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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

INDO-PACIFIC FISHERIES COUNCIL

PROCEEDINGS

5TH MEETING
BANGKOK
THAILAND
22nd January–5th February, 1954

SECTIONS II AND III

IPFC Secretariat, FAO Regional Office
for Asia and the Far East,
Bangkok
1955

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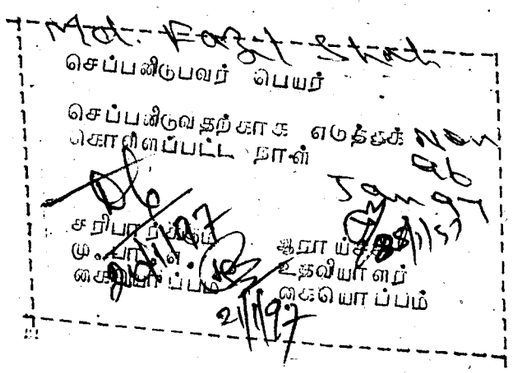

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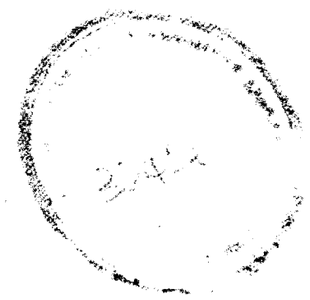

Section II

TECHNICAL PAPERS

1

CHINESE SYSTEMS OF POND STOCKING

by

S. Y. Lin[1]

The basic principle of the Chinese system of stocking ponds for fish culture is to accomplish the full utilization of the space and food available in the pond. On the basis of this principle the system has evolved of stocking various species of carps which live on different types of food and dwell in different layers of water in the same pond. The practice of introducing more than two species of fishes in a pond for cultivation is common in many countries but the idea of associating numerous species in definite proportions seems to be a unique feature of Chinese pond culture. The fishes used are :

1. The grass carp, *Ctenopharyngodon idellus* (Cuv. & Val.), an upper layer dweller and chiefly herbivorous in feeding habit.
2. The black carp, *Mylopharyngodon piceus* (Richardson), a snail and shell-fish feeder.
3. The big head, *Aristichthys nobilis* (Richardson), a macroplankton feeder.
4. The silver carp, *Hypophthalmichthys molitrix* (Cuv.&Val.), an omni-plankton feeder.
5. The mud carp, *Cirrhina molitorella* (Cuv. & Val.), a bottom feeder on worms and small particles of organic origin.
6. The common carp, *Cyprinus carpio* Linnaeus, an omnivorous feeder and bottom scavenger.
7. The bream, *Parabramis pekinensis* (Basilewsky), an omnivorous feeder.
8. The grey mullet, *Mugil cephalus* (Linnaeus), feeding on small particles of cereal and organic matter.
9. The milk-fish, *Chanos chanos* (Forskal), an algae and soft-vegetable feeder.

By means of various systems of stocking, a high production is achieved. But in this connection the fact that all the Chinese ponds are heavily fertilized with manure and the fish are regularly fed with organic matter of both animal and vegetable origin cannot be overlooked. In the silk-producing areas the fish are fed with oil cakes, silk-worm waste, grass, kitchen waste, cereals, etc., at least twice a day, although many canals and field ponds in the low-lying lands are not provided with regular artificial feeding.

Stock spacing.—The conception that 5.6 cubic metres or 4.5 square metres in surface area of water should be given to a carp to raise it to marketable size does not hold true in the Chinese practices. As is indicated in the following tables, when carps are raised for market, the fish farmers usually stock their ponds with 5,250 to 12,200 fingerlings of various sizes per hectare, so that the space allowed per fish is very small, being 1.3 to 3.3 cubic metres or 0.94 to 2.0 square metres. An extreme condition of intensive stocking is shown in the brackish-water ponds of Hong Kong (Table 11). Because of the cheap and abundant supply of grey mullet fry, the brackish-water pond in Hong Kong is stocked with exceedingly great numbers, so that this pond contains as many as 30,700 fish per hectare. In the case of total survival, therefore, there would be only 0.32 square metres of water area available per fish. To relieve the fish from a condition of overcrowding (and to provide them with more space and favourable conditions for growth) after 3 or 4 months part of the stock is fished out once every day or twice a week for market; the larger mullet over 150 grammes in weight are selected for sale, while the smaller ones are returned to the pond for further rearing.

The fish farmer in Malaya practises an entirely different system of stocking; he first rears the young fry about 40 mm long for a few months until they grow to 350–500 grammes in weight and then introduces these fish into the stocking pond at the rate of only 645 to 1,120 fish per hectare, i.e., one fish occupying 9 to 15.5 square metres of area of water, about 130 cm deep, which is a great contrast to the 0.94 to 2.0 square metres per fish in the ponds of South China.

KIANGSU AND CHEKIANG AREA

The characteristic feature of the ponds in the low-lying lands of Kiangsu and Chekiang is their depth, ranging from 2 to 7 metres. As is shown in the following tables, the black carp is more important than the grass carp in pond culture in this area on account of its high market value, and the mud carp is not available because of the cold climate.

[1] Fish Culturist, F.A.O. Expanded Technical Assistance Programme.

Pond snails as food for the black carp are easily obtained from neighbouring canals and rivers. The general belief in this district that grass carp and black carp cannot be grown together on account of their similar feeding habits and roaming nature is more imagination than truth because the black carp feeds chiefly on shellfish, especially the pond snails, while the grass carp is mainly a vegetarian, although it will, when hungry, devour food of both animal and vegetable origin.

It is, however, to some extent true that both the grass carp and the black carp are active fish, roaming everywhere in the pond, and they will interfere with each other in movement when a large number of them are present in the same pond. Both the black carp and the grass carp succumb easily to bacterial diseases such as intestinal inflamation, dysentery, gill rot, etc., and cannot tolerate foul water so well as do other species. The mortality rate of these two species in congested ponds is always high; the fish farmer, learning through experience, is prepared to recognize the almost inevitable result that 50% of his 2,000 or more original stock of black carp or grass carp per hectare will have disappeared at the time of harvest, and it is

Table 1

Typical stocking systems in the Kiangsu and Chekiang low-lying areas (Hung 1946 and She 1946).

Species	Length of fish-fry in mm	Number of fish per hectare of pond with average depth of water 2½ metres		
Systems		A	B	C
Black carp	250-350	1,000	2,000	2,100
Grass carp	200-300		2,000	
Silver carp	150-200	3,000	3,000	2,400
Big-head	150-200	600	1,600	
Common carp	120-150	200	200	1,200
Bream	150-180	500	500	
Black carp		2,000	200	
		7,300	9,500	6,000
Approximate m² of water for a fish:		3-4	2.6	4-1
Approximate m² of water for a fish:		1.3	1.0	1.6

According to Chu, Chang, and Tsui (1934) the stocking systems generally used in Ling Hu, Chekiang for ponds 3 to 7 metres in depth are as follows:

Table 2

Other stocking systems in Chekiang.

Species	Wt. of an individual fish yearling (gms)	Number of fish per hectare		
Systems		D	E	F
Big-head and silver carp	500	4,500	4,500	9,000 3,000[1]
Grass carp	500	600		
Black carp	500		450	200
Common carp	200	200	200	
Total		5,300	5,150	12,200

[1] In many cases 3,000 black carp are used instead of the grass carp.

probable that this fact accounts for the practice of not stocking large numbers of the two species together in one pond.

The fish farmer here believes that the presence of the common carp is necessary in every pond as it acts as a scavenger due to its omnivorous feeding habits and serves as a "protector" of the pond, but that it is not advisable to stock too many in a pond lest it hamper the growth of other species. In other localities, where common grass is available in sufficient quantity, the grass carp is used as a principal species.

Table 3 compiled from data given by C. S. Chen (1935), Liu (1935) and Hung (1946) shows the growth rate of the various carps in the ponds of the Yangtze delta area. First year fish are actually two years old as the fingerlings available for stocking—measuring over 150 mm long and weighing over 200 grammes—originate from the river fry of the previous year. The relationship between the number of fish introduced into the pond, the productivity and mortality, can be calculated according to the general stocking formula, taking into account that the artificial food supplied to the fish has been incorporated into the natural productivity. This productivity may vary from 2,000 to 5,000 kgs per hectare per annum or an average of 3,500 kgs, the total initial weight of the fish being 200 kgs and the average increase per fish 500 gms.

If n = the number of fish to be stocked,
p = average eventual weight increase per fish,
p_1 = initial weight of fish introduced,
p_2 = gross productivity weight, and
V = mortality,

Then
$$n = \frac{p_2 - p_1 + V}{p}$$
$$= \frac{3500 - 200 + V}{0.5}$$
$$= 6600 + V$$

Thus, if 7,300 fish yearlings were introduced into the pond, the mortality in this case would be 7,300 − 6,600 = 700 or 10.6%

In such a case it is the general practice to stock around 7,000 fish per hectare in order to produce fish of the desired marketable size. The smaller the number of fish put in the pond, the bigger they will grow during the season.

Based on the data of Tables 1 and 3 the possible production can be calculated as shown in Table 4. (Mortality is not included in this calculation).

If all the conditions under which a pond is managed are ideal it is possible to have 3,863 kg and 4,815 kg/ha/annum for ponds A and B, respectively, in the lower Yangtze area, although in practice production varies according to individual management and the actual condition of the pond.

Black carp stocking.—The black carp is highly esteemed as a food fish in the lower Yangtze regions and its cultivation is extensive. There are many ponds that are mainly devoted to black carp cultivation. As this carp is very sensitive to heat and will suffer heavy mortality in congested and foul waters, it is not raised in association with a large number of other species. Actually, many fish farmers prefer to stock their pond with black carp alone, although they are not so productive in comparison with those stocked with a combination of species. Nevertheless, the chance of serious loss is comparatively slight if the black carp is raised alone. Tables 5, 6 and 7 represent some common practices employed in Tinghai, Shaoshing, and Chekiang. Liu (1935) also mentions similar stocking in his "Practical Fish Culture".

The mortality in the first year varies from 10 to 20%, so that the gross production figure is roughly 3,000 kgs per year; the actual net increase in total weight should of course be 3,000 less 254 kgs (the

Table 3

Growth rate of carps in Yangtze River Region in grammes.

Species	First year		Second Year		Third Year	
	Total wt. per fish	Net increase per fish	Total wt. per fish	Net increase per fish	Total wt. per fish	Net increase per fish
Black carp	600	550	2,750	2,250	5,000	2,750
Grass carp	600	560	2,000	1,400	4,000	2,000
Silver carp	750	700	1,500	750	3,000	1,500
Big-head	750	700	1,500	750	3,000	1,500
Bream	375	340	750	385	...	...
Common carp	400	350	750	350	1,500	1,350

Table 4

Calculated production of Kiangsu and Chekiang ponds.

Species	No. of fish	Increase in wt. in first yr. (gms)	Calculated production (kgs)
Pond A			
Black carp ..	1,000	550	550
Silver carp ..	3,000	700	2,100
Big-head ..	600	700	420
Common carp ..	200	340	68
Bream ..	500	250	125
Black carp ..	2,000	300	600
Total ..	7,300		3,863
Pond B			
Grass carp ..	2,000	550	1,100
Silver carp ..	3,000	700	2,100
Big-head ..	1,600	700	1,120
Common carp ..	200	340	68
Bream ..	500	250	125
Black carp ..	200	300	60
Total ..	7,500		4,573

Table 5

Stocking system for first year rearing in ponds 130-150 cm deep.

Species	Initial wt. per fish in gms	Age	No. of fingerlings per hectare	Wt. per fish in gms after 1 yr. rearing	Total wt. of fishes calculated in kgs
Black carp ..	35	3 to 9 months	6,000	500	3,000
Silver carp ..	40		400	600	240
Big-head ..	40		400	600	240
Common carp ..	30		400	350	140
Total ..			7,200		3,620

Table 6

Stocking system for second year rearing, depth of pond 2 metres.

Species	Initial wt. per fish (yearlings) in gms	age	No. of yearlings per hectare	Wt. per fish in gms after 1 yr. rearing	Calculated total wt. of fish in kgs
Black carp ..	500	15	1,300	2,750	3,575.0
Silver carp ..	600	to	100	1,500	150.0
Big-head ..	600	21	80	2,000	160.0
Common carp ..	350	months	50	750	37.5
Total ..			1,530		3,922.5

Table 7

Stocking system for third year rearing, depth of pond 2½ to 3m.

Species	Initial wt. per fish (yearlings) in gms	age	No. of yearlings per hectare	Wt. per fish in grams after 1 yr. rearing	Calculated total wt. of fishes in kg
Black carp ..	2,750	27	240	5,000	1,200
Silver carp ..	600	to	400	1,500	600
Big-head ..	600	33	300	2,000	600
Common carp ..	350	months	200	750	150
Total ..			1,140		2,550

total initial weight of the fish), or 2,746 kgs. The fish at this stage are usually kept as yearlings for the second year rearing in deeper ponds, and the system of stocking shown in Table 6 is used.

If the mortality in the second year is 10%, the total calculated yield is 3,530[1] kgs and there is usually no mortality in the third year. As the initial total weight of fish in the second and third year ponds are 775.5 kgs and 1,150 kgs, respectively, we have then: 3,530-775.5 equals 2,754.5 kgs being production in the second year, and 2,550-1,150 equals 1,400 kgs production in the third year.

The second year, in which yearlings of 350 to 500 grams are used as stock, is the most profitable, as its theoretical yield comes to 3,922.5 kgs/ha/annum against 3,620 kgs of the first year and only 2,550 kgs of the third year. The same holds true in the actual increase of weight, for we have 2,754 kgs in the second and 1,400 kgs in the third year. No attempt is made to rear black carp for the fourth year.

WEST RIVER REGION

This area includes most provinces of South China and Tonkin. Examples taken for discussion here are based mainly on actual pond management in Kwangyung and Kwang-i, especially the Delta Region. The most prominent feature of pond culture practice in South China has been the growing importance of grass carp, the decrease in importance of the black carp and the introduction of mud carp into pond associations. As the black carp grows better in the temperate zone than in sub-tropical or tropical areas, it is no longer an important cultivated fish in Taiwan, Fukien, Kwangtung and regions farther South. As the climate becomes hot, there is a higher incidence of disease, resulting in increased mortality; the grass carp and the mud carp, on the other hand, grow better in warm waters and the fertile land of South China supports considerable quantities of grass to feed the grass carp while the temperature in winter is not low enough to kill the mud carp, which is very hardy and can be widely acclimatized in warm water ponds.

The systems of stocking adult fish in ponds in South China do not, however, differ in general principle from those of the lower Yangtze regions. As shown in Table 8 the grass carp, the silver carp or the mud carp are the three most important species in the pond associations. Either the grass carp, the silver carp or the mud carp constitutes 25 to 40% of the total yield of the pond; the other species, though essential to production, are introduced to utilize all the available space and to clean up surplus food.

In analyzing the conditions under which each system works we find that the fish farmers' practical management stands on substantial ground. For example, in Table 8 pond A is located in the silk production area of the Canton delta, where common grass and aquatic plants are easily collected to feed the fish; in addition, the silkworm faeces and remnants of mulberry leaves constitute a nutritious diet for the grass carp. The bottom soil is fertile since it receives organic and inorganic nutrients from the surrounding watersheds, and thus the pond is capable of supporting a large number of mud carp. The common carp reared in these ponds is useful as a scavenger when present in small numbers. However, it will disturb the balance of the pond if a large number is stocked. The black carp will devour most of the snails and mussels occurring in the pond. These are the essential conditions under which the systems for pond A and B have been developed, but a fish farmer may alter the systems to meet particular local requirements.

[1] 3,922.5 — 392.25 = 3,530.25

Moderately deep ponds.—When a pond is of considerable depth and has good water bloom, and common grass is difficult to obtain, systems C and D are usually practised because the plankton (produced in the pond both naturally and through regular addition of fertilizers) will support the normal growth of the large number of silver carp and big-head and the mud carp and common carp at the same time are able to find enough food in such fertile ponds. This type of stocking is common in the thickly populated Canton delta area. Stocking systems E and F are suitable for deeper ponds with plenty of water supply.

