fish, whereas during the period from September 1972 to April 1973, eggs and larvae of numerous species passed through the filter and eventually developed into approximately a thousand "blue breams" (Acanthopagrus berda), several dozen crabs (Scylla serrata, Portunus pelagicus, "mangrove crabs", "fighter crabs", "caledonian crabs") and Stomatopodes (Squilla).

The water contained in the pond rapidly took on a brownish colour, indicating a high density of diatoms. There were almost no green algae, whereas colonization of the banks had previously been a problem.

A significant growth of Copepods was noted around 10 July. It did not however endanger the overall equilibrium.

In order to sustain the growth of the stock of Penaeides supplementary food was used, upon which the shrimps fed actively. It consisted exclusively of fresh fish minced by hand with a household mincer. The minced fish was placed partly in control feeding trays but once the shrimps had shown sustained appetite for it, the food was broadcast from the banks and the dike, it was distributed over the surface which proved most attractive to the shrimps.

The fish used was mostly clupecoid-like fish called "Japanese sardines" (known as "Konoshiro" in local language). A few "Pomadasys hasta" ("Crocros") were sometimes added and most of the small fish consisted of fish locally called anchovy, sardines and "prêtres". The volume and frequency of feeding varied according to the appetite of the shrimps. It should be pointed out that in June and the beginning of July, a significant portion of the food was not used. Therefore, to lessen the risk of pollution, the heads, tails and scales of the biggest fish were discarded before mincing.

The distribution was as follows:

Period	Total food distributed g.	Weight of daily feed g.	Estimated live-weight of shrimps in the pond g.	Daily feed/ weight ratio of shrimps (%)
5 - 17 June	8 000	600	5 000	12
18 - 30 June	22 000	1 800	10 000	18
1 - 10 July	22 000	2 200	15 000	14.6
11 - 20 July	18 000	1 800	22 000	6.2
21 - 31 July	17 000	1 500	30 000	5.0
1 - 10 August	30 000	3 000	40 000	7.5
11 - 20 August	32 000	3 200	45 000	7.0
21 - 31 August	30 000	2 800	50 000	5.6
1 - 10 Sept.	25 000	2 500	55 000	4.5
11 - 20 Sept.	20 000	2 000	60 000	3.3
21 - 30 Sept.	42 000	4 200	65 000	4.4
1 - 10 Oct.	28 000	2 800	70 000	4.0

IX. Further stocking of pond

After the sample batch of 447 shrimps was collected on 10 August, fishing was continued using a simple capetchade net to obtain fresh food. Live Penaeides and Metapenaeides shrimp caught with this net were introduced into the pond, serving as the basis for a new stock. By 10 October, 6.216 live shrimp had been introduced into the pond (not including the 477 specimens introduced on 10 August).

The breakdown was as follows:

	Number of shrimps
- Shrimp caught for initial stocking (25 May to 9 July)...	5.363
- Shrimp caught end of July in Tontouta	55
- Fishing in front of pond, 5 to 7 August	402
Total on 9 August:	5.820
- Sample on 10 August	- 447
Shrimp remaining on 11 August:	5.373
- Shrimp caught 11 to 24 August	276
- Shrimp caught 30 August to 20 September	192
- Shrimp caught 24 September to 10 October	375
Total number of live shrimp introduced:	6.216

X. Operations involved in initial harvesting

In order to observe the growth of shrimp and to make stock estimates, night-fishing was carried out five times between 10 and 14 October, using the gangy-type fixed net.

The following is a breakdown of the catches made:

Period	Penaeus merguiensis Males		Penaeus merguiensis Females		Metapenaeus Males		Monoceros Females	
	No.	g.	No.	g.	No.	g.	No.	g.
10 October	615	5.991	607	10.363	4	33	23	375
11 October	424	3.925	848	14.50	7	61	8	125
12 October	380	3.561	188	3.241	20	164	8	123
13 October	178	1.732	60	1.048	6	49	1	15
14 October	197	1.895	136	2.469	4	31	6	86
Total	1.814	17.104	1.839	31.623	41	338	46	624

The homogeneity and well-balanced nature of the stock fished are to be noted. The average weight of the specimens, weighed when drained of water, was in the case of P. merguiensis, 9.4 g. for males and 17.2 g. for females, and in that of M. monoceros only 8.2 g. for males and 13.5 g. for females.

The very small number of Metapenaeus monoceros caught may be taken to indicate that the gangy-type net is less efficacious for fishing this species, which buries itself in the sand. Penaeus merguiensis on the other hand, stays on the bottom without burying itself, and seems to be very easy to catch by virtue of the fact that it moves around more. It was possible to make more detailed observations while measurements were taken of all specimens of M. monoceros and 400 specimens of P. merguiensis.

Reference should also be made to two mature Penaeus semisulcatus females caught, one of which weighed 25 g. and the other 40 g. Among the smaller and lighter specimens introduced since the end of August, catches were considerably reduced and involved Penaeus merguiensis, 10 males weighing 40 g. in all (4 g. each) and 8 females 51 g. (6.5 g. each).

Thus between 10 and 14 October, 3.742 adult specimens were caught, that may be assumed to belong to the population of 5.373 shrimps placed alive in the tank before 11 August. The catch percentage is very high (69.9%), indicating an extremely high survival rate. This can be verified more precisely during the next fishing operation, which should take place around mid-December 1973.

XI. Marketing the Penaeides shrimp reared in New Caledonia

When the initial fishing operation was carried out, involving about 50 kilos of shrimp, it was decided to investigate the possibility of marketing them in Noumea.

The sale, which was organized by Mr. Paul Guerlain, an oyster farmer in Ouenghi and the owner of a high-quality sea-food store in Noumea, was a great success. 37 kilos were sold for a total of 44,400 fr CFP, so that the average price per kilo was 1,200 fr CFP.

This price of 1,200 fr CFP par kilo ($A 10 or $US 15) may appear to be, and is in fact, rather high. However, to have a better understanding of the level attained, it should be borne in mind that the New Caledonian domestic market is accustomed to importing food products at extremely high prices, its considerable purchasing power being conditioned by a standard of living boosted by mineral wealth and heavy industry.

Further, the farmed shrimps were very favourably received by consumers as the produce was remarkably fresh and very homogeneous. There is no doubt that the consumer is biased in favour of fresh shrimp from the rearing pond, as they have a far better appearance than trawl-fished specimens.

Although mid-October is not a favourable time for selling a luxury product, the demand exceeded the supply so that individual sales had to be limited.

Already, consumers have offered to buy produce expected at the next harvest which, scheduled as it is for the Christmas season, is likely to fetch a higher price that can as of now be assessed at being equal to or over 1,500 fr CFP par kilo ($A 15, $US 22).

If expectations are to be based on such sale prices, it seems possible to envisage the establishment of some pilot farms which could develop more sophisticated techniques, making for much higher production involving larger shrimp stocks.