Now, based on the information given by fish farmers in the Canton delta area concerning the average rate of growth of various carps, it is interesting to figure out how far these actual systems of stocking agree with the general principle. First let us examine pond F (Tables 8 and 9) which represents one of the most productive of the delta ponds in South China.

Under optimum conditions, the mortality would have been 25% or 50% as claimed by the fish farmer, but as a matter of fact ponds belonging to this category are few. A production of 6,000 kgs a year is considered very high but is by no means impossible since grass carp and silver carp are harvested twice a year (in July and January) thus giving more space for the rest of the grass carp and other fishes to grow faster in the fall.

Table 8

Six systems of stocking the ponds in South China (Lin. 1940).

Species	Length of young fish in mm	No. of fishes per hectare of pond with average depth of 1½m			No. of fishes per hectare of pond with average depth of 2m		
		Pond A	Pond B	Pond C	Pond D	Pond E	Pond F
Grass carp	60-150	1,200	1,200	600	480	1,200	2,400
Silver carp	100	300	240	600	1,200	1,800	400
Big-head	100	300	240	1,200	510	1,800	400
Mud carp	75	1,800	4,800	..	2,400	3,600	7,200
Common carp	50	1,200	360	3,600	..	1,200	300
Black carp	50-100	100	24	120	60	..	150
Bream	75	..	..	..	600	..	..
Total		4,900	6,864	6,120	5,250	9,600	10,850
Approx. M^3 of water per fish		3.0	2.2	2.4	2.8	2.0	1.9
Approx. M^2 of water per fish		2.0	1.5	1.6	2.0	1.0	.94
Average annual production in kg.		2,500 to 5,000				6,000	

Table 9

Production of Pond F (one hectare).

Species	No. of fish	Total initial wt. (kg)	6-month & annual increase of wt. per fish (gr)	Total wt. of each species (kg)	Actual annual production as claimed by fish farmer (kg)
Grass carp	2,400 (800)	70	1,500	1,200	2,200[1]
Big-head	1,600		2,000	3,200	
Silver carp	400	50	2,000	800	800
Mud carp	7,200	50	2,000	800	800
Common carp	300	144	200	1,440	1,440
Black carp	150	..	1,250	375	360
Total	10,850	20	2,500	375	360
		334		8,190	5,960

[1] The Grass carp have 50% mortality.

Let us take 5,960 − 334 kg equals 5,626 kg as P the production of the pond (with artificial feeding) and 8,190 − 334 equals 7,856 kg as the theoretical total increase in weight; then each fish would have an increase p of approximately 700 gms per year. Thus:

$$n = \frac{P}{p} \text{ plus } V = \frac{5,626}{.700} \text{ plus } 25\% = 10,000 \text{ fish.}$$

This is quite close to the actual figure (10,850) per hectare used by the fish farmer. Of course when accurate data are available each species has to be calculated separately and feeding factors worked-out in order to arrive at somewhat more precise stocking figures.

Shallow ponds.—Ponds with water less than one metre in depth must be stocked with small numbers of fishes and are therefore not so productive as the deeper ones. By comparing Tables 8 and 10 we see that rich deep ponds with water of two metres or more can accommodate more than 10,000 yearlings and produce more than 5,000 kg/ha/annum. Shallow ponds are stocked with 3,200 to 3,600 fingerlings or yearlings and produce not more than 200 kg/ha/annum. As the water in those shallow ponds is hot during the summer months, they are not suitable for stocking with mud carp and black carp. The other carps are introduced during February and March and harvested in August to October. The fish in excess of 500 gms in weight are then marketed and the smaller ones transferred to deeper and larger ponds for further rearing. It is a general practice that when a pond becomes shallow through long period of silting, the soft bottom mud is removed and placed on the wide embankments where mulberry trees or vegetables are grown.

Table 10

Systems of stocking and production of shallow pond with water less than 60 cm in average depth (Hoffmann, 1934).

Species	Initial wt. per fish (grams)	No. of yearlings	Pond A (one hectare) wt. of fish of 6-8 months (kg)	Total wt. of each species (kg)
Grass carp	50	240	1.000	240
Silver carp	40	1,200	0.800	960
Big-head	100	120	1,200	144
Common carp	0.5	1,680	0.200	336
Total		3,240		1,680
			Pond B (one hectare)	
Grass carp	50	480	.600	288
Silver carp	20	972	.600	583
Big-head	150	240	.800	193
Common carp	0.4	972	.150	146
		2,664		1,210

STOCKING SYSTEMS IN HONG KONG

The fish farmers of Hong Kong have demonstrated how brackish-water ponds can be successfully utilized for intensive fish culture on a commercial scale. Although the supply of fresh-water is inadequate in this area, they have managed to preserve rain water for continuous use through the dry winter season (Lin, 1940 and 1949).

In several coastal districts of Kwangtung, Fukien and Taiwan, and also in Japan, Hawaii and the Philippines, large tidal pools are sometimes enclosed by constructing dykes, in which a gate is built to permit the entry of brackish water at flood tide. During certain seasons the fry of the grey mullet together with the young of the sea bass, sea bream, sea perch, milkfish, etc., are carried into the enclosed area by the rising tide. When the tide begins to run out the gate is closed, so as to retain all the fish fry, the most desirable of which are, of course, the grey mullet. In some cases such foods as wheat and rice bran are used to feed the fish in captivity in order to accelerate growth, but many fish farmers prefer to let them thrive on such natural foods as are produced in the pond. The fish farmer who uses this crude method of fish farming seldom expects a good harvest of grey mullet because no precautions are taken to exclude or destroy the predatory sea bass and sea perch which devour most of the grey mullet.

In about 1928 a wealthy and enterprising fish farmer of the New Territories began to improve the conditions under which grey mullet were cultured; better ponds were constructed for maintaining the water in the enclosed area at a lower salinity than that in the bay. In addition, the fry of the grey mullet is not merely carried into the pond with the tide but is supplied from a reliable source and the fish farmer is always sure, therefore, that only the right kind of mullet fry is present. Experiments have also been made in rearing the grey mullet in association with fresh-water fish.

Although many facts remain to be elucidated, the results so far obtained are exceedingly encouraging. The proper stocking of ponds is still one of the fundamental problems in pond culture and its solution will require time and patience and much practical research. After many years of experience, the owner of one of the largest fish farms in the New Territories recently discovered that the following association proved fairly satisfactory: grass carp (2-4 inches) 2,500 to 3,000; silver carp and big-head (3 inches) 5,000; mud carp (about 2 inches) 30,000 to 40,000; common carp (2 inches) 20,000; grey mullet (1 to 1¾ inches) 50,000 to 80,000; and bream (2 inches) 300 or less. In other ponds one or two of these species are absent and the number of grey mullet may be increased accordingly, but in all cases the grey mullet must be the most numerous species in the brackish-water pond.

However, as is indicated in Table 11, the farmer does not as a rule follow any hard and fast stocking method. The number of fish which it may be decided to introduce depends to a great extent on personal experience, knowledge of the ponds and the availability of spawn. When in some particular year mullet spawn is abundant, it might happen that a farmer might decide to stock his ponds with twice as many grey mullet as another in the same district, in which case he would introduce less grass carp and mud carp.

To avoid overcrowding, the grey mullet must be thinned out daily as soon as they reach a size above 5 inches and this process usually commences in June. The fish are rather sensitive to the reduction of the oxygen content of the water during hot weather, when there may be high mortality from suffocation if this gradual removal does not take place; more space is also made available for the proper growth of the remaining fish. The freshwater carps are hardier fishes than the grey mullet and they can be left in the ponds with safety. To ensure uniform growth, it is desirable to stock a pond with fry of uniform size. When the fish have been reared in a pond for four months or longer some of them will have grown faster than others; it then becomes necessary to collect them by means of a large seine and to pick out the larger specimens either for sale or for transfer to other ponds which are either not yet stocked or which contain fish of about the same size. This gives a chance to both the smaller fish left in the original ponds and the larger ones in the new ponds to grow faster. Another method is to catch every day with a cast net, retaining the larger specimens for market and returning the smaller ones to the pond.

Table 11

Three systems of stocking adopted in the brackish-water ponds in Hong Kong (Lin, 1940).

Species	Length of fry in mm	Average number of fish per hectare of pond with water from 1 to 2½ metres in depth		
		Farm A	Farm B	Farm C
Grey mullet	25-45	12,000	27,360	15,000
Grass carp	50-100	1,534	300	700
Silver carp	75	2,208	2,568	600
Big-head	75	1,536	624	600
Mud carp	50	9,600	3,120	9,000
Common carp	50	..	..	4,800
Bream	50	..	..	..
Total		26,868	33,972	30,700
Approx. M² of water surface for a fish		.38	.30	.32
Average annual production in kg per ha.		2,434	1,872	..

Table 12

Two systems of stocking as practised by farmers A and B in the New Territories.

Kinds of fish	Farm A		Farm B	
	Total No. of fish in 7 ponds (14 ha)	Approx. No. of fish per ha	Total No. of fish in 9 ponds (20.7 ha)	Approx. No. of fish per ha
Grey mullet	178,500	12,750	565,965	27,297
Grass carp	21,600	1,543	1,645	80
Silver carp	31,266	2,233	53,264	2,568
Big-head	21,756	1,554	13,195	624
Mud carp	136,645	9,760	65,455	3,120
Total	389,767	27,840	698,624	33,689

MALAYA AND THAILAND

As Chinese carps are among the principal fish reared in ponds in Malaya and Thailand, the general rule for stocking is similar to that practised in China. However, some modifications have been introduced to suit local conditions.

The most outstanding features are: (1) less fish are stocked in a pond and (2) the grass carp becomes the most important species in ponds. Common carp fry are obtained locally but the grass carp, the silver carp and the big-head must be imported from China; the growth rate of the mud carp is too slow to compensate the expense of bringing the spawn from China to Singapore or Bangkok. Moreover, because of the high cost of transportation the fish farmer in Malaya can only afford to purchase a limited quantity of spawn. The common grass relished by the grass carp is, however, abundant everywhere, and by taking advantage of the consistently warm climate, the grass carp are thinly stocked in association with silver carp and the big-head, and are heavily fed with grass. As a result the fish grow very rapidly and two crops of marketable fish may be harvested in a year.

Table 13 shows the four systems of stocking with variations depending on the availability of the fish fry.

Table 13

Systems of stocking Chinese carps in Malaya and Thailand.
No. of fish per hectare of pond with water 1.2—1.5 metres deep).

Species	Wt. of young fish in gms	Pond 1	Pond 2	Pond 3	Pond 4
Grass carp	350-600	300	320	375	500
Big-head	,,	100	120	75	175
Silver carp	,,	100	125	75	200
Common carp	30-60	145	150	120	250
Total		645	715	645	1,120
Approx. M³ of water per fish		20.1	18.1	20.1	13.3
Approx. M² of water area per fish		15.5	14.0	15.8	9.0

A study of the production of ponds in Malaya as compared with the stocking system is most interesting. The Malayan fish farmers claim that their ponds produce from 2,000 to 2,500 kg of fish per hectare per annum. In theory the yield of the pond is quite close to the figures shown in Table 14 obtained by multiplying the number of fish stocked by the increase of weight during the period of rearing.

Table 14

Production per hectare of the Malayan ponds stocked according to the system adopted for pond 3.

Species	(a) Av. wt. of young fish (gms)	(b) No. of fish stocked	(c) Estimated wt. of fish after 5 months (gms)	(d) Total yield c × b kg	(e) Total increase in weight (d−a × b kg)
Grass carp	500	375	1,800	675	487·5
Big-head	500	75	3,000	225	187·5
Silver carp	500	75	2,400	180	142·5
Common carp	40	120	400	48	43·2
Total ..	..	645	..	1,128	860·7

The total weight of the young fishes is 267·3 kg (d − e) and the total increase in weight after 5 months is, in round figures, 860 kg a year.

The fish farmer at Singapore, not being satisfied with this yield, has developed another stocking system which has increased production considerably. Instead of rearing the fish to 500 grammes in a nursery pond for a period of about 3 months, he allows the fingerlings to grow in the nursery for 8 months where they attain 1,500-2,000 grammes in weight and the fish are then placed in fattening ponds for another 6 months. Table 15 shows that such a pond can produce 2,652 kg per hectare in 14 months or 2,273 kg per hectare per year. Here the productivity of the rearing pond, which is about 2,825 kg per hectare per 8 months, is higher than that of the fattening pond and it would therefore have been more profitable on a tonnage basis to sell the fish at this stage, but unfortunately the market requirement is for bigger fish, and the fish farmer has to raise them further in order to fetch higher prices even at some sacrifice in production per hectare.

Progressive methods of fish stocking—In order to avoid unnecessary losses due to predatory fishes, frogs, snakes and insects and to provide equal feeding opportunities, it is a general practice to raise fish of about the same size in a pond. It is also advisable to use ponds of different depth and area for the production of the various stages; this procedure has several economical and technical advantages which can be summarized as follows: (1) as small fishes do not need large and deep ponds as do larger fishes, it is imperative to grade them according to size as far as possible; (2) small fish require more care than larger ones and if they are kept in small ponds the enemies can more easily be kept away, the water more easily controlled and feeding more easily regulated; (3) the growth of the fish is enhanced by providing them with optimum conditions, which change with growth; (4) an old pond will

Table 15

Stock figures and production per hectare of Malayan ponds.

Species	Rearing pond stocking			Adult pond stocking		
	Wt. of each fingerling (gms)	No. of fish stocked	Growth per fish after 8 months (gms)	No. of fish stocked	Growth per fish after 8 months (gms)	Total yield (kgs)
Grass carp ..	30	1,250	1,500	450	3,000	1,350
Big-head ..	40	250	2,000	150	4,000	600
Silver carp ..	40	250	1,800	175	3,500	612
Common carp ..	30			225	400	90
Total ..		1,750		1,000		2,652

tend to become silted and a change will free the fishes from contaminated water and promote health in the new environment; and (5) the fish may be counted and weighed as they are transferred from one pond to another.

The application of the progressive method of stocking to augment the yield of a group of ponds by a Singapore fish-farmer provides an excellent example to illustrate the above points (*Figure 1*). The farmer owns a total of approximately 3·9 hectares of water area, which is divided into 6 separate ponds, the biggest measuring approximately 1·4 hectares, two others 8,000 sq. m each, one of 5,000 sq. m and two of 2,000 sq. m each. All of them receive good water supply. The two smallest ponds, A and B with a depth of 60 and 75cm respectively, are used for rearing fingerlings or yearlings and the rest are fattening adult ponds averaging 1·3 metres in depth.

The farmer buys a thousand spawn of about 50 mm length (500 to 700 grass carp, 150 big-head and 150 silver carp) from a nurseryman who imported them from China. They are placed in pond A for rearing for a period of a month; at the end of this period, as all the fish have grown to about 150 mm and about 30 to 40 gms each, they are caught with a seine, about 600 of the largest ones are selected for introduction into the second rearing pond B and the rest are left in the original pond. They are then allowed to grow for 50 to 90 days or longer until they attain 350 to 600 gms in weight. During these rearing days, the fry are fed intensively with rice bran, duckweed, peanut cake and later, in the second rearing pond, also with tender common grass. At the end of the second rearing period these yearlings are ready for transfer to the fattening ponds.

The fish farmers in China apply this method with some modifications, but in many cases they prefer a selective marketing method to increase production. The brackish-water ponds in Hong Kong are a good example. Also, in the deltaic regions of China, carp of different ages are reared in different ponds; some of the Shun Tak fish farmers harvest their ponds twice a year by selecting those which have reached a marketable size for sale at the middle of the year and transferring the remaining smaller ones to another pond for further rearing, stocking of the first pond commencing anew at this stage.