XII. Conclusion

Initial experiments involving the controlled farming of Penaeides and Metapenaeides shrimp in St. Vincent's Bay indicate that it is possible to hope for economically feasible results provided one can readily obtain several hundred thousand post-larvae to supply the stock of juveniles that can get the maximum benefit from the favourable hydrological and climatic conditions in rearing ponds, which can be set up at moderate cost in many locations on South Pacific Islands.

The remarkable results obtained by CNEXO in the Vairao laboratory in Tahiti, allow one to hope that by the end of 1973 or the beginning of 1974 at the latest, further experiments on these lines will be carried out in the St. Vincent's Bay Mariculture Demonstration Centre, taking into account initial data collected since work began in August 1972.

More particularly, it may be hoped that thanks to the judicious rotation of generations - with small tubs being used for pre-growing the shrimp - there would be three main harvests per year.

As behaviour varies between different species, greater numbers of shrimps can be farmed, associating species that ordinarily live buried in the sand (Penaeus semisulcatus, P. monodon, Metapenaeus monoceros) with a species that always remains above the sand floor like Penaeus merguiensis.

Recent progress achieved both in Japan and the United States, in Europe as well as in Tahiti, in developing a cheap and standardized feed in the form of manufactured pellets, will help in the transition from the present stage, involving research in a small number of specialized institutions, to the practical application of the results in shellfish farms that could bring in a considerable amount of income both to the private investors and the territories concerned.

BIOMETRY

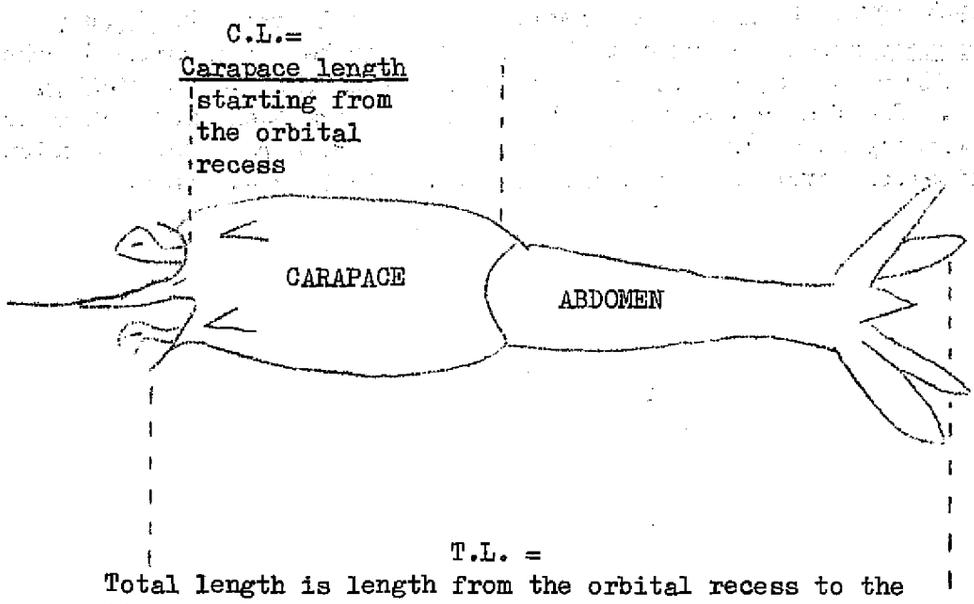
Although produced from natural stock that is necessarily heterogeneous, fished at random with capetchades, the stock in the pond was found to be surprisingly homogeneous. This confirmed the initial indications of the first tests carried out at the end of 1972. As in December 1972, the number of samples being far larger, the Penaeus merguiensis males are shown to be grouped together in a narrow bracket (over 80% of the specimens weighed being within the 9.00 to 9.99 g. range). The females, as was to be expected since their individual weights vary greatly according to the sexual stage, were more widely distributed. Nevertheless, over 80% are within the 16.00 to 18.5 g. range.

Penaeus merguiensis : Distribution of mean weight in grams

Males			Females		
Weight in g.	No.	%	Weight in g.	No.	%
7.50 - 7.99	10	0.9	14.00 - 14.49	10	0.8
8.00 - 8.49	10	0.9	14.50 - 14.99	-	-
8.50 - 8.99	80	7.0	15.00 - 15.49	20	1.6
9.00 - 9.49	408	35.7	15.50 - 15.99	70	5.7
9.50 - 9.99	510	44.7	16.00 - 16.49	140	11.4
10.00 - 10.49	104	9.1	16.50 - 16.99	240	19.6
10.50 - 10.99	20	1.7	17.00 - 17.49	251	21.0
			17.50 - 17.99	170	13.9
			18.00 - 18.49	180	14.7
			18.50 - 18.99	90	7.3
			19.00 - 19.49	40	3.2
	1.142	100.0		1.211	100.0

A more detailed morphometric study involving 50 specimens of each sex made it possible to determine the length/weight ratio in the two sexes and the stage of sexual maturity among the females.

Morphometry : Guide marks involved in the two measurements made



Total length is length from the orbital recess to the tip of the middle segment of the telson

Morphometry of a random sample of 50 males and 50 females

Penaeus merguiensis

Males			Females			
T.L.	C.L.	Weight in g.	Sexual stage	T.L.	C.L.	Weight in g.
9.2	2.0	9.0	0	12.3	3.2	17.0
9.3	2.1	7.0	0	12.0	2.9	17.0
9.3	2.1	8.5	0	12.8	3.4	20.0
9.5	2.2	8.0	0	12.5	3.3	18.0
9.5	2.3	9.0	0	12.3	3.3	18.0
9.5	2.2	8.0	0	11.4	2.9	15.0
9.5	2.3	8.2	0	11.8	3.0	15.0
9.5.	2.2.	8.0	0	12.2	3.7	18.0
9.5.	2.2	8.0	0	12.3	3.1	16.0
9.6.	2.2	8.0	0	13.0	3.3	19.0
9.6.	2.3	8.0	0	11.2	2.8	13.0
- 9.7	2.2	8.0	0	12.0	2.9	17.0
- 9.7	2.3	8.0	0	10.9	2.4	11.0
- 9.7	2.4	9.0	0	12.3	3.0	15.0
9.8	2.4	8.5	0	12.3	3.1	18.0
9.8	2.5	9.0	0	11.8	3.2	15.0
10.0	2.2	10.0	1	12.7	3.3	20.0
10.0	2.4	8.5	1	11.9	3.2	16.0
10.0	2.2	8.0	1	11.8	2.7	17.0
10.0	2.2	8.0	1	12.4	3.2	18.0
10.0	2 2	9.0	1	11.9	3.1	18.0
10.0	2.3	9.0	1	11.5	3.0	15.0
10.0	2.4	9.0	1	12.4	3.3.	18.0
10.0	2.3	9.0	1	13.0	3.4	20.0
10.1	2.5	9.0	2	12.2	2.8	17.0
10.1	2.3	9.0	2	12.5	3.2	18.0
10.2	2.3	9.0	2	12.0	2.7	16.0
10.2	2.3	9.0	2	11.6	3.1	16.0
10.2	2.5	10.0	2	12.8	3.2	20.0
10.2	2.4	9.0	2	12.4	3.2	19.0
10.3	2.1	9.0	3	12.5	3.1	18.0
10.3	2.4	10.0	3	12.3	3.0	17.0
10.3	2.3	9.0	3.	12.4	3.3	18.0
10.3	2.3	9.0	3	11.5	3.0	14.0
10.3	2.4	9.0	3	11.6	3.0	15.0
10.3	2.3	9.0	3	12.4	3.3	16.0
10.3	2.3	9.0	3.	11.6	2.9	15.0
10.3	2.3	9.0	3	12.5	3.4	19.0
10.4	2.5	9.0	3	12.6	3.3	18.0
10.5	2.5	10.0	3	13.0	3.3	19.0
10.5	2.3	10.0	3	12.9	3.4	19.0
10.5	2.3	9.0	3	11.0	2.5	12.0
10.5	2.4	10.0	3	12.8	3.5	20.0
10.5	2.6	10.0	3	12.0	3.2	16.0
10.5	2.5	10.5	3	12.5	3.4	18.0
10.6	2.3	9.0	3	13.0	3.5	20.0
10.7	2.4	11.0	3	12.9	3.6	18.0
10.7	2.4	10.0	3	12.6	3.6	18.0
10.9	2.6	11.0				

Key to Table page :

T.L. : Total length in cm from the orbital recess to the tip of the middle segment of the telson.

C.L. : Length of carapace is length from the orbital recess to end of carapace (in cm).

Weight in grams.

Sexual stage: 0 = immature
1 = start
2 = mature
3 = about to spawn

It is worthwhile pointing out the characteristics of females found to be still carrying spermatophores after moulting.

Penaeus merguiensis females that have moulted and still carry spermatophores:

Total length	Carapace length	Weight in g.
10.7	2.6	12.0
11.0	2.6	15.0
11.2	2.2	15.0
11.2	2.2	15.0
11.3	2.5	14.0
11.3	3.0	16.0
11.5	3.0	16.0
11.5	2.6	16.0
11.5	2.5	15.0
11.5	2.7	15.0
11.8	3.1	17.0
12.0	2.6	16.0
12.0	2.5	17.0
12.0	2.6	16.0
12.0	3.0	18.0
12.0	2.5	18.0
12.2	2.7	18.0
12.3	3.3	19.0
12.5	3.2	18.0
12.5	3.3	18.0
12.7	3.3	19.0

Though the number of Metapenaeus monoceros present was small, it was considered that - in view of their very particular behaviour, to note the biometric characteristics of samples from this species.

Morphometry of Metapenaeus monoceros males:

Total length	Carapace length	Weight in g.
7.2	1.6	6.0
8.1	1.9	7.2
8.5	1.9	8.0
8.7	2.0	8.2
8.7	2.2	8.0
8.8	2.1	7.9
8.8	2.3	8.0
8.8	2.2	8.2
8.9	2.0	8.5
8.9	2.4	8.5
8.9	2.2	8.9
9.0	2.2	9.0
9.0	2.1	9.0
9.0	2.5	8.0
9.0	2.5	9.6
9.0	2.7	10.5
9.0	2.0	8.4
9.1	2.4	9.4
9.3	2.5	9.5
9.3	2.3	9.0
9.3	2.6	9.5
9.3	2.4	10.1
9.4	2.3	10.2
9.4	2.2	9.5
9.0	2.3	10.8
9.8	2.8	12.0
10.0	2.5	15.5
10.4	2.9	14.5
10.5	2.7	15.2
10.5	2.9	15.0
10.5	2.7	13.0
10.5	2.5	14.0
10.6	3.0	17.0
10.7	2.9	15.0
10.7	2.4	14.0
10.7	2.7	15.0
10.8	2.9	15.0
10.8	3.0	16.8
10.9	3.2	19.0
11.0	2.9	17.4
11.0	3.0	16.0
11.0	3.2	17.0
11.0	3.2	15.0
11.0	3.0	16.0
11.0	3.0	16.8
11.2	3.1	17.5
11.2	3.0	16.0
11.3	3.3	19.0
11.3	3.1	18.1
11.4	3.3	19.0
11.5	3.3	20.9
11.5	3.0	19.0
11.5	3.0	19.0
11.8	3.2	19.0
12.0	3.4	20.0

* * *

Deep-water fishing in some islands of the South-West Pacific *)

by

P. Fourmanoir
ORSTOM, Noumea

Deep-water fishing can, for practical purposes, be limited to that practised at a depth of between 120 and 400 metres. In fact, fishes of commercial importance, with the exception of oil-fish, grow scarce beyond the 250 m mark. Such fishing in deep-water is undertaken in the New Hebrides and in Mare (Loyalty Islands), where, as there is no reef, it is possible to go fishing at night. In New Caledonia, as the waters of the lagoon are so full of fish, deep-water fishing is only carried out on an experimental basis. The same applies to the atolls of French Polynesia. In Tahiti, about ten fishermen are still engaged in night-fishing for oil-fish (Uravena), touching depths of 450 metres, other deep-sea fish having practically disappeared. This kind of fishing is mainly centred on the capture of snappers which can be very plentiful indeed and are much valued.

I. Fishing methods and gear

When the weather is fine and in places where the slopes are not too steep, it is better to let down the line with a temporary sinker (expendable sinker such as rock, iron, etc.) about 2 kg in weight - which can be released near the bottom with a jerk - rather than a fixed sinker, which makes for the less sensitive fishing. When the drift is fast over a changing ocean-floor, use must be made of a permanent weight of 0.8 to 2 kg, generally of lead, to ensure that the fishing line stays close to the bottom. In such cases, it is advisable to fix the lead weight in the centre of a metal rod (of brass or galvanized iron) 90 cm long with a diameter of about 3 mm. This would prevent the sinker's getting lost in a rock crevice, such losses being actually almost as common between depths of 120 m and 250 m as on markedly uneven coral beds between 30 and 60 m below the surface. As regards leaders, we would recommend the use of 4 or 5, about 65 cm apart, fitted with double-circle hooks Nos 5 to 7.

Instead of a vertical line, held in the hand or run off a reel, a bottom line (or longline) may be used, provided with a dozen hooks fitted on leaders 1 m long, about 3 m apart. This bottom line, about 40 m long, is weighed down at the free end by a 4 kg chain, its buoy-cable end being attached to a chain weighing 6 kg. Before being released, the longline is laid out in the shape of a U, both its ends being kept in the boat. Then the free end with its sinker is cast into the water, the other end being held till the longline is played out as the motor starts and the boat goes slowly forward. Now the second sinker still holding the longline is cast into the water so that the line extending almost horizontally on the surface, sinks to the bottom dragging down the single buoy-cable. The bottom line is generally raised after 20 minutes.

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*) This information relates to fishing carried out close to the ocean floor, and not to subsurface fishing such as is practised in the case of tuna, opahs (Lampris), and breams (Taractes).