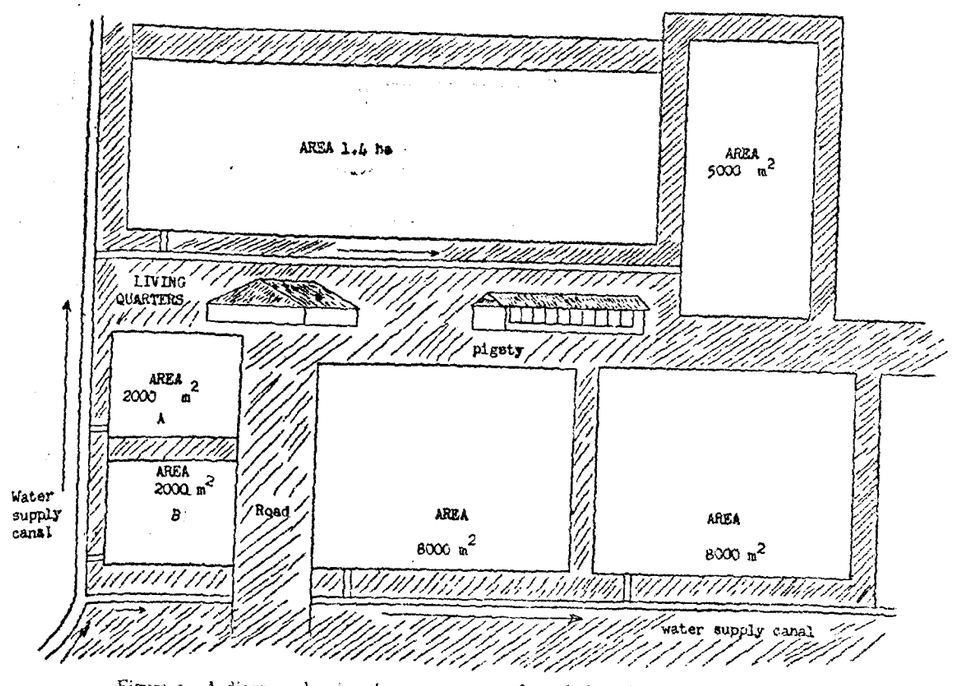

Figure 1—A diagram showing the arrangement of ponds in a fish farm in Singapore.

According to Sasaki (1943) the Taiwan milkfish pond is highly productive; 4,000 fry of the previous year are introduced to one hectare of pond and reared from April to June or July and the fish are allowed to grow to about 300 gms each when they are then harvested and marketed. Meanwhile the same pond has been stocked with subsidiary new fry collected from the sea in May or June which are reared until November of the same year, attaining about 150 gms, at which weight they are suitable for sale as bait for the tuna fisheries. In this manner of management one hectare of pond with 2 stockings and 2 harvestings can produce more than 1,200 kg of fish a year.

Chen (1952) summarises the system of stocking milkfish in Taiwan ponds as is shown in Table 16.

Table 16

Stocking figures of one hectare of Taiwan milkfish ponds.

	No. of fish introduced	No. of fish removed	No. of fish in pond
March			
April			
May	3,000		
June	5,000	..	3,000
July	..	..	8,000
August	3,000-4,000	..	8,000
September	..	3,000	8,000-9,000
October	..	..	8,000-9,000
	..	..	8,000-9,000
	..	..	3,000-4,000
	..	..	3,000-4,000

The 3,000 yearlings 6 to 11 cm long which were collected the year before and kept in the winter pond are introduced into one hectare of production pond in March or April. They are then reared for three months to reach a size about 300 gms and are ready for market. In April when new young fry are collected from the sea about 5,000 fish are added to the pond, and again in June when the older fish have been harvested, another 3,000 to 4,000 young fry are introduced, making a total of not more than 9,000 fish in the pond. Three months later, *i.e* in September or October, about 5,000 larger fish of about 150 gms weight are removed and sold, and the remaining 3,000 to 4,000 smaller ones will be kept in the winter ponds for next year's stocking. Most of the production ponds in Taiwan are drained and kept dry for some months in winter, so as to increase the productivity of the pond.

Besides being reared separately in brackish-water ponds, milkfish are also grown in freshwater ponds in Taiwan in association with the grass carp, the common carp, the silver carp, the big-head and the mud carp, but there appears to be no definite stocking system which has been generally adopted by the fish farmers. According to the Kangshan Fish Culture Cooperative and Chen (1952), some milkfish ponds in Taiwan may produce as much as 2,000 kg per hectare per annum.

SUMMARY

1. In raising fish for food the Chinese system of stocking appears to be very economical and efficient and at the same time provides various types of fish for market.

2. The different species of the carp family so far as known give the most satisfactory association in ponds although such fishes of other families as grey mullet, milkfish etc. are also used in slightly brackish-water ponds.

3. Among the 9 kinds of fish introduced into ponds in association in China, the grass carp, because of its feeding habit, appears to be the universally dominant one, although the black carp is important in some farms in the lower Yangtze delta area and the silver carp in the West River delta area.

4. Having learned through long years of experience and tradition the Chinese fish farmer adopts different systems of pond stocking in accordance with (1) the climate, (2) fertility of the pond, (3) condition of water supply, (4) availability of fish fry, (5) availability of feeding stuff, (6) depth of the pond, (7) market demand and (8) size of the fish used for stocking. All these important factors for pond stocking need further explanation and discussion later.

5. Better production of a pond has been actually achieved through the practice of adopting proper systems of stocking and selective catching. The practice of proper stocking and selective catching is also responsive for the better production of the Taiwan milkfish ponds.

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2

DO CHINESE CARPS SPAWN IN JAPANESE WATERS?

by

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Three species of Chinese carps, *Ctenopharyngodon idellus*, *Hypophthalmichthys molitrix* and *Aristichthys nobilis* are now frequently seen in natural waters in Japan and are often raised in ponds. According to the records of the Japanese Government Fisheries Agency, the fry of the first two species were imported from Shanghai as early as 1878. The fish introduced at that time appear to have survived, but there is no record of further shipments of Chinese carps until the period of the two world wars (1915-1945). These later shipments included fry of *Aristichthys nobilis* and *Mylopharyngodon piceus*, and perhaps others.

Contrary to the general belief that these species may grow normally, but will never spawn when stocked in waters other than those of their native habitat, numerous young individuals have been collected in Japanese waters since 1947 and there is reason to believe that these were the offspring of the introduced fish. However, no direct evidence of spawning activity was encountered, either in natural waters or in fish ponds.

Experiments revealed that sex hormones, when fed to *C. idellus*, may induce development of the male gonads, but the females did not respond to similar treatment. It was, however, found possible to cross the *C. idellus* males which had been brought to sexual maturity in this manner with female *Cyprinus carpio*. But it is too early to say whether the hybrids thus obtained will survive and spawn.

HISTORY

According to the records of the Japanese Government Fisheries Agency, the fry of Chinese grass-carp, *Ctenopharyngodon idellus*, and silver-carp, *Hypophthalmichthys molitrix* were introduced to Japan from Shanghai as early as 1878. The result of this initial introduction may be considered to have been successful, since the fish later attained sizes of 30 to 85 cm both in fish ponds and in lakes. However, no further shipments of fry have been made since that time until the recent years, probably because of the lack of an enthusiastic demand from the fishermen, due to the unfamiliar appearance of these foreign species.

The necessity of obtaining increased quantities of fish for food, which has been gradually felt during the recent war periods, brought about considerable activity in various fields of the fisheries industry, including the renewed importation of Chinese carp fry. The known records of fry shipments are shown in Table 1. The Chinese carps transferred to Japan were mostly of the two species mentioned above, but, as explained by Lin (1949), the fry-stock has recently also included *Aristichthys nobilis* and *Mylopharyngodon piceus*, and probably others. The introduction of these fry came to an end in March, 1945, and no shipments have been made since then, despite a strong demand from fishermen and fish culturists in this country.

PRESENT STATUS

The renewed introduction of Chinese carp fry (Table 1), made in the years of 1941 to 1945, resulted in the establishment of quite large populations in rivers, lakes and ponds of Japan and adult fish

Table 1. Record of shipments of Chinese carp fry to Japan**

Year	Locality of fry collection in China	Number of fry	Destination in Japan
1878	Yangtze River	.....	3 Prefectures
1915	West River	.....	(Former) Tokyo University of Fisheries
1920	Chao River	.....	Shiga Pref. Fish. Exp. Stn.
1935	West River	5,000	,,
1936	,, ,, ...	20,000	3 Prefectures
1941	Kiu River	40,000	4 Prefectures
1942	,, ,, ...	240,000	19 Prefectures
1943	,, ,, ...	1,160,000	17 Prefectures
1944-45	,, ,, ...	1,300,000	21 Prefectures
		1,000,000	

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** Source: Japan Fisheries Agency.

resulting from these introductions are often seen in fish ponds and elsewhere. Unfortunately, however, the present distribution of the species in natural waters is not clearly known, except for some sporadic collections made by fisheries workers and indications received from fishermen. From these data it may be assumed that these Chinese species are commoner in the western half of the main island of Honshu and in Kyushu and Shikoku than in the north-eastern part of the main island. There are frequent reports of the occurrence of these fish especially around Lake Kasumi near Tokyo and Lake Biwa north of Kyoto city, but it may be merely due to the fact that more attention is paid to these large bodies of water by fisheries workers rather than to any special abundance of the fish there. As to the amounts caught of these species, we are at present unable to obtain any reliable information.

The chief interest of the fishermen in the Chinese carps are:

(1) the fast rate of growth,
(2) the large size attained, surpassing almost all the species of native freshwater fishes, and
(3) their feeding habits, which do not interfere with those of the native species. In addition to the food value of these fishes, the use of *C. idellus* as a weed destroyer in farm ponds has been now recognized. In his experiment Hata (1949) found that the species may be used in preference to chemicals for the elimination of noxious weeds which indirectly influence the production of *Cyprinus carpio* and *Carassius auratus* which are the principal objective in farm-pond fisheries operations.

Reliable information on the growth of these fish in Japanese waters is again scanty, and the available data are given in Table 2. Nevertheless, the fishermen and fish culturists of Japan are very anxious to obtain the fry of *C. idellus*, frequently requesting the Government and other appropriate agencies to resume the importation of the seed from abroad.

DISCOVERY OF YOUNG OF CHINESE CARPS SPAWNED IN NATURAL WATERS

Our limited knowledge tells us that *C. idellus* and *H. molitrix* grow adequately when transplanted outside their native rivers. However, according to Nakamura (1949) and others, they have never been known to spawn in the waters where they were stocked outside China. This was believed to hold true in Japanese waters, and was the only objection to their general utilization.

This concept had, therefore, been generally accepted by both fishermen and fisheries scientists of Japan for a considerable time prior to 1947. In that year Mr. M. Tange of Ibaraki Prefecture Fisheries Experimental Station collected several specimens of young Chinese carps at Lake Kita, about 65 km east of Tokyo city. These young fish were identified as *C. idellus* and *H. molitrix*. Since then, further collections of these young carps were made almost all along the coast of Lake Kita and in nearby Lake Kasumi. They were also found along the River Tone, which enters the two lakes at the southern end (Tange, 1949, 1951 and 1952); in 1950 two juvenile *C. idellus* were also collected in Teganuma, a swamp connected with the Tone River. In the meantime, Nakamura (1949) discovered a number of young specimens of *C. idellus* and *H. molitrix* in the River Watarase, which is a tributary joining

Table 2. Length-weight data on the adult Chinese carps collected or raised in Japanese waters.

Species	Body length in cm	Weight in kg	Age in years	Waters	Source
C. idellus ..	91	7.9	—	Natural	Tange (1949)
	50-60	1.9-1.2	5 (?)	,,	Kawamoto (1950)
	124	20.6	—	,,	,,
	113	24.0	—	,,	,,
	92	11.8	—	,,	,,
	78-82	13-15	7	Pond	Sugiura and Kajikawa (1951)
	103	12.7	—	Natural	,,
	78-89	14	8	Pond	Sugiura (1952)
	113	17.25	—	Natural	,,
M. piceus ..	89	13.5	—	,,	Tange (1949)
A. nobilis ..	89	17.8	—	,,	,,
H. molitrix ..		17	—	,,	,,

the Tone at a point about 100 km above the lakes above mentioned.

In August, 1950, Mr. Tange succeeded in finding young fish identified as *Aristichthys nobilis* in the same River Tone and later in Lake Kasumi (Tange, 1952).

Whether these young specimens originated in the waters where they were found is now questioned. In his report of 1949 Mr. Tange made a careful study of the specimens collected in the lake region. Firstly, in the region where most of the young specimens were collected, it is learned from the records that the liberation of fry originating from China took place in January, 1943 and March, 1945, but never afterwards. Those fish should, therefore, have grown to 3 years old by March, 1948. The author also made a comparison of his collected specimens with those of which the exact age is known, and a check of the length-weight measurements and the number of growth rin s on the scales was attempted as between these two lots of fish. It was found that in *C. idellus*, the fry about 5 cm in body length grow to about 40 cm in 3 years and 55 to 65 cm in 4 years and the annuli numbered 9 or 10 in these fish. In the lake specimens collected in 1948, the fish measuring 8.8 to 14.7 cm in body length had 3 rings with or without another poorly recognized ring, and those measuring 17 to 18.5 cm showed 4 rings, while a fish of 28.2 cm had 6 rings. Based on this study of length and growth rings the author believed that his specimens collected since 1948 were undoubtedly born in the waters where they were collected.

The present writer places considerable importance on the data presented by Mr. Tange and also believes that *C. idellus* spawn in Japanese waters. He is not, however, convinced that the growth rings constitute a reliable criterion of age determination in this species, at least in the presented data, and Tange's (1949) conclusion that two rings signify one year old fish seems to be a premature conclusion. This, of course, does not nullify the thesis that the species reproduces in Japanese waters.

The young of *H. molitrix* were studied in a similar way by the same author. His finding is as follows:

Table 3. Selected data on length-weight measurement of young of three Chinese carps collected in Japanese waters.

Locality	Date	Number of Specimens	Body length in cm	Weight in gr	Source
C. idellus					
Lake Kasumi and Kita	Sept. to Nov., 1948	18	8.8-25.2	13.5-387	Tange (1949)
River Tone ..	Jan. to Dec., 1949				
Tegaruma	Feb., 1950	15	9.3-43	20-1,688	,, (1951)
River Watarase ..	Jan., 1950	24	6.1-11.9	5-31	,,
Lake Kasumi ..	Jan., 1949	2	9.4,19.7	13.2,159	,,
	Sept., 1950 to Jan., 1951	1	19.2	82	Nakamura (1949)
		4	20-22	191-234	Tange (1952)
H. molitrix					
Lake Kasumi and Kita	Oct.—Nov., 1948	9	10.1-19	20.3-134.8	Tange (1949)
River Watarase ..	Jan., 1949	1	18.4	72.5	Nakamura (1949)
River Tone ..	Aug., 1950	14	9.6-11.5	15.5-29	Tange (1952)
,, ..	,,	15	3.3-5.8	0.65-4	,,
Lake Kasumi ..	Sept. to Dec., 1950	6	6.7-20	6-176	,,
A. nobilis					
River Tone ..	Aug.—Sept., 1950	4	4.3-7	1.4-6.6	Tange (1952)
Lake Kasumi ..	Dec., 1950	1	15.7	95	,,
,, ..	Jan., 1951	1	14.2	63.5	,,

the pond-raised fry grow from 6 cm in body length to 18 cm in 8 months, 27 cm in 9 months and 37 cm in 10 months, these fish having 2, 3 and 3 growth rings on scales respectively at the end of these periods. The specimens collected in the River Tone in August, 1950, were 3.3 to 11.5 cm in body length, and these fish were smaller even than the fry shipped from China, which seems to be a positive indication that they were born in the river where they were collected. It must be emphasized here that the last introduction of fry from China to Japan was made in March, 1945. The 9 young specimens collected in October and November, 1948, measured 10 to 19 cm in body length, and 7 out of 9 had only one ring on the scales, two fish showed 2 rings, one having 2 plus one doubtful ring. On the basis of the rate of growth of this species in ponds as noted above (which is by no means a suitable comparison), it appears that these fish were also born in Japanese waters.

The discovery of young *A. nobilis* by Tange (1952) was made in August and September of 1950 in the waters of the River Tone near Lake Kasumi. These specimens measuring 4.3 to 7 cm in body length were also firmly believed by the author to have been born there. The present writer agrees with him in this belief on the basis of the size of fish, provided that the species was accurately identified.

As is explained above, the Chinese carps, *C. idellus* and *H. molitrix*, are believed to spawn in Japanese waters, judging from the collection of their young. The question then arose as to whether their spawning habits could be observed in these waters. It is regretted, however, that our knowledge of their spawning habits is completely lacking at the present moment, though we do know in what natural conditions these species spawn in their native Chinese rivers, through the works of Lin (1935) and Chen and Lin (1935). The observations of the natural environment in Chinese waters, however, gives no information relating to the actual spawning of these fish, the only positive indication being that they lay their eggs in rivers but not in standing water of lakes. This suggestion was advanced by Tange (1949) and Nakamura (1949), on the basis of the locality and time of collection of young specimens. On the other hand, Kawamoto (1950) believed that in Lake Biwa *C. idellus* " come towards the shore for spawning " from April to June. This belief was based on the study of the gonads of the adult fish. Dr. Kawamoto's belief, however, has not up to the present been actually proved. The fishing intensity is very high in that lake and fishermen there would not have overlooked the occurrence of the young foreign species if these were found mixed in their catch.

APPLICATION OF HORMONES TO INDUCE THE DEVELOPMENT OF GONADS IN *C. IDELLUS*

In our traditional experience of fish culture it has been generally accepted that the spawning of freshwater fish does not greatly depend on environmental factors. This concept, held especially by practical fish-culturists, has however received a check in the absolute sterility of introduced Chinese carps both in the natural waters and also in their own fish-ponds, and this has given rise to considerable conjecture. In order to solve this curious problem, attempts were made, in various ways, to induce the fish to spawn in ponds, but unfortunately we have never witnessed the actual spawning of the fish in enclosed waters. The following, however, are the results of some experiments carried out by fisheries scientists.

A painstaking experiment was made by Kawamoto (1950) with the object of obtaining fry of *C. idellus* in ponds. He administered hydrosol of androsteron and enteron to the fish, mixed with the diet, and in his 55 repeated experiments it was found that the males of *C. idellus* so treated arrived at sexual maturity, which was recognized by the exudation of milt from fish under manipulation. Moreover, at least some females produced apparently matured ova which, however, were not fertile. In this experiment it was also found that, in this species, the development of the gonads was actually hastened by the application of sex hormones.

Saguri and Kahikawa (1951) fed *C. idellus* confined in ponds with a fortified diet of silk-worm pupae, water plants, calcium salts and vitamin E, over a period of 3 months. The results of this experiment were identical with those obtained by Dr. Kawamoto viz., only the male fish attained effective sexual, maturity. Saguri's (1952) second experiment with *C. idellus* in which the chemical component in the diet was slightly modified, produced exactly the same results.

CROSSING OF MALE *C. IDELLUS* × *CYPRINUS CARPIO*

When it was discovered that the maturation of the gonad in males of *C. idellus* might be artificially induced in fish-ponds, the next step was directed towards the crossing of this species with the common carp, *Cyprinus carpio*, of which the matured ova are easily obtainable under artificial conditions. In 1948, the Shiga Prefecture Fisheries Experimental Station for the first time attempted such a cross of male *C. idellus* raised in ponds with the female of the common carp also cultivated in ponds.

Hybrids were easily obtained and raised for about 30 days, when they measured 3.7 cm long (Shiga Fish. Exp. Stn., 1950). The second experiment was carried out by Kobayashi and Mizumoto (1950) in the same combination, and it was found that:

(1) the hybrid fry hatched out about 80 hours after fertilization at a temperature of 19° to 22°C. but that they all died within 4 days,

(2) 86% of the hybrids obtained in the experiment showed deformities, especially in the vertebral column. No further attempts at hybridization between these two forms have to our knowledge been made, and those mentioned above represent the sum total of the information available regarding this problem.

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3

ON THE PADDY FIELD PRAWN FISHERY OF TRAVANCORE-COCHIN AND AN EXPERIMENT IN PRAWN CULTURE[1]

by

M. K. Menon[2]

The extensive paddy fields on both sides of the backwaters and many of the connected canals in the northern ports of the Travancore-Cochin State, which are single crop lands, have been used for the past several decades for prawn fishing. Enquiries have revealed that about 11,000 acres of such fields are being utilised for this purpose at present, the annual yields from which, judging from the figures collected, seem to vary very widely, from about 700 lbs. to 1,900 lbs. per acre. Expressed in terms of dry meat, which is the form in which these prawn catches are marketed, the yields vary from 106 lbs. to 295 lbs. per acre. Practically the entire production is exported from Cochin to Rangoon, Singapore and Hong Kong. In 1952, 3,825 tons of dried prawns valued at approximately 85 lakhs of rupees were exported from this port.

The owners of the fields, in most cases, do not fish the prawns themselves, but lease out the fields after the harvest is gathered to those engaged in the industry, deriving thereby, an additional income which, in recent years, has been quite considerable (about Rs. 100 to Rs. 300 per acre). The lessee's right to fish is usually limited to a period of 5 months or less, from about the 15th of November to the 15th of April. He is also required to take out a licence from the State Government.

In view of the importance of this fishery in the economy of these coastal villages it was considered desirable to collect accurate data on various aspects like the annual yield per acre, the monthly catches and their fluctuations, if any, the different species represented, their proportions and size range from month to month etc. A field of about 1¼ acres in extent on the border of one of the main canals of this place was, therefore, taken on lease in October, 1951. It has been divided into two portions, one of which is exactly an acre in area. A sluice 7′ long, 5′ high and 1½′ wide has been put up in each portion.

The one acre portion had been used for carrying on fishing operations while the smaller portion has been devoted to experiments in prawn culture. A similar experiment has also been carried out in a portion of the fish farm belonging to the State Fisheries Department through the courtesy of the Superintendent. The farm was originally a part of a long stretch of low-lying swampy land situated close to the sea shore and not quite suited for paddy cultivation.

FISHING OPERATIONS

The fishery has been described in some detail by Panikkar[3] (1937), but the operations involved may be briefly stated here. Soon after the paddy crop is harvested in October, the bunds of the fields are strengthened and sluices are installed. The method is, in reality, simply a device for large-scale prawn fishing which does not allow any time for the prawns to grow within the fields. Enquiries, however, show that in some localities e.g. in and around Narakkal, the current practice is a later development and that some 25-30 years ago it was actually a process of culture that was in vogue. After allowing prawns to enter the fields in the manner indicated above for some days, the sluices were finally closed and the prawns were left in the completely enclosed fields for 2-3 months after which they were fished.

When letting in water at high tide, the sluice is opened only after the water has risen almost to the highest level in the canal. This is to ensure that the water flows in with the maximum force possible, since the number of prawns entering depends largely on the force and duration of the current. The time taken to bring the water in the field to the same level was 25-30 minutes. A good portion of the water is let out at low tide (this also is done when the level of water has dropped almost to the lowest) so as to allow more water to flow in at the next high tide. A lamp is hung at the mouth of the sluice at night when taking in water in order to attract prawns towards it.

[1] Published with the permission of the Chief Research Officer, Central Marine Fisheries Research Station, Mandapam Camp, S. India.

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[3] Panikkar, N. K. The Prawn industry of the Malabar Coast. *Jour. Bombay Nat. Hist. Soc.* Vol. 34, 1937.

The fishing usually starts with the neap tides, 4-5 days before every new and full moon and is continued for 7-8 days. The net, about 20′ long has a rectangular wooden frame tied to its mouth. Its cod end is tied up with a piece of rope to which a float is attached. When the level of water in the canal is nearly at the lowest limit, the wooden frame of the net is fixed vertically inside the sluice and the shutters are removed. Water rushes out through the net with considerable force, carrying with it some of the prawns, which collect at the narrow end, which is lifted from time to time and emptied into a boat moored nearby. The time taken for completing the operation (till the level of water inside and outside the field is equal) is about the same as that taken for filling the field. If the fishing is done after dusk a light is also used.

MONTHLY CATCHES AND TOTAL YIELD

Operations were started in the first week of December in the 1951-52 season, a fortnight after they had begun in many of the neighbouring fields. In 1952-53 fishing was started somewhat early in the first week of November. The last fishing was done on 18-4-53 and 21-4-53. The weight of prawns (fresh) caught and the number of days on which fishing was carried out in each month are given in Table 1. On the last day cast nets were used since the ordinary method usually leaves a considerable number of prawns and some water behind in the fields. The catches of March and April, when the salinity of the canal water ranged from 26% to 33‰, were on the whole better than those of other months and this was true in regard to several other fields also.

The approximate yield per acre for the two seasons of a number of other fields situated at different places was obtained for purposes of comparison and these are included in Table 2. The yield from every one of these fields is considerably more than that of our experimental field for the corresponding season, probably because, owing to their much larger size, the length of time taken to fill them will be greater, thus allowing a larger number of prawn to pass into them. The table also tends to show that besides acreage some other factors like location, nature of the bottom etc. may also affect the yield.

SPECIES OBTAINED

Eight species of prawns and shrimps have been obtained in the catches, namely *Peneus indicus*, *P. carinatus*, *Metapenaeus monoceros*, *M. dobsoni*, *Palaemon rudis*, *Leander styliferus*, *Caridina gracilirostris* and *Acetes* sp. Among them *P. carinatus* and the last two species have been obtained in extremely small numbers on a few days only and are, therefore, of no importance to the fishery. The percentage values of the other species for each month will be found in Table 3, which also includes the range of salinity of the canal water during each. It is very likely that the fall in the percentage value of *M. monoceros* may be correlated with the rising salinity of the canal water. It is also noteworthy that the maximum numbers of *P. indicus* have been captured in the months of March and April, i. e. at the end of the season, in the other months its percentage value not exceeding 12. Such a low proportion of the only species of penaeid prawn that grows to a fair size in the backwaters is one of the factors that may render prawn farming in such fields hardly more profitable than by the present method. The data collected in regard to growth of penaeids in these environments, particularly

Table 1

Monthly weight of prawn catches in 1951-52 and 1952-53 seasons from a 1-acre field

Month	1951-52		1952-53	
	No. of days	Wt. caught (wet)	No. of days	Wt. caught (wet)
November	..	..	14	105½ lbs.
December	13	78 lbs.	15	113 ,,
January	13	91 ,,	16	74½ ,,
February	14	62 ,,	13	107½ ,,
March	8	125 ,,	16	139½ ,,
April		130 ,,	10	171 ,,
Total ..	61	486 lbs.	84	711½ lbs.

Table 2

Approximate yields per acre of some other fields

Acreage	Situation	Distance	Yield per acre 1951-52		Yield per acre 1952-53	
			Dry meat	Fresh prawns	Dry meat	Fresh prawns
11½	Canal	Adjoining experimental Field	106 lbs.	690 lbs.	131 lbs.	851 lbs.
16	-do-	2 Furlongs north	139 ,,	904 ,,	138 ,,	897 ,,
15	Backwaters	8 miles north	106 ,,	690 ,,	..	..
60	-do-	½ mile east	155 ,,	1,008 ,,	153 ,,	995 ,,
26½	-do-	-do-	294 ,,	1,911 ,,	181 ,,	1,177 ,,
32	-do-	5 miles south	97 ,,	630 ,,	131 ,,	852 ,,

Table 3

Approximate composition of prawn catches and range of salinity

Species	November		December		January		February		March		April	
	1951	1952	1951	1952	1952	1953	1952	1953	1952	1953	1952	1953
		%	%	%	%	%	%	%	%	%	%	%
M. dobsoni ..		87.9	74.6	82.3	81.6	89.8	86.8	89.5	79.2	67.1	34.5	45.7
M. monoceros ..		8.6	14.3	7.0	5.6	0.6	7.5	2.6	2.8	1.1	0.8	2.6
P. indicus ..		1.6	7.5	8.7	11.7	9.0	8.4	7.0	12.5	29.8	2.0	48.0
Pal. rudis ..		1.8	2.5	1.1	0.5	0.5	0.8	0.4	1.5	1.0	..	1.3
L. styliferous ..		..	0.8	0.1	0.5	..	2.4	..	3.9	..	12.6	2.4
Range of sal. ..		4.9	4.9	15.73	19.89	22.41	25.12	24.76	26.74	28.91	31.62	33.24
per 1,000 ..		14.29	18.17	21.33	23.86	24.76	26.74	28.73	29.63	31.26	31.98	23.05

of the two species *P. indicus* and *M. dobsoni* also tend to support this inference.

Unless prawn farming can be shown to lead to an improvement in production, at least in respect of those fields of which the present yields are comparatively low, it has little chance of being adopted by those engaged in the industry. Improvement could be effected if the proportion of *P. indicus* can be appreciably raised, or if they could be made to grow larger than at present within the fields. Observations so far made have indicated the presence of considerable numbers of the fry of this species in the canals and back-waters in October and November.

GROWTH OF *P. INDICUS* AND *M. DOBSONI*

Random samples from the catches of each fortnight have been regularly analysed and the proportion, sex ratio, length frequencies etc. in regard to the three species of peneids determined. The frequencies for each month in respect of *P. indicus*

and *M. dobsoni* have been plotted in order to estimate whether and to what extent growth takes place in the brackish-water environments of the backwaters and canals. *M. monoceros* was omitted from this study because of the insignificant numbers occurring in some months.

The frequency curves in respect of *P. indicus* illustrate a steady diminution in the percentage of prawns exceeding about 90 mm,due to intensive fishing. Further, as the days become hotter many of them would go down into the mud at the bottom of the fields and may not therefore be carried in the out-flowing current.

There is clear evidence of growth, however, in regard to the small sized individuals. The curve for December, 1951, shows that 57.2% of the catch was formed of juveniles measuring not more than 50 mm while those between 50 mm and 90 mm accounted for 14%. In the succeeding months there is a steady fall in the percentage of the former group and a corresponding rise in that of the latter. In March the first group constituted only 20.6% of the catch, while the remainder was almost entirely composed of prawns of the second group. It cannot, of course, be claimed that the whole of this increase in the proportion of the latter is due to growth ; a part of it, no doubt, is only apparent, being the effect of the disappearance of individuals of over 90 mm in length. The majority size group of December, 1951, was 31-35 mm in length while that of March, 1952, measured 71-75 mm.

The curves for November, 1952, to March, 1953, are substantially similar, though the percentage of juveniles does not show any fall in December and January.

It would, therefore, seem that in the conditions prevailing in the canals and backwaters, the extent of growth of these juveniles of *P. indicus* has been about 40-50 mm in the course of approximately 4-5 months.

In the case of *M. dobsoni*, the frequency curves do not help in estimating the growth of the young ones. It seems fairly clear, however, that the vast majority of prawns belonging to this species do not grow beyond 61- 65 mm in the backwaters during these months.

EXPERIMENT IN PRAWN FARMING

While the observations detailed above were in progress, an experiment in farming for a short period of about two months was conducted in the smaller field (about ¼ acre in extent) mainly for the purpose of ascertaining roughly how growth is influenced by the different conditions obtaining in paddy fields. The preliminary operations of taking in water and letting it out were done exactly as described above for a period of 10 days (from 1-2-52 to 10-2-52) and the sluice was kept closed thereafter. On 11-2-52 a few sheafs of paddy straw were introduced in order to approximate the conditions prevailing soon after harvest. A week later the water turned green owing to the abundant growth of microscopic algae[1] and a scum appeared on the surface, which persisted in patches till about 9-3-52. During this period the temperature of the water rose to a maximum of [illegible] during the day and the salinity was 28.7‰ on 5-3-52. Many of the prawns were seen swimming at the surface at daybreak and remained there for about a couple of hours, exposing themselves to the attacks of crows and kites. A little water was therefore let in on some days and this proved effective in preventing the prawns from remaining at the surface long. They seemed to be otherwise unaffected by the conditions induced in the field by the fertiliser and temperature. They were fished in the first week of April, thus allowing about two months for growth. The length frequencies indicated that substantial growth had taken place, although the method adopted to stock the fields with prawns makes it difficult to determine their initial length frequencies.

The differences in the frequencies of most of the groups of *P. indicus* were reduced appreciably, probably because of their unequal growth rates, the smaller groups growing more rapidly than the larger. The increase in the proportion of groups between 75 and 95 mm would also seem to show that growth has been more rapid than in the backwaters and canals.