II. Deep-water fish

1. SNAPPERS

a) Pristipomoides: Flavescens, Filamentosus, Typus, Sieboldi

b) Etelis: Carbunculus, Oculatus

2. GROUPERS

Epinephelus; Chlorostigma, Compressus, Morrhua

3. JACKS

Seriola purpurascens

1. SNAPPERS

a) There is a difference of 10 units on the number of scales present along the lateral line in snappers belonging to the genus Pristipomoides:

Typus	50 scales
Flavescens, Filamentosus	60 - 62 scales
Sieboldi	72 - 74 scales

They are characterized by a pearly pink coloration, a shape similar to that of sea-breams or beckers, and a continuous dorsal fin. The meat of these fish is excellent.

PRISTIPOMOIDES FLAVESCENS (Yellow snapper)

The top of the head presents a mottled lilac-pink to olive-yellow appearance. Both the lateral line and the pectoral fin of this fish are yellow, and the caudal fin pink with a yellow fringe. There are also large yellow spots on the dorsal membrane.

The habitat of this snapper is between depths of 150 and 300 m. It is widespread beyond the great New Caledonian reef and off the Ouvea Atoll (Loyalty Islands). It does not seem to be very mobile. While all other species of snappers are found in the Indian Ocean and the Pacific, the "Yellow" one is at present found only in New Caledonia.

Maximum weight: 3 kg.

PRISTIPOMOIDES FILAMENTOSUS (Rosy Job-fish, Opakapaka) *)

The difference between this species and the preceding one, though hard to determine by meristics, can easily be made out through the fact that flavescens has a predominantly yellow coloration, and that the caudal fin of filamentosus has a red border.

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*) See figure

This white snapper, which is very mobile, is found in schools comprising over a hundred fish, which it has been possible to observe in the Loyalty Islands at depths of 40 m. The habitat of this fish may go from depths of 30 to 280 m. It is sometines caught in channels by New Caledonian fishermen. This is the fish that is best known among amateurs in Mare, who catch it along with Gymnocranius at a depth of between 80 and 100 m.

Maximum weight: 6 kg.

Synonyms: P. microlepis, P. violascens, P.roseus, Apsilus microdon.

PRISTIPOMOIDES SIEBOLDI (Kalikali)

Generally small in size (T.L.28cm) in New Caledonia, it is rarely caught with the big hooks used for deep-water fishing.

It is distinguished by the fact that the scales found along the lateral line, numbering 73-74, are rather small.

This snapper is always caught at depths of over 180 m.

PRISTIPOMOIDES TYPUS

This big fish is plentiful south of the Isle of Pines at depths of between 190 and 210 m. As this area has a regular insular shelf sloping only slightly (sometimes the depth increases by only 100 m over a distance of 2 miles), trawling may be resorted to in places.

Maximum weight: 6 kg.

Synonyms: P. brevirostris, P. multidens.

b) Snappers of the genus Etelis are found at greater depths, are larger, redder and still better than those belonging to the genus Pristipomoides. Their dorsal fins are discontinuous and there are 50 scales on their lateral line.

ETELIS CARBUNCULUS (Ulaula, Paru iihi) *)

This is the largest of the snappers, and it can weigh as much as 30 kg. It is deep red in colour, with a slightly orange tinge. The lateral line of this fish is tinted yellow.

The caudal fin is short and white at the tip of the lower lobe. It lives at a depth of 230 to 350 m, at the foot of under water cliffs rising from a rocky bottom. In New Caledonia, small or large specimens are caught. Fish weighing between 2 kg and 10 kg have not been met with.

Synonym: Etelis marshi.

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*) See figure

ETELIS OCULATUS

This magnificent cherry-red fish differs from the preceding one in that its dentition is less adequate, its shape more slender and the upper lobe ot its caudal fin frequently elongated. Red in colour, the latter reminds one of a tongue of fire.

This Etelis goes down to a depth of 400 m in New Caledonia and the Loyalty Islands. Its diet includes small deep-sea squids, lantern fish and barracudas (Lestidiinae).

Maximum weight: 20 kg.

Synonyms: Etelis corruscans, E. evurus

Both species occur in almost equal numbers in New Caledonia. In Polynesia E. carbunculus is more common than E. oculatus.

2. GROUPERS

EPINEPHELUS COMPRESSUS

This big grouper is identified by the fact that there are great gaps in its dorsal membrane between the spines, its rather compressed shape and its dark violet-brown colour.

Younger specimens bear eight very distinct black vertical bands, which are not as clearly distinguishable in fish weighing over 10 kg.

Epinephelus compressus is found in Lifou, where we caught it around the Torche Bank, at a depth of 290 m, where this species of grouper is plentiful. It is also familiar to the Marquesas Islanders.

The record for the heaviest fish caught (60 kg) is held by the Marquesas.

Epinephelus compressus was described for the first time in 1964, in the Reunion.

EPINEPHELUS MORRHUA

This fish has a maroon-green skin with 3 or 4 brownish-black bands that alternate with a garland made up of dots. It attains a length of 90 cm and a weight of 5 kg. Smaller specimens are encountered starting from a depth of 140 m, adults going down in New Caledonia to as much as 260 m. This is the commonest deep-water grouper found in the Indian Ocean and the Northern Pacific. In its place is found in Polynesia a very similar species, E.tuamotuensis.

The meat of this fish is mediocre in quality and has led to some minor cases of fish poisoning in Mauritius.

EPINEPHELUS CHLOROSTIGMA

Covered with very small olive-green to brown haemetite hexagonal spots, closely spaced. It attains a length of 90 cm and 9 kg. Specimens caught at depths between 150 and 280 m in New Caledonia weigh on an average 2 kg. The meat is very fine.

3. JACKS

SERIOLA PURPURASCENS (Yellow-tail)

This fish is caught near the bottom at depths varying between 140 and 300 m. The larger specimens, which may weigh as much as 25 kg, are found at greater depths.

The meat, which is mediocre in quality, is relished nevertheless in Japan and Hawaii.

This inventory of deep-water fish found at depths of 120 to 350 m is somewhat theoretical. In deep water are also found fish caught in the shallows of the lagoon such as:

Aprion virescens up to 130 m.

Variola louti up to 230 m.

Lethrinus nebulosus up to 130 m.

Lethrinus miniatus up to 230 m.

Lethrinus chrysostomus up to 260 m.

Epinephelus microdon up to 200m.

Epinephelus kohleri up to 150 m.

Lutjanus bohar up to 240 m.

Sharks that go down to depths of up to 300 m are Carcharhinus milberti, (Sand bar) and Carcharhinus albimarginatus (White tip). Sharks constantly present include Squalus blainvillei, Galeorhinus japonicus and Hexanchus vitulus.

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The Development of Tuna and Skipjack Fishing in French Polynesia and Experience in Live-bait Techniques

It is a well-known fact that the waters of French Polynesia, particularly around the Society Islands (Windward and Leeward) abound in skipjack (Katsuwonus pelamis) and yellowfin tuna (Neothunnus albacora), which during the season come together in surface-shoals off these islands.