The second experiment similar to the one described above was conducted in a part of the Government fish farm, about two acres in extent. Its location and the nature of the land have been referred to in the introduction. Water was let in, as in the former experiment, for about 11 days (from 10-3-52 to 21-3-52) and was stopped only after making sure that a good number of prawns had entered. Two days later some sheafs of paddy straw were put in, mainly to stimulate algal growth, which gave rise to the same changes as were noticed in the first experiment. The salinity of the water in the farm rose to 33.06% in the first week of April. As in the previous experiment most of the prawns used to swim at the surface in the morning during the period, but kept to the bottom after allowing some water to pass in occasionally. They were apparently quite healthy as long as the experiment lasted and hardly any mortality occurred. Fishing was done on 8-5-52 and the following day, but some prawns, mostly small, were still left behind. The total quantity fished was 767 lbs. In addition, a few pearl spots, catfish and mullets were also caught. On one day one of the bunds was slightly breached and a few prawns may have escaped before the breach was closed. Making an allowance for this, it would not be wrong to assume that about 800 lbs could have been fished, i.e about 400 lbs per acre.

During the period November to May, at least two and probably three crops of prawns could be raised. The annual average yield per acre could, therefore, be estimated at approximately 800 to 1,200 lbs. As such land is not usually used for rice cultivation and as prawns in the surrounding canals had become very scarce after the monsoon started, the farm was stocked with some young mullets and chanos in the last week of May. Nothing was done to influence their growth and they were fished on the 17th and 19th, October, 1952. The catch consisted of :—

Mullets	79	lbs.
Chanos	527	,,
Pearlspots	26	,,
Other fish	73	,,

The total weight of the catch is thus 705 lbs and the net yield was about 350 lbs. per acre. Though the number of mullets originally stocked was more than the number of chanos, the number actually caught was remarkably few. The experiment would thus seem to show that farms developed in such coastal tracts with facilities for taking in water by tidal action from backwaters and canals could be expected to yield between 1,000 and 1,500 lbs of valuable food per acre annually.

My thanks are due to Dr. N. K. Panikkar, Chief Research Officer of the Central Marine Fisheries Research Station, for his helpful suggestions in the planning of the work and in the preparation of the paper.

[1] According to Dr. F. Thivy, Algologist, there are two dominant species, one a blue-green alga belonging to the genus *Anabaenopsis* and the other a species of diatom of the genus *Chaetoceros*.

4

A COMPARATIVE STUDY ON COARSE DARAK AND CORN MEAL AS FEED FOR BANGOS FINGERLINGS

by

P. G. Padlan* and H. R. Montalban*

ABSTRACT

Due to lack of natural food, artificial feeding is generally resorted to in progressive bañgos fishponds in the Philippines. Experiments recently undertaken show striking possibilities in the use of *darak* (rice bran) and corn meal as artificial supplementary feeds for bañgos fingerlings in the Philippines. Efficiencies of both feeds are compared on the basis of the gains in weight of the fish. Certain economic aspects of the feeding experiments are analyzed in terms of feed cost and fish recovery or production.

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NOTE ON THE OCCURRENCE OF CHANOS FRY IN THAILAND

by

J. Thiemmedh*

Chanos (*Chanos chanos* Forskal) the 'milk fish' is known in Thailand as 'nuan chan thale', 'chalin', 'tu nam cut' and 'dok mai'. Its presence in Thai waters was first recorded by Chabanaud in 1924, and later confirmed by specimens identified by the late Dr. H. M. Smith. Since then, additional findings of full-grown chanos, including matured females containing ripe eggs, have been reported from time to time. However, it was the capture of some young chanos from the brackish-water ponds at Chanburi, on the east coast of the Gulf, by the FAO Fisheries Mission to Thailand during November-December 1948, that presented positive indication of the possibilities for development of chanos culturing in Thai waters.

A scheme for investigating the time and extent of the occurrence of this fish fry has been initiated since the middle of 1950, by the Thai Fisheries Department, at Klong Wan, Prachuab Province, but due to unforeseen difficulties, the intensive work was not carried out until the beginning of 1952.

On 13 September 1950, chanos fry were collected for the first time in Thailand. Since then, collecting operations have been conducted at regular intervals with four kinds of collecting gear. Although it is too early to draw any definite conclusion, yet the data accumulated have shown that chanos fry do occur abundantly in Thai waters, and that they occur from the month of March to December with two peak periods, one in April and May and the other in September.

The results obtained including notes of observations of related ecological conditions are presented in this paper purposely to serve as a basis for more detailed future studies.

Klong Wan is a fishing village situated 8 km south of Prachuab, a coastal town on the western side of the Thai Gulf about 300 km south of Bangkok. The place is named after that of a small tidal canal which drains the waters from the swamps and the nearby areas into the sea through its estuary facing south east.

The highest water level of Klong Wan is 1½ metres above mean sea level and the tidal range is about 2½ metres during the highest tide.

At the mouth of the river there is a long stre of flat sandy beach. Beyond the entrance of t river there are mud flats with sandy clay abo 25 cm thick on the top.

The river water is brackish, with salinity rangi from 1% in the rainy season to 3.5% in dry weather. The temperature of the water varies from 24°C to 32.5°C. The pH of the water is between 6 and 7. The water is generally clear except during the rainy seasons when turbidity is present.

The plants present in the area are mostly mangrove, represented in abundance by the genera *Bruguiera*, *Avecennia*, *Rhisophora* and *Ceriops*. Of the algal forms very common are the blue-green and green algae of the genus *Enteromorpha* and its closely related forms.

Of the fish present, the important ones are the mullets (*Mugil*), sea bass (*Epinephelus* and *Lates*), anchovies (*Stolephorus* and *Setipinna*), threadfins (*Polynemus*), soles (*Synaptura*) and baracuds (*Sphyraena*).

Very common among the invertebrate animals are shrimps, including the larval forms of *Peneus monodon*. The economically important blue crab (*Scylla serrata*) and several species of oysters are also found in the locality.

The four kinds of gear used for collecting fry are (1) the triangular scoop net or push net, (2) the seine or drift net, (3) the Philippines "saplad" and (4) the Indonesian "blabar".

1. THE SCOOP NET. The scoop net is made of a piece of triangular coarse cotton cloth of 2 mm mesh, with two of its sides attached to two crossed bamboo poles each about 1.24 m long. When fully stretched the net is about 90 cm wide at its outer margin and is about 50 cm deep. The fisherman pushes the gear forward, back and forth, in the water pools and on shallow, gently sloping, sandy shores. After a while the net is raised and the fry are dipped from it by means of a small cup. After sorting they are kept in earthenware jars.

2. THE DRAG NET. This is simply a small cotton seine of about 3 m long and 1.2 m wide with a mesh of 2 mm. Its four sides are sewn to cotton ropes c

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½ inch diameter. The rope ends are left extending beyond the wings of the net for handling purposes.

When in use, two persons, each handling the ends of the ropes on a side, keep dragging the seine along the beaches until a number of chanos fry are caught. The operation is then stopped and the fry are transferred to the fry containers by means of a dipper.

3. THE "SAPLAD". This is a stationary trapping gear introduced from the Philippines. The gear consists of two main parts: the two wings and the net proper. The wings are made of closely set nipa leaves arranged in place and fixed to bamboo stakes, and are constructed in a V-shaped barricade with the opening facing the entrance of the river mouth, estuary or the sea. The net proper is made of cotton cloth about 1½ m long and 80 cm wide. It is suspended by means of strings on four bamboo poles right at the opening of the intersection point of the wings. The net is set facing down stream, in a hammock-like shape at the bottom of a shallow area with water about a metre deep.

In actual operation the fry collector stands close to the net using a small, white basin to collect the fry which come with the incoming tide. The fry pass into the trap and reach the net. They are taken out and stored in the fry containers. The collecting operation continues until the tide becomes too high for the collectors.

4. THE "BLABAR". This gear was introduced from Indonesia. It consists of a jute fibre rope about 20 metres long, with dried herb sedge closely twisted in a garland-like fashion with a diameter of about 8 inches. The gear is set up in a straight line at right angles to the shore line, and is kept floating in the shallow water along the sandy shore with the ends of the rope tied firmly to the fixed bamboo poles.

The fisherman uses a small scoop net to collect the fry which drift along with the water current and congregate at the side of the floating lure line. The fry thus collected are transferred at intervals, with a small aluminium bowl, into earthenware fry containers.

From March 22, 1951, to July 31, 1953, there were 589 operations carried out. These gave a total catch of 81,350 fry most of which were obtained from the "saplad" and drag net. Unsuccessful operations were observed when there were rough waves, strong winds and heavy rains which on many occasions made the operations impossible.

The occurrence of the fry in Klong Wan starts from March and lasts until December, a duration of 10 months, and the majority of the catches were obtained during two peak periods, the early one in April and May and the late one in September.

The chanos fry collected are usually found in association with the fry of mullets (*Mugil*), spade fish (*Scatophagus*), tenpounders (*Elops*), theraponids (*Therapon*), slipmouths (*Leiognathus*), whitings (*Sillago*), anchovies (*Stolephorus*), silversides (*Atherina*), cardinal fish (*Apogon*), glassperch (*Ambassis*), and gobies (*Gobiidae*). The fry of anchovies, locally called "sai tan" and of clops, "ta luak", resemble closely the chanos fry in external appearance.

The results so far obtained, especially the big catches obtained during the two peak periods, (April-May and September), were observed to have certain correlations with the prevailing conditions such as the tides, rainfalls, winds and water currents in the area.

The occurrence of the chanos fry generally corresponds with the time of daily high tides. The two monthly maximum catches were obtained (1) around the beginning and (2) around the middle of each lunar month.

Some correlation between the occurrence of chanos fry and rainfall has also been noted. Although it rains in Prachuab Province almost the year round, it is recorded that the chanos fry occurred most when there was little rain.

The time of occurrense of chanos fry corresponded to that of the prevailing winds of the area. In April the fry was caught when there was breeze from the sea locally known as "lom ta pao" from the south-east. This wind blows from February to April during which the water current flows from South to North.

In September, when the late fry were collected in plenty, there was another "padhya" wind also blowing from the sea but from the south-west. Its occurrence is from July to September. During this period the water current is again from South to North.

During the period of October to January, there is the north-east monsoon, which is not favourable for sea fisheries on this side. Very few chanos fry were caught during this season.

The writer wishes to express his thanks to Nai Boon Indrambarya, Director-General of Fisheries, for his kind encouragement, and to Dr. S. W. Ling, FAO-ETAP Fish-culturist, for his valuable advice and assistance in the preparation of this note. To Nai Rob Nilkuha, Fishery officer of Prachuab, the writer is especially indebted for his generous assistance in gathering the necessary records.

6

APERCU GENERAL SUR LA MIGRATION ET LA REPRODUCTION DES POISSONS D'EAU DOUCE DU CAMBODE

par

Sao-Leang* et Dom-Saveun**

INTRODUCTION

Les eaux douces du Cambodge sont réputées très riches en poissons. Elles sont si riches qu'on a coutume de dire dans le pays: 'Quand il y a de l'eau, il y a des poissons'. Ceci semble de prime abord exagéré mais, en vérité, on peut pêcher au Cambodge, non seulement dans les fleuves, rivières, lacs et étangs, mais aussi dans les rizières, voire dans les moindres dépressions où pataugent les buffles. Parfois, pendant les fortes pluies, on peut capturer à la main certains poissons qui remontent les eaux de ruissellement dans l'espoir de rejoindre quelque part une eau hospitalière.

Cette source de richesse naturelle qui fait partie intégrante de l'économie générale cambodgienne, mérite donc que nous prenions des mesures adéquates pour la conserver et l'améliorer. Et ceci nous amène á approfondir, en premier lieu, les connaissances sur la migration et la reproduction de nos poissons.

Cette tâche a été abordée à plusieurs reprises par l'ancien Institut Océanographique de Nhatrang. Cependant, les études faites jusqu'alors ont besoin d'être complétées à cause des lacunes relevées à ce jour et surtout en raison des changements survenus ces dernières années à la physionomie générale de notre domaine piscicole—changements dûs à l'homme et aux phénomènes d'érosion et de colmatage.

Cet exposé est loin d'être complet; toutefois, nous espérons qu'il est suffisant pour expliquer l'état d'évolution de notre domaine et les principaux problèmes inhérents à un tel changement.

I. Le Regime Des Eaux Du Cambodge

Le Cambodge est soumis au régime des moussons; il a deux saisons distinctes: la saison des hautes eaux ou 'mousson d'été' et la saison des basses eaux ou 'mousson d'hiver'. Durant la mousson d'été, de Mai à Octobre, le vent souffle du Sud-Est au Nord-Ouest, c'est-à-dire de la mer vers la terre. Il est souvent accompagné de fortes pluies qui, en quelques mois, font déborder tous les cours d'eau, recouvrent toutes les plaines et inondent une partie des forêts des arrières-berges. On peut estimer que les 2/3 du pays sont ainsi périodiquement recouverts d'eau.

Dès début Novembre, les ondées deviennent de plus en plus rares et les eaux commencent à baisser. Le vent change aussi de direction; il souffle maintenant du Nord-Ouest au Sud-Est, c'est-à-dire de la terre vers la mer. Dès lors le niveau des cours d'eau baisse partout progressivement pour atteindre l'étiage vers début Mai. A ce moment, la majorité des lacs, rivières et étangs sont à sec, sauf le Mékong, le Bassac, le Tonlé-Sap, les Grands Lacs et quelques grandes rivières et bengs. Encore ces Grands Lacs et certains cours d'eau et bengs ne sont-ils eux aussi que très peu profonds, de sorte que la navigation des grosses embarcations y devient fort malaisée.

En principe, l'inondation est un véritable danger pour le pays. Au Cambodge, cette règle devient une exception. Cette inondation périodique est plutôt une source de nombreuses richesses naturelles. Elle est attendue, chaque année, avec confiance, tant par les agriculteurs que par les pêcheurs; c'est grâce à elle que notre sol est automatiquement ameubli chaque année et toujours prêt à être cultivé. Examinons maintenant les causes et les conséquences heureuses de cette inondation sur le domaine piscicole. Mais pour les comprendre facilement, regardons d'abord l'aspect physique de notre bassin hydrographique.

Le Cambodge est traversé du Nord au Sud par le Mékong, son principal cours d'eau. Ce fleuve prend sa source dans le Tibet. Après avoir traversé tout le Laos, il se jette sur le Cambodge par la chute de Khône haute de 15 mètres. Tumultueux dans le Laos, il devient pacifique sur notre territoire et se divise en Quatre Bras à Phnom Penh, notre Capitale, pour former le Mékong proprement dit, le Tonlé-Meat-Chrouk, le Tonlé-Bassac et le Tonlé-Sap. Celui-ci communique avec

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les Grands-Lacs, le principal bassin cambodgien Tous ces cours d'eau ont des tributaires multiples qui se ramifient à leur tour sur presque tout le pays, telles les veines dans notre corps, reliant les uns aux autres toutes les dépressions naturelles.

A noter que la terre de berge est plus haute que celle des arrières-berges, ce qui fait que les rivières tributaires qui relient les principaux cours d'eau aux lacs et plaines des arrières-berges, jouent le rôle de déversoirs en période d'inondation.

Prenons, par exemple, le Tonlé-Sap et les Grands Lacs pour illustrer ce phénomène d'inondation, puisqu'ils jouent le même rôle que les autres lacs et rivières précités, mais sur une échelle plus grande.

Pendant les mois de Juillet, Août et Septembre, grossi par la fonte des neiges du Tibet et par les pluies, le Mékong déborde; son trop-plein est alors aspiré par les Grands-Lacs et toutes les dépressions des arrières-berges; les plaines environnantes, ainsi que toutes les forêts qui les entourent sont inondées. En cette période, si l'on survole le pays, on ne peut plus distinguer les cours d'eau; on ne trouve que de l'eau partout, sauf dans les régions montagneuses. Toutes les villes et agglomérations semblent émerger tout d'un coup d'un immense lac.