Surface-tuna and skipjack fishing using a pearl shell lure has been traditionally practised by Tahitians for a long time. Nowadays they use small, fast boats manned by a crew of three, in fleets consisting of about 100 craft.

In 1972, there were in the Society Islands ninety-seven skipjack fishing boats involved in pearl shell lure fishing, with 84 in the Windward Islands (Tahiti and Moorea) and 13 in the Leeward Islands. This fleet grew rapidly, doubling over the 5 years between 1967 and 1972. Overhauling is carried out by local shipbuilders who, in 1972, turned out 12 new boats.

It is difficult to have a clear idea of catches made by Tahitian bonito boats, as they do not go out fishing regularly and as half the boats are not actually in full-time use, either for want of crew, through docking for maintenance purposes or owing to the fact that fishing time is so closely dependent on seasons, when the market is glutted, and prices fall in consequence.

The only place where sales can really be checked is the Papeete Municipal Market, where sales from the operations of local fishermen amounted to 34 tons of tuna and 450 tons of skipjack in 1971, and 34 tons of tuna and 536 tons of skipjack in 1972. These quantities have at least to be doubled, if not trebled if one is to have an idea of the production actually achieved, for many fishermen sell their catches directly to local dealers (Chinese grocers in particular) or get all they can off their hands through their families, and friends living in the districts (roadside or door-to-door sales). So that only the surplus is supplied to the Papeete City Market. However, even at a generous assessment, the production of the local bonito-boat fleet could hardly exceed 2,000 tons per year - 1,700 tons in the Windward Islands (Tahiti accounting for 1,500), 200 tons in the Leeward Islands and 100 tons in the other island groups. This is rather low and far below the possible yield from the natural stock.

The Fisheries Department of the Territory of French Polynesia therefore decided to carry out research into the possibilities offered by live-bait fishing techniques. In 1972-1973, following an agreement reached with an American firm, three live-bait fishing vessels came to carry out tests which, though mainly involving the Windward Islands, were also extended to the Leeward Islands and even to certain areas around the Tuamotu and Marquesas Islands.

In the Windward Islands (Tahiti, Moorea, Maiao), the initial live-bait fishing operations, carried out between February and June 1972 with the boat Moetu, yielded only fair to middling results, with an average per trip of a mere 337.5 kg of fish, the total number of fishing trips being 28. A second operation was organized between December 1972 and February 1973 with the boat Anela; and very encouraging results were obtained in the course of 19 fishing trips, with a recorded average of 5,355.5 kg of fish caught per trip. Further Redonda, a third boat, put out to sea five times between the end of March and the beginning of April 1973, returning with almost 1,000 kg of fish per trip.

It should be pointed out that a considerable percentage of the catches comprised large skipjack tuna of over 8 kg. Weighing on an average 13.3 kg between February and June 1972, and 11.9 between December 1972 and February 1973, these fish bring up special problems both as regards the most suitable bait-size and the fishing gear to be used.

Research was also carried out in the Leeward Islands. In 20 fishing trips between February and September 1972, the Moetu recorded an average yield of 577.7 kg of fish per trip, i.e. about 60% more than was recorded in the Windward Islands during the same period. The Anela, operating from the end of December 1972 to the beginning of January 1973, confirmed Leeward Islands prospects with a yield over 6 fishing trips of 3,018 kg per trip, which is excellent.

Finally, the few trials made in the Tuamotu Archipelago were disappointing, though in the Marquesas Islands the skipjack population seems to be considerable and likely to provide mammoth yields, at least in season.

The information accumulated in the course of the experiments carried out by the Moetu, the Anela and the Redonda, is only a beginning, and there are still many problems to be solved before progress can be made in setting up live-bait fishery operating along industrial lines.

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Live-bait Skipjack fishery Experiments in various French Polynesian Island Groups

Boat	Period	Trips	Fish caught								Total		Yield/trip	
			Skipjack						Yellowfin tuna					
			2 - 3 Kg		3 - 8 Kg		8 - 20 Kg							
			No.	kg	No.	Kg	No.	Kg	No.	Kg	No.	Kg	No.	Kg
Leeward Islands														
MOETU	20 - 25 Feb. 72	2	27	54							27	54	13.5	27
	19 - 30 March 72	5	970	2910					62	2440	1032	5350	206.4	1078
	1 - 7 July 72	7	181	543					173	990	354	1533	50.5	219
	21 - 24 August 72	2			270	4050					270	4050	135	2025
	28 August - 8 Sept. 72	4	162	426					3	90	165	516	41	129
ANELA	14 - 20 Dec. 72	4	635	3810	396	3168	37	555	46	257	1114	7790	2785	1947.5
	14 - 18 January 72	2	80	160			731	10103	6	80	817	10343	408.5	5171.5
Tuamotu														
MOETU	24 July - 3 August 72	4	79	237	2	16					81	253	20	55.5
ANELA	3 - 7 December 72	3	246	663							246	663	82	221
Marquesas														
ANELA	19 February - 25 March 73	5			1735	10410					1735	10410	347	2082
	27 May - 7 April 73	1	391	1173	2110	16880					2501	18053	2501	18053

Results of Experimental Live-bait Fishery in the Windward Islands (Tahiti, Moorea, Maiao)

Boat	Period	Trips	Fish caught: Skipjack 2 - 3 kg No.	Skipjack 2 - 3 kg kg	Skipjack 3 - 8 kg No.	Skipjack 3 - 8 kg kg	Skipjack 8 - 20 kg No.	Skipjack 8 - 20 kg kg	Yellowfin tuna No.	Yellowfin tuna kg	Total No.	Total kg	Yield/trip No.	Yield/trip kg
MOETU	15 - 18 Feb. 72	1	32	64					24	48	56	112	56	112
	6 - 11 March 72	2	34	68			46	690	10	100	90	868	45	434
	13 - 18 March 72	1			1	8	127	1918			128	1926	128	1926
	30 March-2 April 72	1					80	1200			80	1200	80	1200
	4 - 8 April 72	2	50	150					36	360	86	510	43	255
	10 - 13 April 72	3	108	216			2	30	100	1200	210	1446	70	482
	17 - 22 April 72	3	98	196	2	16			17	85	117	297	39	99
	25 - 29 April 72	2					15	180			15	180	7.5	90
	9 - 19 May 72	5	229	458			87	870	70	420	386	1748	77.2	349.6
	23 - 28 May 72	4			13	91	42	425	2	82	57	598	20.5	149.5
	29 May - 2 June 72	2	22	44					19	95	41	139	20.5	69.5
	5 - 10 June 72	2			87	435					87	435	43.5	217.5
MOETU	Total	28	573	1196	103	550	399	5313	278	2390	1353	9449	48.5	337.5
ANELA	10 - 13 Dec. 72	3	907	2721	204	1020	121	1573	79	237	1311	5551	437	1850
	7 - 11 Jan. 73	3	72	37			853	11089			925	11126	308.3	3708.6
	12 Jan. 73	1			253	3102					253	3102	253	3102
	25 - 26 Jan. 73	2					500	8068			500	8068	250	4034
	28 - 30 Jan. 73	2					1606	21722			1606	21722	803	10861
	31 Jan. - 2 Feb. 73	2	20	40			982	12766	2	4	1004	12810	502	6405
	4 - 7 Feb. 73	3					1300	16900			1300	16900	433.3	5633.3
	8 - 9 Feb. 73	1					311	4043			311	4043	311	4043
	10 - 15 Feb. 73	2					1418	18434			1418	18434	709	9217
ANELA	Total	19	999	2798	457	4122	7091	94595	81	241	8628	101756	449	5355.5
REDONDA	27 March - 7 Apr. 73	5	161	644			50	750	1200	3600	1411	4994	282.2	998.8
GRAND TOTAL		52	1733	6638	560	4672	7540	100658	1559	6231	13392	116199		

EXPLORATORY SHRIMP TRAPPING IN THE HAWAIIAN ISLANDS

by

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Introduction

During 1967 and 1968 the National Marine Fisheries Service (NMFS) devoted four cruises of the RV Townsend Cromwell to demersal resource surveys in the Hawaiian Islands. The primary sampling gears utilized were shrimp trawls, although limited shrimp trapping experiments were conducted (Yoshida, 1972). These surveys demonstrated that the penaeid shrimp (Penaeus marginatus) was available in modest amounts and amenable to harvest by shrimp trawls. Two species of caridean shrimps (Heterocarpus ensifer and H. laevigatus) were also taken in small numbers with the trawls. However, the initial investigations indicated that trapping, rather than trawling, was a more effective method for harvesting these latter species.

Clarke (1972) conducted trapping surveys during 1969 and 1970 at seven locales off Oahu, Hawaiian Islands. The sampling gear consisted of several trap types, but all were uncovered traps. These surveys provided data on the depth distributions of H. lensifer and H. laevigatus and indicated that these species were present in sufficient quantities to support a commsrcial fishery.

Further trapping trials were conducted by the NMFS during fall, 1972 at various localities in the main group of the Hawaiian Islands. These trials were of a preliminary nature, and a variety of trap types, bait containers, and baits was utilized. It was demonstrated at this time that traps covered with burlap were more effective in capturing H. ensifer than were uncovered traps. It was also determined that proper catch preservation of this species was essential to insure a quality product.

We also have data from 23 sets of our gear off Oahu by staff members of the Hawaii Institute of Marine Biology, University of Hawaii during May 1973.

Methods

The traps measure 2 by 2 by 4 ft. The frame is constructed of 3/8-inch diameter steel bar and is covered with 1/2-inch square mesh galvanized wire screen. The sides, top, and bottom are then covered with burlap. The tunnels (one at each end) are also constructed with the screen (but are uncovered) and taper to 2- to 3-inch openings about one-third the distance in from each end. Bait containers are constructed with 1/2-inch wire screen and are suspended in the trap between the two tunnel entrances. One to two pounds of chopped bait are sufficient for sets of 12-14 hours.

Each trap has a 7-ft wire bridle attached to opposite corners on the top of the trap. The bridle has a snap at the center for attachment to the ground line. The ground lines and buoy lines consist of 1/2-inch polypropylene rope. The traps are spaced at 10-fathom intervals, and the first and last traps on a string have 5-pound anchors attached to a trap corner. We usually fished six or eight traps to a string, but this would vary according to the capabilities of the vessel. We have our buoy lines made up into 100-fathom lengths, and these are stored in plastic garbage containers of approximately 40-gallon capacity. The ground line is made up with this line by forming loops for each trap at 10-fathom intervals in the distal portion of the first 100-fathom section. The proper number of 100-fathom sections are then added as the traps are set in order to give an excess amount of buoy line on the order of 50-150 fathoms greater than the depth of water being fished. Just before the entire amount of line is payed out, a buoy is attached and set as the final few fathoms are run out. A weight is snapped onto the buoy line about 10 fathoms below the buoy to assure that the polypropylene line does not float at the sea surface. The set is retrieved with a Marco* crab-pot hauler; the 100-fathom sections are stowed directly into their containers as the line comes aboard.

Because the trapping operations were interspersed with other vessel programs, the traps were set at dusk and retrieved at dawn. We do not have data on daytime catch rates.

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* Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

Results

Different types of traps, bait containers, and baits were tested by various combinations of these factors on sets of four to eight traps per string. Traps measuring 1 by 2 by 4 ft were less effective than the larger traps measuring 2 by 2 by 4 ft. Traps with 1-inch mesh wire screening caught fewer H. ensifer (through escapement) than those with 1/2-inch mesh screening. Comparison between alternated covered and uncovered traps during eight sets of four to six traps resulted in the covered traps outfishing the uncovered traps by 2.5-10 times. Possibly the covering on the sides of the trap concentrates the bait scent near the entrances at the ends of the traps, resulting in greater catch rates. Quite probably traps constructed of any material that conforms to the basic design principle of the covered trap would be equally effective.

Saveral bait container types were tested. Containers constructed of 1/2-inch mesh screening (measuring 6 by 6 by 6 inches) were generally superior to plastic containers of the same size perforated with 1/4-inch holes or bait wrapped in cheesecloth.

Five types of bait were tested: finely ground fish, squid, shrimp (H. ensifer) and coarsely chopped fish and shrimp. Chopped fish species that are oily or bloody were found to be the best baits. Possibly the fine-ground baits dispersed too rapidly. Fish and shrimp were superior to squid.

Catch rates of H. ensifer obtained during 1972 were highly variable due to the variety of traps, bait containers, baits utilized and depths sampled. At this time the best catches ranged between 15 and 63 pounds per trap for an overnight set.

More reliable data on catch variability was provided by 21 sets of covered traps (four per set) off the south coast of Oahu in depths of 200-220 fathoms during spring, 1973. Only one bait type (fish) was utilized. During this series of sets catches of H. ensifer ranged from 2 to 34 pounds per trap and averaged 15.2 pounds per overnight set. Considerable variation in catch rates between localities was noted.

These catches of H. ensifer with covered traps generally exceeded those experienced by Clarke (1972) off the northeast coast of Oahu with uncovered traps. Catches there for nine sets in the 150-250 fathom depth range varied from 0.6 to 11.9 pounds per trap and averaged 4.5 pounds.

The larger H. laevigatus is apparently much less abundant than H. ensifer. Our usual catches of H. laevigatus were 1-3 pounds, but occasionally ranged up to 9 pounds per trap. Clarke (1972) experienced similar catch rates.

The model size group of H. ensifer retained by the 1/2-inch mesh traps range from 35 to 45 individuals per pound (heads on). The largest individuals of H. laevigatus range from 8 to 12 per pound. For both species the tail (with shell) comprises about 45% of the total body weight.