Ce renversement du courant des grands fleuves vers les plaines au moment des pluies fréquentes et souvent diluviennes présente un intérêt inestimable. Il adoucit la force du courant dans les cours d'eau principaux, évite le déchainement des eaux à travers les villes et agglomérations et l'érosion massive de la terre arable, fléau de l'agriculture. La plupart des terres reçoivent annuellement, au contraire, des alluvions qui les enrichissent. Nous allons insister, plus loin, sur l'influence bienfaisante de cette inondation sur la faune aquatique qui nous intéresse particulièrement dans cet exposé.

Cette inondation pacifique se retire progressivement à partir du mois d'Octobre quand le niveau du Mékong commence à baisser. Alors, lentement les rivières tributaires des grands fleuves restituent à ces derniers les eaux qu'elles leur avaient empruntées. Mais l'inondation a laissé derrière elle de nombreuses nappes d eau plus ou moins profondes dont la plupart ne se dessèchent que 6 ou 7 mois après, tandis que d'autres, tels que des grands bengs, gardent toujours assez d'eau jusqu'au retour des pluies. C'est dans ces nappes d'eau renouvelées annuellement par les crues du Mékong que nous allons étudier les conditions de migration et de reproduction de nos poissons d'eau douce.

II—Migration Des Poissons.

Le mot migration a ici un sens assez restreint; il signifie simplement 'déplacements périodiques' de nos poissons des lacs et fleuves vers les plaines et forêts inondées et vice-versa. Il y a certes quelques espèces de poissons, peu importantes, qui sont d'origine marine. Nous ignorons encore comment ces poissons émigrent de la mer vers nos eaux douces, ni comment ils se reproduisent, nous avons pu noter simplement leur présence dans nos cours d'eau.

Nos poissons d'eau douce se groupent en 2 catégories distinctes: les poissons noirs ou 'poissons des bengs' et les poissons blancs ou 'poissons des fleuves'. Ils sont ainsi appelés, parce que les premiers sont en général de couleur noire et se confinent dans les bengs, c'est-à-dire dans les lacs et étangs, après le retrait de l'inondation, tandis que les derniers sont argentés, s'empressent de quitter des arrières-berges pour venir vivre dans les fleuves, principalement dans le Mékong dès que les eaux commencent à baisser.

Nous avons signalé plus haut que, pendant la baisse des eaux, nos poissons se retranchent dans deux camps; les premiers dans les lacs, mares et étangs (eaux fermées), les seconds dans les fleuves et rivières (eaux courantes). Pendant que les premiers se contentent de vivre confinés dans une eau plus ou moins trouble, à forte température et peu oxygénée, les seconds évoluent le long des cours d'eau à la recherche d'un emplacement de stabulation convenable.

D'une manière générale, pendant les grandes chaleurs, les poissons se retirent dans les profondeurs des eaux, se tapissant soit sur un fond sablonneux ou vaseux, soit sur un fond rocailleux. Dès qu'il fait frais, ils sortent de leurs repaires pour évoluer à la surface des eaux et rechercher leur nourriture; on commence alors à sentir leur présence et entendre leurs bruits.

En sortant des arrières-berges, presque tous les 'poissons blancs' ont toujours tendance à remonter le Mékong. Ainsi, au mois de Novembre, Décembre et Janvier, on peut voir des bancs serrés de ces poissons s'élançant vers l'amont du fleuve. Mais en Février, ces bancs de poissons sont vites dissémines par une pêche intensive. On peut alors remarquer que toutes les espèces se mélangent et se répartissent un peu partout dans notre domaine, à l'exception du Trey Pra (*Pangasius sutchi*) et du Trey Pruol (*Cirrhinus auratus*) qui vivent presque toujours en colonie et qui choisissent chacun un habitat spécial. Le premier se concentre dans le bief du Mékong compris dans la province de Kompong-Cham, où le fond du fleuve est constitué de nombreux bancs de sable et où les eaux sont profondes; quant aux seconds, ils continuent leur route jusqu'au delà de Kratié pour se disperser ensuit parmi les chutes et les rochers qui constituent le

fond du Mékong dans cette région Nord du pays. Le Trey Pruol aime en effet l'eau claire, rapide et très oxygénée.

En ce qui concerne les poissons noirs qui sont confinés dans les lacs ayant quelquefois à peine 1 ou 2 mètres de profondeur, ils sont presque complètement exploités. Un certain nombre d'entre eux réussissent à s'enfoncer dans la vase et à vivre ainsi enterrés pendant quelque temps pour reparaître à l'air libre dès l'arrivée des premières pluies. C'est ce qui explique ces paroles de nos anciens 'quand il y a de l'eau, il y a des poissons'.

La plupart d'entre eux se ruent parfois hors des bengs, en remontant les moindres filets d'eau de pluies. Beaucoup de ces poissons rampants meurent ainsi quand la pluie cesse de tomber brusquement, avant qu'ils n'atteignent une autre nappe d'eau.

Ce phénomène reste encore inexplicable, cependant nous supposons qu'au mois de Mai, par suite d'une longue sècheresse, l'eau se trouvant dans les bengs devienne inhabitable pour ces poissons qui cherchent alors à quitter ces lieux à la première occasion pour aller trouver un habitat meilleur.

Parmi ces poissons, on peut citer les Trey Râs (*Ophicephalus striatus*), Trey Chdor (*Ophiephalus micropeltes*), Trey Kranh (*Anabas testudineus*) et Trey Andèng (*Clarias batrachus*).

En tout cas les poissons noirs, comme les poissons blancs, suivent au fur et à mesure la montée des eaux pour aller s'éparpiller dans les herbes ou les broussailles des plaines et des forêts inondées. Mais comme nous l'avons dit plus haut, seuls les poissons blancs se retirent avec la baisses des eaux vers les fleuves principaux, tandis que les poissons noirs restent dans les bengs ou étangs, voire dan les petites flaques d'eau des rizières oú ils sont facilement pêchés par les paysans.

On se demande souvent si nos poissons sont attirés périodiquement vers les plaines et les forêts inondées par un instinct naturel ou simplement par l'abondance des nourritures.

D'aucuns admettent que c'est simplement pour satisfaire leur faim que ces poissons reviennent annuellement dans les lieux inondés. Cependant il y a une doute à cette hypothèse, car cette migration ne se fait pas durant toute la saison des crues qui ouvre l'accès des forêts inondées; elle est subordonnée à d'autres circonstances. Ainsi l'on peut prévoir ce courant de migration en observant les conditions atmosphériques et le niveau des fleuves. D'après nos observations, la ruée des poissons vers les arrièresberges et les Grands-Lacs, a lieu en 3 vagues principales durant les mois de Juin, Juillet et Août. Nous avons remarqué que la monté eaux de l'étiage à l'étale ne se fait pas brusquement, d'un seul coup, mais par étapes successives dont chacune est plus ou moins retardée par plusieurs petites 'baisses'. Celles-ci ont lieu lorsque les pluies ont cessé de tomber pendant quelques jours. Pendant ce temps, la ruée des poissons est arrêtée comme par un pouvoir mystérieux, même si les pluies recommencent à tomber, et tant que les eaux n'aient pas encore dépassé le niveau de la précédente étape.

A l'occasion de chaque ruée vers les arrières-berges, en navigant sur un fleuve ou sur une rivière quelconque, on peut entendre une sorte de concert discordant émanant des divers bruits que font nos poissons, mêlés au chantonnement du courant. Ces bruits marquent peut être leur appel de migration si ce n'est le prélude de leur instinct de reproduction.

Les poissons blancs commencent à se précipiter vers les sorties dès que les décrues se font sentir. Qe retour des poissons blancs vers les fleuves, que nous appelons la 'grande descente' se fait en masse et par vagues à des époques déterminées.

On peut diviser cette descente en 3 vagues principales correspondant à la période de lune croissante des mois de Décembre, Janvier et Février. Dès le 4è ou 5è jour de la lune croissante de chacun de ces 3 mois, on peut voir une affluence considérable de poissons à toutes les embouchures des rivières. Les observations sur les productions journalières des barrages installés à travers ces embouchures, ainsi que celles faites sur les autres pêcheries installées le long du Tonlé-Sap et dans le Mékong, nous ont prouvé que cette affluence est la conséquence des facteurs suivants ; profondeur des eaux, phases lunaires, conditions atmosphériques et température des eaux.

La descente s'intensifie donc à partir du 4è ou 5è jour de la lune croissante pour atteindre son maximum aux environs du 12è jour ; à partir de cette date, elle décroit graduellement pour devenir presque nulle vers les premiers jours de la lune décroissante. Durant ces périodes de descente, il fait normalement frais, le ciel est légèrement couvert et une brise souffle presque continuellement du Nord-Est. L'eau a environ 18 à 25 degrés, la nuit et le matin. Si par hasard, quelques pluies retardataires tombent à ce moment les poissons, comme par enchantement deviennent rares dans toutes les voies de sortie.

Pour avoir une idée de ces mouvements d'exode des poissons du Cambodge, on pourrait se référer utilement à la communication que nous avons présentée l'année dernière sur 'La Pêche au Day dans le Tonlé-Sap'.

A l'occasion de chaque descente des poissons de la forêt inondée vers les fleuves, nous avons noté aussi que toutes les espèces se mélangent ; toutefois ces mélanges sont faites dans des proportions variables suivant les époques de l'année. D'une manière générale, le pourcentage des poissons de grande taille, tels que Trey Pruol (*Cirrhinus auratus*), Kroum (*Ostéochilus hasselti*), Pra (*Pangasius sutchi*), Pô (*Pangasius larnaudi*), Khlang Hay (*Belodontichthys*), Chkok (*Cyclocheilichthys enoplus*) etc. dominent pendant les mois de Décembre et Janvier. A partir de Février, ce sont les poissons de petites tailles tels que Trey Linh (*Thynnichthys thynnoïdes*), Riel (*Cirrhinus jullieni*), Kanchrouk (*Botia modesta*) etc. . . . qui dominent.

Cette observation nous a amené à constater que la profondeur des eaux dans les forêts et les plaines influencent pour une large part sur les déplacements de nos poissons. Les spécimens pêchés en divers points du pays à différentes époques et les méthodes employées pour la captnre de chaque espèce ont confirmé cette observation.

Par ailleurs, à chaque exode des poissons des fleuves vers les arrières-berges et vice-versa, un fait particulier a frappé notre attention. La parallèle des Quatre-Bras constitue en quelque sorte une ligne de démarcation que les poissons migrateurs de la région Nord du pays ne franchissent que très rarement. Si certains poissons se sont laissés entraîner par le courant des crues pour descendre le Mékong sans entrer dans les rivières tributaires de ce fleuve, ils n'ont presque jamais dépassé la pointe de Chrui-Changvar, en face de Phnom-Penh, qu'ils contournaient instinctivement pour remonter le Tonlé-Sap et se diriger vers les Grands-Lacs. De même à la 'descente', les poissons sortis de Grands-Lacs contournaient toujours cette pointe de Chrui-Changvar pour remonter vers le Mékong.

Dans la partie Sud du parallèle des Quatre-Bras, (région Sud du pays) le peuplement est presque semblable à celui de la région Nord à l'exception du Trey Pra (*Pangasius sutchi*) qui y sont rares, et du Trey Pruol (*Cirrhinus auratus*) qui y fait complètement défaut.

Nous signalons enfin que le débordement des fleuves et des rivières dans ces 2 parties du pays ne se fait pas en même temps ; ce débordement n'a lieu dans la partie Sud que lorsque toutes les dépressions de la région Nord sont entièrement plaines, c'est-à-dire un mois après. Aussi les poissons du Sud émigrent-ils vers les plaines des arrières-berges avec un mois de retard sur leurs congénères du Nord.

III. Reproduction Des Poissons

Beaucoup d'études ont déjà été faites par l'Institut Océanographique de Nhatrang pour déterminer les époques de ponte des diverses espèces de nos poissons, notamment celles qui ont une certaine importance commerciale. Ces études portaient sur l'examen des poissons adultes et des alevins recueillis sur divers points du pays à différentes époques. A la suite de ces examens, on est arrivé à conclure que la ponte a lieu principalement durant la période de Juin à Septembre pour toutes les régions du pays.

Depuis quelques temps, nous avons repris les mêmes études par la méthode de recoupement. Notre but est de déterminer, cette fois, les frayères et les époques de ponte de chaque espèce de poissons, particulièrement le Trey Pruol (*Cirrhinus auratus*) et le Trey Pra (*Pangasius sutchi*) dont l'importance commerciale est très grande et dont la rareté se fait de plus en plus sentir.

IV. Perturbations dans la migration et la reproduction

En général, le peuplement de poissons d'eau douce est très vulnérable. Si ce peuplement reste encore assez florissant dans notre pays, malgré l'intensité progressive de notre pêche, c'est grâce aux crues annuelles qui triplent périodiquement l'étendue de nos eaux au moment où les poissons se reproduisent. Ces crues augmentent l'espace vital de notre faune aquatique, permettant ainsi aux milliards d'alevins de trouver des refuges sûrs parmi les broussailles et les arbres inondés où la nourriture ne leur manque pas. Ainsi la nature aurait tout fait à elle seule pour maintenir constante notre richesse ichtyologique si les hommes ne se mêlaient pas de la contrecarrer de diverses façons, en détruisant inconsidérément les reproducteurs, leurs refuges, leurs oeufs et leurs alevins. C'est pourquoi quelques signes d'appauvrissement se sont fait sentir ces dernières années. Les gens constatent maintenant avec inquiétude la rareté de certaines espèces de poissons qui, auparavant, constituaient une source de commerce considérable.

Les causes de l'appauvrissement de nos poissons sont multiples. Elles émanent en premier lieu, comme nous l'avons dit plus haut, de la capture des poissons porteurs d'oeufs ainsi que de la destruction des alevins. D'autre part, on s'ingénie à modifier l'état naturel de notre domaine piscicole et, partant, les conditions de migration et de reproduction que nous avons exposées plus haut.

Nous essayons maintenant de démontrer ces formes de perturbations et leurs conséquences néfastes sur la faune aquatique.

(*a*) *Méthode de pêche*.—Certaines méthodes de pêche utilisées chez nous créent de graves perturbations dans le cycle régulier de la migration et de la reproduction des poissons. Parmi ces méthodes destructives on peut citer le 'Samras' et le barrage obstruant les cours d'eau, à toute époque de l'année.

Un 'Samras' est composé de brânchages immergés dans l'eau le long des berges, des fléuves ou au milieu du lac, au moment de la baisse des eaux; il constitue une sorte de forêt inondée artificielle. Les poissons qui ont l'habitude de se réfugier dans les forêts inondées qu'ils savent très hospitalières, en rencontrant cette forêt artificielle, la prennent pour leur lieu déal de stabulation et y restent en dépit du retrait des eaux. Bientôt les pêcheurs ont vite fait d'entourer ces Samras de claies de bambou et de capturer presque la totalité de leurs habitants. Ceux qui peuvent échapper au massacre, notamment, les 'poissons blancs' trouvent leur retraite coupée par d'autres barrages, ou finissent par mourir dans un lieu qui ne leur convient pas; seules les espèces résistantes, tels que les Trey Pra, Pô, etc . . . peuvent survivre dans les lacs assez grands et profonds.

Comme les Samras utilisés chaque année comptent par milliers et couvrent chacun des dizaines et des certaines d'hectares, on peut imaginer l'étendue de leurs conséquences sur les mouvements de migration des poissons.

(*b*) *Destruction des frayères et colmatage des plaines*.—A mesure que la population augmente, on a besoin de défricher plus de terres pour l'agriculture. Les terres qu'on défriche de préférence sont celles inondées périodiquement, car elles sont généralment très fertiles et ne s'épuisent pas grâce à l'apport annuel d'alluvions charriés par les eaux des crues. En enlevant la couverture végétale de ces terres, on détruit non seulement les frayères où les poissons ont l'habitude de pondre et de chércher la nourriture, mais encore on favorise l'érosion des terres de berge dont les dépôts vont colmater les plaines des arrières-berges, les lacs et les étangs, etc . . . C'est ainsi que certains lacs ou dépressions naturelles sont actuellement presque comblés et que certaines rivières ont leur seuil obstrué et fermé au passage des poissons. Ce colmatage est encore plus rapide dans les èndroits où existent les Samras signalés plus haut.