Clarke (1972) found that H. ensifer occurs in depths of 80-400 fathoms in the Hawaiian Islands, but is most abundant between 150 and 250 fathoms. Shrimps taken in this latter depth range were found to be significantly larger than those taken at the upper and lower limits of the total depth range. H. laevigatus occurred in depths of 200-400 fathoms; there was no obvious trend in abundance between 250 and 400 fathoms. Our findings during all surveys are in accord with these results. The optimal depth range for H. ensifer corresponds to bottom temperatures of 7°-13°C.

The traps have been fished on a variety of bottom types. The only constraints are that the slope must be gentle enough to permit the traps to fish without drifting off and the bottom must be smooth enough to obviate trap loss.

Attempts to market the two species of Heterocarpus in Hawaii have been generally unsuccessful in the past. This is due to enzymatic breakdown of the chilled tail meat within 12-24 hours which results in a soft and unacceptable product when cooked. We found that cooking the shrimp immediately after catching resulted in a chilled shelf life of 3-4 days. One test of immediate freezing of raw shrimp in a brine solution at about -20°C resulted in a superior product. After brine freezing, the shrimp were placed in a conventional freezer and tested at intervals over a 2-week period and found to be very acceptable. Very little salt was taken up by the shrimps during brine freezing.

Care must be taken not to overcook these species. Boiling times of 2-4 minutes are adequate for the frozen shrimp. The tail meat can be shelled easily for other methods of preparation by briefly thawing with running water.

H. ensifer is known to occur in tropical waters from the western Atlantic to Hawaii. This species, and/or a congener undoubtedly occurs in areas of the South Pacific. The standing biomass of H. ensifer has been greatly underestimated in the past because shrimp trawls appear to be inadequate sampling devices for this purpose. If members of this genus are as abundant in other regions of the tropics as in Hawaii, together they probably represent a biomass exceeding that of any commercially exploitable tropical crustacean.

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Developing the Exploitation of *Trochus niloticus* Stock on the Tahiti Reefs

Readers of our Newsletter have already been informed that the stock of trochus (*Trochus niloticus*) which has developed on the reefs of Tahiti, from a few dozen specimens introduced in 1957 from New Caledonia has started to be methodically harvested (see SPIFDA Newsletter No. 3-4, March 1972, p. 32).

Begun in the southern part of the island (Tahiti Iti peninsula, districts of Tautira and Pueu), the harvesting, strictly supervised, was gradually extended to the whole of the island and over four diving periods from November 1971 to June 1973, more than 350 metric tons of shells were marketed (from over 450 tons of live specimens, for a value of about 5 million Frs CFP (equivalent to about US$ 70,000).

Results of the trochus diving operations

District	Diving period from	to	Number of diving days	Gross weight in kilos	Net weight of shells marketed kilos	Sale value in Francs CFP
1st Period						
TAUTIRA	3.11.71	14.12.71	234	70,541	56,430	790,048
PUEU	2.11.71	24.11.71	97	18,605	15,300	214,000
2nd Period						
TOAHOTU	7. 8.72	15. 8.72	89	10,883	8,200	114,800
VAIRAO	15. 8.72	30. 8.72	216	36,229	27,420	362,290
MAATAIA	19. 6.72	10. 8.72	125	12,724	4,374	65,600
TEAHUPOO	8. 8.72	29. 8.72	159	31,471	25,240	314,710
PAPEARI	26. 6.72	27. 7.72	33	3,456	2,641	39,615
3rd Period						
FAAA	4.12.72	11.12.72	70	16,983	7,250	101,898
PUNAAUA	5.12.72	8.12.72	151	27,766	22,320	416,490
PAEA	5.12.72	14.12.72	86	18,051	8,540	97,633
PAPARA	5.12.72	7.12.72	94	29,460	21,632	346,112
PAPARA (mortal.)	11.12.72	12. 1.73	181	61,200	48,717	673,111
PAPEARI	4.12.72	11.12.72	76	16,756	13,210	198,200
PAPEARI (mortal.)	8. 1.73	12. 1.73	9	6,410	4,964	89,352
MATAIEA	4.12.72	12.12.72	82	15,585	12,210	185,400
4th Period						
PAPEETE	4. 6.73	8. 6.73	43	7,516	5,014	68,704
PIRAE	4. 6.73	8. 6.73	14	4,132	3,326	46,278
ARUE	6. 6.73	11. 6.73	12	3,603	2,420	36,030
FAAONE	18. 1.73	19. 1.73	78	5,880	4,674	93,480
AFAAHITI	18. 1.73	22. 1.73	54	13,200	9,815	176,601
PUEU	18. 1.73	19. 1.73	116	25,200	20,293	344,981
MANINA	5. 6.73	7. 6.73	39	4,432	3,685	66,335
TIAREI	7. 6.73	9. 6.73	44	5,873	4,699	92,445
HITIAA	5. 6.73	7. 6.73	76	12,325	9,280	149,606

These excellent results are due to a carefully planned and controlled organization. This could be set up since trochus shell is a completely new resource which has at no time been a part of the traditional socio-economic system, so that it was excluded from all custom-based constraints and competition between rival family or professional groups. Harvesting is authorized through a special ordinance of the Governor of French Polynesia, which determines the opening and closing of the diving season, and the appropriate quotas per village and per district. The size of trochus shells should be over 8 centimetres and under 12 centimetres. The fleshly portion is to be removed either by immersion in water or by means of a metal hook. Any trochus shell that has been immersed in boiling water for more than 30 minutes is considered as being unfit for sale, and is to be destroyed by the Fisheries Department staff.

All trochus shells harvested are to be submitted to a Control Committee which certifies their place of origin and supervises sales. The Committee in each village comprises representatives of the Local Council and those of local fishermen, along with a member of the Chamber of Agriculture and two officers from the Fisheries Department. Buyers must have a permit issued by the Fisheries Department.

This system ensures the conservation of trochus stock now well established on the Tahiti reefs. Further, it makes for sales that are fully satisfactory both for fishermen and buyers.

Apart from being in charge of the technical organization involved in the process of harvesting and marketing, the Fisheries Department of French Polynesia has undertaken highly advanced scientific research on the characteristics of the new stock. This study of dynamic ecology is the subject of a Ph.D thesis in Biological Sciences which is to be submitted in Paris (Sorbonne and Museum National d'Histoire Naturelle) at the end of 1973 by Mr Philippe SIU, a native of the Territory and a biologist in the Territorial Fisheries Department.

Trochus flesh is beginning to be used in the manufacture of dried food in pellet form for the rearing of shell-fish (Macrobrachium and Penaeid shrimps). The CNEXO Laboratory in Tahiti has developed a dry food made from trochus shell and skipjack, which is very palatable for shell-fish and has a very high conversion ratio.

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Development of the "Turtle Project" in French Polynesia

The Department of Fisheries of French Polynesia has continued its efforts towards better knowledge of the problems involved in the conservation of green turtle (Chelonia mydas) stock in the Tropical and Equatorial Pacific.

Taking into account the advice and recommendations of SPIFDA consultants Professors Hirth and Hendrikson, a tagging programme was initiated at the beginning of 1972 (see SPIFDA Newsletter No. 5, May 1972, p. 23-24) with support from the SPC and SPIFDA. An initially encouraging result came when two tagged turtles were recovered in July and August 1972, in Fiji and Tonga respectively (see SPIFDA Newsletter No. 6, September 1972, p. 14). Despite difficulties and the cost of operations to be carried out in the Scilly atoll (Fenua Ura) the French Polynesia Fisheries Department went ahead with its tagging programme in December 1972 and February 1973, which made for the recovery of two turtles in Fiji and Wallis, tagged in February 1973. As the SPIFDA Project is about to terminate, it is timely to review the progress achieved through this joint effort.

Catching and tagging turtles

Under the supervision of Mr Jean TAPU, French Polynesia's Chief Fisheries Officer, a team visits periodically the Scilly atoll, west of the Society islands group, where it is common knowledge that turtles come regularly and in great numbers to lay eggs. The turtles are caught either on the beach or by diving, and kept in pens constructed within the closed lagoon, formerly used to hold turtles awaiting despatch to the Papeete market. When enough turtles have been collected, measurements are taken and the turtles are tagged before being released into the lagoon, from which they can get back to the open sea, crossing the reef barrier at high tide. As the island of Scilly is so far away from Tahiti (500 km), such operations can only be carried out two or three times a year. Details of the work done are given below:

1st operation

During April 1972, 67 female green turtles were tagged, being released on 30th April. All the turtles had been caught on the beaches of the atoll from January 1972, and had to be kept in pens and fed on green leaves during their captivity. Tag numbers were 13 to 98. Measurements made: total length and width of shell, plastral length, width of head.

2nd operation

During December 1972, 166 female green turtles and 13 male ones were tagged and released. 32 turtles had been caught in October and November and held in the pen. 147 turtles, 13 of which were males, were caught in the course of the operations which were all effected outside the reef on the outer sea-slope. The same measurements were made on all the turtles as in the case of the 1st operation. Besides this, it was possible to weigh 148 females and 7 males. Tag numbers from 68 to 75, 101 to 212 (186 missing) and 1301 to 1361.

3rd operation

From the middle of December 1972 to mid-February 1973, 107 females turtles were caught on the beaches of the atoll and placed in pens. After they were tagged, measured and weighed, they were released on February 19th, 1973. Tag numbers 1362 to 1468.

Thus, during operations carried out in three series, 353 green turtles (Chelonia mydas) were tagged and measured, of which it was possible to weigh 262. The total weight of the 353 turtles released may be taken to be 43,000 kilos, representing a potential market value of about 5 million francs CFP ($US 65,000) in the Papeete market.

Results

Some numerical data are given in the following tables.

Size in centimetres, total shell-length of turtles tagged in Scilly atoll by the Fisheries Department of French Polynesia

cm	30 April 1972 females	December 1972 females	December 1972 males	February 1973 females	Total
80		1		3	4
80		1		3	4
81					-
82		1			1
83		1			1
84		2		1	3
85		1	1	1	3
86		3	1	2	6
87		1	1	2	4
88	1	2	1	5	9
89	1	3		3	7
90		9	3	4	16
91		5	1	4	10
92	4	14		3	21
93	5	14	1	6	26
94	8	8		6	22
95	3	7	2	11	23
96	3	9	1	4	17
97	4	12		7	23
98	7	17		9	33
99	5	4		6	15
100	2	14		5	21
101	9	7		4	20
102	6	10	1	5	22
103	2	6		3	11
104	4	3		4	11
105	2	3		3	8
106	1	3			4
107		1		1	2
108		3			3
109		1			1
Total	67	166	13	107	353

Weight of turtles tagged in Scilly atoll, taken before they were released in the sea

Weight in kilos	Number of turtles			Total
	December 1972		February 1973	
	males	females	females	
70 - 79		1	2	3
80 - 89	1	1	3	5
90 - 99	2	14	9	25
100 - 109	2	17	13	32
110 - 119	1	23	16	40
120 - 129	1	22	22	45
130 - 139		24	13	37
140 - 149		28	16	44
150 - 159		10	6	16
160 - 169		4	5	9
170 - 179		2	2	4
180 - 189		1		1
190 - 199				-
200 et plus		1		1
Total	7	48	107	262

Migration of turtles tagged in Scilly

4 turtles tagged in Scilly were caught 3 to 4 months after their release in an area about 1,500 to 2,000 nautical miles to the west.

Date of release	Tag No.	Sex	Centimetres				Date of capture	Places
			Shell		Plastral Length	Head Width		
			Length	Width				
30.4.72	18	F	101	77	84	14	9.8.72	Vavau island, Tonga archipelago
30.4.72	26	F	102	71	77	14	26.7.72	Rabi island-Vanua Levu, Fiji arch.
19.2.73	1402	F	88	67	71	12	26.6.73	Wallis island
19.2.73	1403	F	95	73	77	12	mai 73	Lami Point (Suva) Viti Levu island, Fiji archipelago.

This brings out clearly the fact that all South Pacific island groups are involved in migrations by green turtles (Chelonia mydas). The phenomenon calls for a regional approach if one is to obtain concrete results in conserving and developing stocks of this species, considered everywhere as symbolizing the constancy of the island way of life.

Ensuring that green turtles are protected by very strict rules in French Polynesia (see the new text promulgated in December 1971, SIPFDA Newsletter No. 5, May 1972, pp. 25-26) would hardly seem to serve any purpose if elsewhere the indiscriminate massacres of these animals were to be continued.

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Catch Data, American Samoa Tuna Longline Fishery, 1972

Month	Total hooks (thousands)	Albacore		Bigeye Tuna		Yellowfin Tuna	
		Thousands of fish	C/100 hooks	Thousands of fish	C/100 hooks	Thousands of fish	C/100 hooks
January	2,735	66	2.4	8	0.3	28	1.0
February	2,822	36	1.3	13	0.5	46	1.6
March	2,951	35	1.2	12	0.4	53	1.8
April	3,057	134	4.4	8	0.3	37	1.2
Mai	3,667	170	4.6	9	0.2	28	0.8
June	3,353	111	3.3	9	0.3	22	0.6
July	3,891	143	3.7	14	0.4	26	0.7
August	3,252	105	3.2	12	0.4	23	0.7
September	2,415	48	2.0	11	0.5	25	1.0
October	2,164	43	2.0	8	0.4	13	0.6
November	2,439	45	1.8	10	0.4	13	0.5
December	2,741	68	2.5	6	0.2	14	0.5
T o t a l	35,487	1,004	2.8	120	0.3	328	0.9

The above data are summarized by months for the year 1972. Because of the length of the fishing trips, the data for the last quarter are probably incomplete.

The tuna fishery is made up primarily of Korean and Taiwanese vessels. Japanese vessels had essentially pulled out of the fishery in 1972. The data presented were derived from logbook records collected by the Honolulu Laboratory, National Marine Fisheries Service. Logbook records were collected from an average of 70% of the trip actually made. Hence, the catch per 100 hooks statistics were calculated directly from the data, while the total catch and hooks data were estimated using the logbook information and the percent of trips made by the fleet that were actually sampled.

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