Nous nous trouvons donc actuellement devant un problème très complexe à résoudre: protéger et favoriser les conditions optima de migration et de reproduction de nos poissons. C'est à cette difficulté que s'attache actuellement le Service National des Pêches en combattant énergiquement les facteurs destructeurs exposés dans cette étude.

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INVESTIGATIONS ON THE RACIAL CHARACTERISTICS AND BIOLOGY OF THE HILSA OF THE HOOGHLY RIVER

by

T. V. R. Pillay*

ABSTRACT

Certain tentative observations on the morphologic characters, blood grouping, fecundity, spawning duration and length-weight relationship of *Hilsa ilisha*, which is being studied by the author with samples from Nawabgunge, Calcutta, Falta and Diamond Harbour on the Hooghly River, are recorded. It is surmised that body height may serve as a distinguishing character of Hilsa stocks.

The appearance of three blood groups and their pattern of distribution in a sample are mentioned. It has been found possible to rear young Hilsa in masonry cisterns. A direct relation between the total weight of the fish and the number of eggs in the ovary was observed. The spawning season is noted to be extended.

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8

FISH CULTURE IN VIET-NAM

by

Cao-Thien-Buu*

(in French)

ABSTRACT

A brief account is given of the principal features of fish cultural practices employed in Viet-Nam. There are trapping ponds, nursery ponds to rear fry into fingerlings and rearing ponds to obtain marketable fish. Fish culture in paddy fields is also practised.

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9

ON THE OCCURRENCE OF CHANOS FRY IN INDONESIAN WATERS

by

Hasanuddin Saanin*

ABSTRACT

Reports regarding the breeding season, spawning area and occurrence of fry of Chanos in various regions of Indonesia are given. Some correlation of such factors as wind, rain, sunshine and tide with the abundance of fry is suggested. The conditions of certain associated animals and plants—aquatic as well as shore forms—are also indicated. Available statistics of fry gathered in the different provinces reflect the intensity of collection. Notes are given on the collecting implements, mode of transport and nursery practices. High mortality rate (about 80%) is stated to be an urgent problem in the Indonesian fry ponds.

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10

A STUDY OF THE OPTIMUM DENSITY AND COMBINATION OF COMPATIBLE SPECIES

by

Nguyen Nhu Nghi*

ABSTRACT

Vietnamese fish culturists very often overstock their ponds. They sometimes prescribe 100 fish for a pond of 360 square metres; but they seldom practise this principle and generally stock nearly 10,000 fish per hectare. The species generally reared in Vietnamese ponds are: *Cyprinus carpio, Hypophthalmichthys harmandi, Labeo collaris, Mylopharyngodon aethiops,* and *Ctenopharyngodon idellus.*

*Chef, Service des Peches au Nord-Vietnam.

11

RECENT STUDIES ON THE DISTRIBUTION AND MIGRATION OF TUNAS AND RELATED FISHES IN JAPAN

by

H. Nakamura*

ABSTRACT

The paper provides a review of the data made available in various Japanese papers during the past three decades on different factors relating to Tuna distribution and migration, such as water temperature, body temperature of fish, salinity, transparency and colour of water, ocean currents, topography, environmental biota, fishing grounds and seasons etc. Certain papers dealing with the biology of tuna and related fishes in the Japanese waters are also reviewed.

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12

FISHERIES OF THE SIND COAST

by

M. R. Qureshi*

ABSTRACT

The Sind coast is about 120 miles in length consisting of a network of creeks extending for a considerable distance inland. The river Indus is 50 miles south-east of Karachi. The coast is gradually sloping and there is a swatch opposite the mouth of the Kediwari.

The fishing boats, numbering approximately 1000, are of three types, all propelled by sails. No mechanized fishing is practised yet, but mechanization of these boats is being planned.

Different types of fishing nets and methods of fishing are described. The most important fishery of this coast is the prawn fishery which is carried on from October to March in shallow water.

The total annual landings amount to some 9,000 tons, of which prawn accounts for 3,000 tons. It is indicated that steps are being taken to improve the handling and marketing of fresh fish.

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13

THE SHRIMP INDUSTRY OF SINGAPORE

by

Tham Ah Kow*

Tham Ah Kow

THE FAUNA

The Shrimp Industry of Singapore is based mainly on members of the families Peneidea and Sergestidae. During certain months of the year mysids are abundant in the estuarine and coastal areas of Singapore and carideans (palaemonids) and alpheids also appear in the catches. The following are the species most commonly caught:

Sub-Class Peracatida
Order Mysidacea
Family Mysidae
(1) *Mesopodopsis orientalis* Tattersall
(2) *Rhopalophthalmus egregius* Hansen

Sub-Class Eucarida
Order Decapoda (Sub-order Natantia)
Section Peneidea.
Family Peneidae (Sub-family Peneinae)
Genus *Peneus*

(1) *Peneus japonicus* Bate
(2) *Peneus latisulcatus* Kishinouye
(3) *Peneus carinatus* Dana
(4) *Peneus semisulcatus* de Haan
(5) *Peneus indicus* var. *longirostris* de Man
(6) *Peneus merguiensis* de Man

Genus *Penaeopsis*
(1) *Penaeopsis ensis* de Haan
(2) *Penaeopsis brevicornis* H. Milne-Edwards
(3) *Penaeopsis monoceros* Fabricius
(4) *Penaeopsis affinis* H. Milne-Edwards

Genus *Parapenaeopsis*
(1) *Parapenaeopsis cornuta* Kishinouye
(2) *Parapenaeopsis sculptilis* Heller var. *cultrirostris* Alcock

Family Sergestidae

Genus *Acetes*
(1) *Acetes erythraeus* Nobili
(2) *Acetes vulgaris* Hansen
(3) *Acetes serrulatus* Kroyer
(4) *Acetes dispar* Hansen

Section Caridea
Family Palaemonidae

Genus *Palaemon*
(1) *Palaemon carcinus* Fabricius
(2) *Palaemon sulcatus* Henderson & Natthai

FISHING METHODS

In the inshore coastal areas of Singapore two methods are commonly used, viz., (i) a push net known locally as the "Sondong" and (ii) the beach seine known locally as the "Pukat Tarek". In the mangrove swamps, ponds are formed by the construction of earth bunds. The shrimps are allowed to grow up in these ponds and during certain days in the month part of the water in the pond is allowed to flow out through gates built in the bunds. These gates are closed with filter nets in which the shrimps are trapped.

(a) The Sondong

It consists of two light poles from 10 to 15 feet in length crossed at a point about two feet from the thicker ends. The slender ends of the poles are each fitted with a shoe-like device made of wood to facilitate the pushing operation. The fine-meshed scoop-like net is fastened to the longer arms so that the bag end is nearest to the fisherman, and the latter stands in waist-deep water with the shorter arms gripping his waist so that the point where both poles cross is just in front of him. He grips the longer arms of each pole with each hand at a point about 18" from the intersection of the poles. To begin operations, he lowers the poles so that the "shoes" touch the sea bed and pushes the net slowly along the sea floor. After a while he lifts the poles using his waist as a fulcrum and shakes the catch into the smaller bag-like end of the net. The catch is then thrown into a basket fastened to his waist by a piece of rope. This basket is kept afloat by means of two bamboo floats attached to its bottom and it floats behind him as he pushes his net along.

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(b) The Pukat Tarek

This gear is used mainly to catch fish, but peneid prawns, although forming only a small proportion of the catch, contribute considerably towards the price received. The main types of prawns caught are *P. semisulcatus*, *P. indicus* var. *longirostris* and *P. merguiensis*. The bulk of the fish caught is fit only for the consumption of pigs and ducks.

The net consists of a roughly cone-shaped bag of netting with long wings. The bag is about 20 feet long with graduated mesh from 1" stretched mesh at the tip or apex of the cone to 1½" stretched mesh at the mouth of the bag. Each wing consists of a wall of netting 500 feet long at the end of which is attached a rattan lead about 2,500 feet long. The depth of the net near the mouth is about 36 feet and decreases gradually along each wing to about 9 feet at the junction of the netting with the rattan leads. The mesh of the wing netting increases from 1¾" stretched mesh near the mouth of the bag to 2½" stretched mesh at the extremity of the wings. The rattan lead is made by plaiting together about five strands of rattan of about ¾" diameter. Three sizes of cotton twine, *viz.*, No. 6, 9 and 12, are used to make up the net. The head line consists of two pieces of Manila rope of 3/8" diameter between which all the floats are sandwiched. The floats are made of light wood and the distance between two adjacent ones varies from 1' 2" to 2' 6". The foot rope consists of two pieces of Manila rope—one of 7/16" diameter and the other ½" in diameter. Weights are sandwiched between the two pieces of foot rope at a uniform distance of 1 foot. They consist of ellipsoidal pieces of sandstone with a circular hole. The net is worked by 15 or 16 men and is shot from a wooden rowing boat 35' long, 5' wide at the centre and 2' deep.

As in all other haul seines, the net is shot from a stationary point on the beach and the boat is towed as rapidly as possible in a seaward direction, paying out the net at the same time more or less in a semi-circle and ending up at another point farther along the beach. When this is done, the hauling operation starts, the fishermen dividing into two groups, each hauling on one lead. Meanwhile the headman of the team rows out in the boat and stations himself somewhere near the bag, lifting up the float line when necessary to prevent the fish from leaping over. When the bag is hauled in, the fish are dropped into the boat and sorted, whilst the net is properly stowed for the next operation. Fishing operations usually begin when the tide is at half ebb and stop when the tide is at half flood.

Month	*Peneus*
January	20
February	3
March	2
April	5
May	4
June	3
July	3
August	2
September	3
October	4
November	4
December	11

x One katty = 1⅓ lbs.

(c) Prawn Ponds

A large part of the mangrove areas has been turned into brackishwater ponds by the construction of earth bunds. These bunds are about 2 to 3 feet wide at the top and are from 1 to 2 feet above high water at full spring tide. These ponds vary in size from 1 acre to 80 acres according to the lay of the land. The majority of them are between 1 and 10 acres. Sluice gates are provided for each pond to enable the incoming tide to flow into the pond in the daytime. During the night, filter nets are fixed to these sluice gates and the water, together with the fish and prawns, are washed out and filtered by the nets. The catching operations are carried out on 15 to 20 nights in a month during spring tides. The number of sluice gates for each pond varies with the acreage of the pond and the length of the bunds. Generally speaking there is one sluice gate for every 3 to 4 acres of pond.

The catches consist of (i) small estuarine fish which are used mainly as 'pig and duck' food and (ii) prawns, mainly *Penaeopsis* spp. and *P. indicus* var. *longirostris*.

CATCH STATISTICS

(a) The Sondong

The catching power of the Sondong net depends on (1) the energy of the operator (2) his experience of the ground and (3) the season. The following table gives the average catch in Katties* per day of a Malay Sondong operator during 12 months of the year.

Acetes	Crabs	Small Fish etc.
23	2	4
42	1	1
22	..	2
..	6	7
..	..	1
..	..	1
..	..	1
..	..	3
..	..	4
..	..	4
1	..	3
..	..	3

It will be noticed that catches, especially of *Acetes*, are highest during the north-east monsoon. Generally speaking, the salinity of the water is low during the period January to March, but no correlation between salinity and catch had been found so far. The turbidity of the water is highest during this period. This is due to the strong north east winds prevalent in the area during this period. There are indications of the existence of a correlation between turbidity and the strength of the north-east components of the prevailing wind on the one hand and the quantity of catch on the other. Investigations on this point are still proceeding. All four species of *Acetes* are present in the catches but *Acetes erythraeus* is the most abundant during the period December to March. Catches of Peneids by the Sondong belong mainly to the genus *Penaeopsis*.

(b) Prawn Ponds

The following table gives the average monthly catches in Katties of one of the more productive prawn ponds in Singapore for the last three years. The area is about 20 acres and the pond is provided with two sluice gates.

January	200
February	550
March	640
April	520
May	1,260
June	1,100
July	660
August	780
September	500
October	450
November	890
December	630
Total	8,180 katties

About 10% of the catch consists of mixed small estuarine fish.

MARKETING

The Sondong fishermen are only part time operators excepting during the height of the north-east monsoon when *Acetes* spp. are so abundant as to make it sufficiently profitable for full time operation. During the other months of the year the catch is made up of (1) peneid shrimps—mainly *Penaeopsis* spp. (2) small inshore fishes, small crabs and stomatopods. The peneids are all sold fresh and un-iced to residents in the vicinity of the area of operation or are collected by fish dealers for sale in the markets. A small amount is usually retained by the fishermen for their own consumption. A portion of the remainder of the catch is also retained by him for his own use as pig and duck food. The rest is sold to neighbours who require it as feed for pigs and ducks. During the season for *Acetes* spp., only a portion of the *Acetes* could be sold fresh and the rest is boiled in diluted brine and sold as boiled shrimps.

The prawns caught by the Pukat Tarek are also sold fresh and un-iced. They are collected by (1) fish dealers who retail them in the market and by (2) hawkers who retail the fish in the vicinity of the area of operation.

The shrimps and prawns caught in the prawn ponds are collected by fish dealers and iced by them for auction in the markets.

A GUIDE TO THE IDENTIFICATION OF THE COMMERCIALLY IMPORTANT SHRIMPS AND PRAWNS FOUND IN THE MANGROVE SWAMPS AND COASTAL AREAS OF SINGAPORE

The shrimps and prawns caught in the mangrove ponds and coastal areas of Singapore fall into three main groups, *viz.*:—

(1) Sub-class Peracarida. Order Mysidacea.
(2) Sub-class Eucarida. Order Decapoda. Sub-order Natantia. Section Peneidea.
(3) Sub-class Eucarida. Order Decapoda. Sub-order Natantia. Section Caridea.

These three groups can be readily separated from one another by the following diagnostic points:—

(a) Members of the Order Mysidacea usually have a statocyst on the inner branch of the tail fan (Fig. 1). They are small animals and are about 10 mm in length and have the habit of carrying their young in a brood pouch formed by plates on some or all of their thoracic appendages (Fig. 2).

(*b*) Members of the sub-class Eucarida, Order Decapoda, have the usual shrimp-like appearance. The market specimens vary in length from 20 mm to 250 mm. The members of the two sections Penicidea and Caridea can be separated readily in that the pleura of the second abdominal segment in the caridean overlaps the one in front and behind (Fig. 3), whilst this does not happen in the case of the peneids. The carideans also never have three pairs of chelate appendages.

(1) Sub-class Peracarida. Order Mysidacea. Family Mysidae.

This group of crustacea, sometimes known as the Oppossum Shrimps, is well represented in the plankton of Malayan seas, but so far only two species have been found in sufficiently large numbers in Singapore waters to be of commercial importance. They are *Mesopodopsis orientalis* Tattersall and *Rhopalophthalmus egregius* Hansen. During certain seasons of the year these two species appear in large swarms in the estuarine areas and are caught by means of bag nets. They have been mistaken by local fishermen for the young of members of the genus *Acetes*.

Rhopalophthalmus egregius belongs to the sub-family Rhopalophthalminae. It is distinguished by its much shorter eye-stalks from the only other species in the genus, *R. flagellipes* Illig. which is found in the estuary of the Congo. It can be easily distinguished from other mysids found in the area by its very characteristic telson (Fig. 1) the apex of which is armed with four strong, stout, serrate spines. The distal half of the lateral margins is armed with about 12 spines on each side. Both rami of the uropods are divided by a transverse joint distal to the centre.

Mesopodopsis orientalis belongs to the sub-family Mysinae. There are only two known species in the genus. The other species, *viz.*, *M. slabberi* has not so far been observed in this area. *M. orientalis* can be easily distinguished from ot mysids in this area by its very characteristic tels (Fig. 4). Details for the separation of these t species are given by Tattersall (1908-9).

(2) Sub-class Eucarida. Order Decapoda. S order Natantia.

SECTION PENEIDAE

The members of this group which are found Singapore waters fall into two families, *viz.*:—

(*a*) Family Peneidae. Sub-family Peneina

(*b*) Family Segrestidae.

For the purpose of separating those members o these two groups which are found in Singapor waters, one has only to remember that the peneid have a comparatively longer rostrum with mor than three teeth whilst members of the genus *Acetes* which are representatives of the Sergestidae i Singapore waters, have a very short rostrum wit only two teeth.

The members of group (a), 12 species in all, a drawn from three genera, *viz.* :—

(1) *Peneus* (Fabr.) s.s.

(2) *Penaeopsis* H. Milne-Edwards.

(3) *Parapenaeopsis* Wood-Mason.

The members of group (b), 4 species in all, are drawn from one genus only, *viz.* :— *Acetes* H. Milne-Edwards.

FAMILY PENEIDAE

Sub-family Peneinae

Diagnostic points common to the whole group. Rostrum well-developed and laterally compressed. Eyes large. Basal joint of antennular peduncle hollowed dorsally to lodge the eye. The first three pairs of legs are chelate and the last two pairs of legs are monodactylous. Only representatives of three genera are found in Singapore waters.

KEY TO THE PENEID GENERA FOUND IN SINGAPORE WATERS

I. Rostrum serrated on both edges. —*Peneus*.

II. Rostrum serrated on its dorsal edge only.

1. A pleurobranch on somnite XIII but not on somnite XIV. Exopodites on all or all but the last pair of thoracic legs.

—*Penaeopsis*.

2. No pleurobranch on somnite XIII or XIV. An exopodite on all thoracic legs.

—*Parapenaeopsis*.

(Fourth pair thoracic legs attached to somnite XIII).

(Fifth pair thoracic legs attached to somnite XIV).

KEY TO THE SPECIES OF THE GENUS *PENEUS* FOUND IN SINGAPORE WATERS

I. Only one tooth on inferior margin of rostrum. Three small spines on each side of tail segment.

(1) Dark vertical stripes along sides (Figs. 5, 6, 7) —*P. japonicus* Bate.

(2) Dark spots along sides (Figs. 8, 9, 10) —*P. latisulcatus* Kish.

II. Three or more teeth on inferior margin of rostrum. Telson without marginal spinules.

(1) Exopodite on last pair of thoracic appendages absent (Fig. 11, 12, 13) —*P. carinatus* Dana.

(2) Exopodite of last pair of thoracic appendages small but well formed.

(*a*) Upper antennular flagellum not longer than its peduncle (Figs. 14, 15, 16) —*P. semisulcatus* de Haan.

(*b*) Upper antennular flagellum a good deal longer than its peduncle.

(*i*) Dactylus of external maxillipedes of adult male about as long as propodite. Rostral crest of both sexes of only moderate height (Fig. 17, 18)—*P. indicus* H. Milne-Edwards var. *longirostris* de Man.

(*ii*) Dactylus of external maxillipedes of adult male hardly half length of propodite and spatulate in form. Rostral crest conspicuously high and broadly triangular in form especially in the adult female (Figs. 17, 19) —*C. merguiensis* de Man.

KEY TO THE SPECIES OF GENUS *PENAEOPSIS* FOUND IN SINGAPORE WATERS

Members of the genus *Penaeopsis* look very much alike and are more difficult to separate. The following key is only a rough guide and in all cases the identification should only be based on the form of the petasma, thelycum and the merus of the last pair of thoracic legs in the case of adult males.

I. Telson with lateral marginal spines at the distal end. No exopodite to last pair of thoracic legs (Figs. 20, 21, 22, 23, 23a) —*P. ensis* de Haan.

II. Telson without lateral marginal spinules. No exopodite to last pair of thoracic legs.

(*i*) Rostrum short and with five or six teeth. Figs. 20, 24, 25, 26, 27 —*P. brevicornis* Ho Milne-Edwards.

(*ii*) Rostrum long and with seven to nine teeth. Figs. 20, 28, 29, 30 —*P. monoceros* Fabr.

Figs. 20, 31, 32, 33 —*P. affinis* H. Milne-Edwards.

The differentiation of these two species can only be made with certainty by referring to the petasma and thelycum of the adult specimens.

GENUS *PARAPENAEOPSIS*

Only two species belonging to this genus have been found in Singapore waters so far. They are *Parapenaeopsis cornuta* Kish. and *Parapenaeopsis sculptilis* Heller var. *cultrirostris* Alcock. They can best be identified by referring to the rostrum, petasma and thelycum of the adult specimens. *P. cornuta* is not common *P. sculptilis* var. *cultrirostris* (Figs. 34, 35, 36, 37).

FAMILY SERGESTIDAE

Those members of the family Sergestidae of commercial importance found in Singapore waters all belong to the genus *Acetes*. They are all small shrimps from 10 mm to 20 mm in length and pinkish in colour when fresh. They all look very similar to the naked eye and are consequently difficult to separate without the aid of the microscope. The specimens in the commercial catches are sufficiently developed to permit definite identification. The males of each species exhibit a distinctive outer antennular flagellum and petasma whilst the females may be distinguished by the peculiar form of the third thoracic sternite and basal segments of the third pair of pereiopods. So far only four species

of the genus *Acetes* have been found in Singapore waters. They are:

(1) *Acetes erythraeus* Nobili (Figs. 38, 39, 45)
(2) *Acetes vulgaris* Hansen (Figs. 41, 42)
(3) *Acetes serrulatus* Kroyer (Figs. 45, 46)
(4) *Acetes dispar* Hansen (Figs. 43, 44).

They may be identified by reference to the diagram. *A. erythraeus* can be immediately separated from the other three species by the presence of a procurved spine between the first pair of pleopods in both the male and female (Fig. 47). In the other three species no such spine can be found.

The males of the other three species can easily be separated by the peculiar shape of their petasma and distinctive antennular flagellum.

The female of *A. dispar* can be separated from the other two species by the presence of a large subquadrangular plate which begins between the posterior part of the coxae of the third legs and reaches considerably behind (Fig. 48). The female of *A. vulgaris* has two distinctive rounded protuberances one on each side of the plate near the proximal angle of each coxa (Fig. 49). In this way it can be separated from *A. serrulatus* (Fig. 50).

SUB-CLASS EUCARIDA. ORDER DECAPODA. SUB-ORDER NATANTIA. SECTION CARIDEA

Among the carideans of commercial importance are two species of the genus Palaemon. They are (1) *Palaemon carcinus* Fabricius and (2) *Palaemon sulcatus* Henderson & Matthai. These two species can be easily separated by the 'tooth formula' of the rostrum and the proportions of the different sections of their chelipods.

Species.	Tooth Formula.
P. carcinus	$\frac{12 - 15}{10 - 14}$
P. sulcatus	$\frac{13 - 12}{4 - 6}$

The tooth formula is distinctive for *P. carcinus*. For further differentiation of the different species of *Palaemon*, the reader is referred to Henderson and Matthai (1925).

Members of the family Alpheidae are also found in the commercial catches made around Singapore. They are commercially unimportant and are utilized mainly as duck food. For their specific identification, the reader is referred to De Man (1911).

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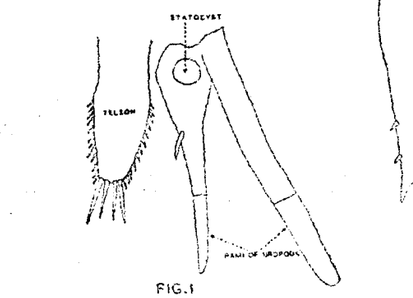


FIG. 1

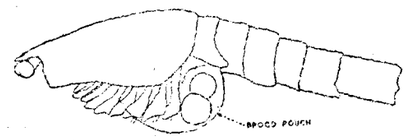
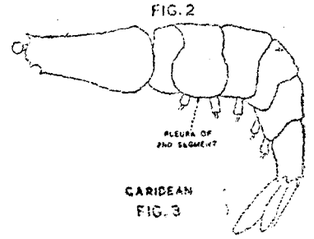


FIG. 2



CARIDEAN
FIG. 3

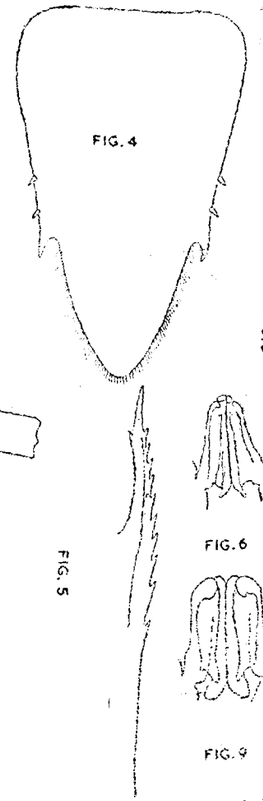


FIG. 4

FIG. 5

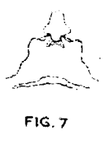


FIG. 6

FIG. 7

FIG. 8

FIG. 9

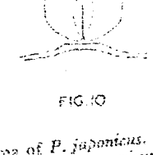


FIG. 10

Fig. 1. Telson and tail-fan of *Rhopalophthalmus egregius*
Fig. 2. Mysid showing brood pouch.
Fig. 3. Caridean.
Fig. 4. Telson of *Mesopodopsis orientalis*.
Fig. 5. Rostrum of *Penaeus japonicus*.
Fig. 6. Petasma of *P. japonicus*.
Fig. 7. Thelycum of *P. japonicus*.
Fig. 8. Rostrum of *P. latisulcatus*.
Fig. 9. Petasma of *P. latisulcatus*.
Fig. 10. Thelycum of *P. latisulcatus*.

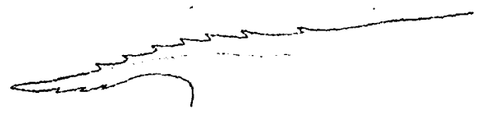


FIG. 11

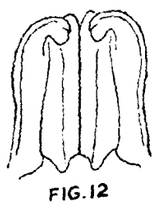


FIG. 12

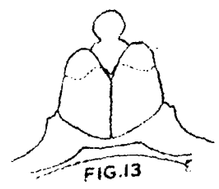


FIG. 13

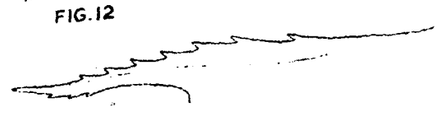


FIG. 14

FIG. 15

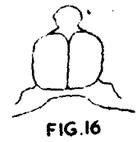


FIG. 16

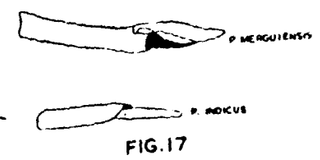


FIG. 17

Fig. 11. Rostrum of *P. carinatus*.
Fig. 12. Petasma of *P. carinatus*.
Fig. 13. Thelycum of *P. carinatus*.
Fig. 14. Rostrum of *P. semisulcatus*.
Fig. 15. Petasma of *P. semisulcatus*.
Fig. 16. Thelycum of *P. semisulcatus*.

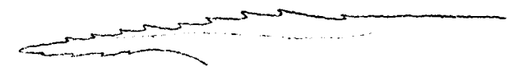


FIG. 18

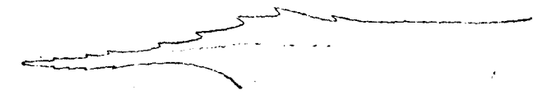


FIG. 19

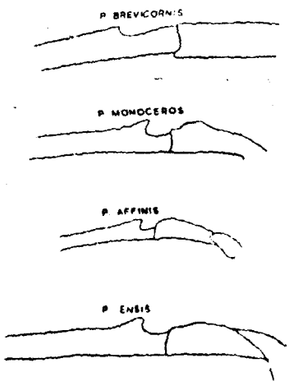


FIG. 20
MALE 5TH LEG

Fig. 17. Dactyli of external maxillipedes of *P. indicus* var. *longirostris* and *P. merguiensis*.
Fig. 18. Rostrum of *P. indicus* var. *longirostris*.
Fig. 19. Rostrum of *P. merguiensis*.
Fig. 20. Male 5th legs of various species of *Penaeopsis*.

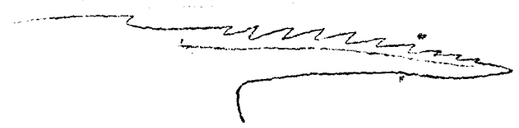


FIG. 21

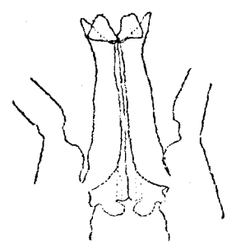


FIG. 22

FIG. 23

FIG. 23A

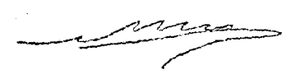


FIG. 24

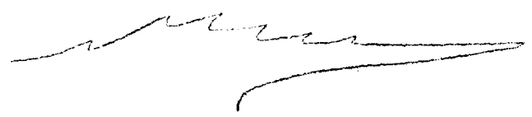


FIG. 25

FIG. 26

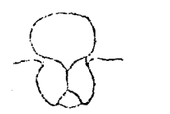


FIG. 27

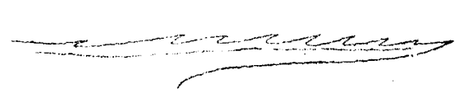


FIG. 28

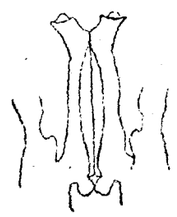


FIG. 29

FIG. 30

Fig. 21. Rostrum of *Penaeopsis ensis*.
Fig. 22. Petasma of *P. ensis*.
Fig. 23. Thelycum of *P. ensis*.
Fig. 23a. Telson of *P. ensis*.
Fig. 24. Rostrum of *P. brevicornis* adult male.
Fig. 25. Rostrum of *P. brevicornis* adult female.
Fig. 26. Petasma of *P. brevicornis*.
Fig. 27. Thelycum of *P. brevicornis*.
Fig. 28. Rostrum of *P. monoceros*.
Fig. 29. Petasma of *P. monoceros*.
Fig. 30. Thelycum of *P. monoceros*.

FIG. 31

FIG. 32

FIG. 33

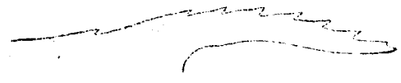


FIG. 34

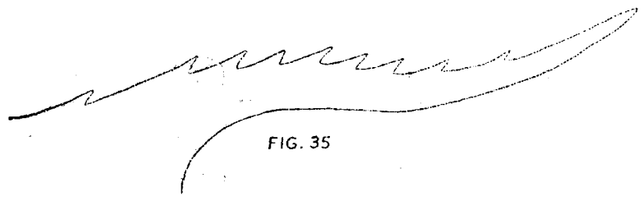


FIG. 35

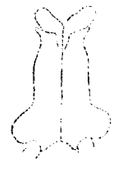


FIG. 36

FIG. 37

FIG. 38

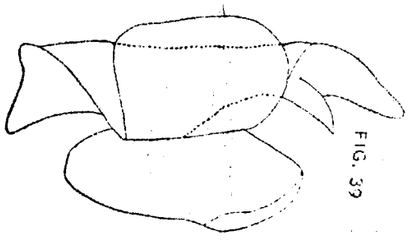


FIG. 39

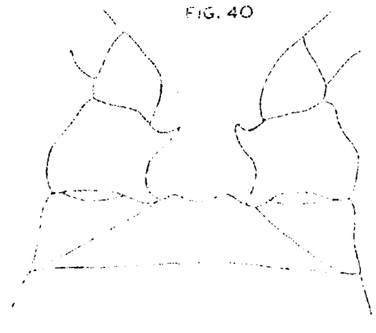


FIG. 40

Fig. 31. Rostrum of *P. affinis*.
Fig. 32. Petasma of *P. affinis*.
Fig. 33. Thelycum of *P. affinis*.
Fig. 34. Rostrum of *Parapenaeopsis sculptilis* var. **cultrirostris male.**
Fig. 35. Rostrum of P. sculptilis var. cultrirostris female.
Fig. 36. Petasma of P. sculptilis var. cultrirostris.
Fig. 37. Thelycum of *P. sculptilis* var. *cultrirostris*.
Fig. 38. Outer antennular flagellum of male *Acetes erythraeus*.
Fig. 39. Petasma of *A. erythraeus*.
Fig. 40. *A. erythraeus*. Posterior part of thorax of female from below.

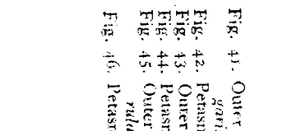


FIG. 41

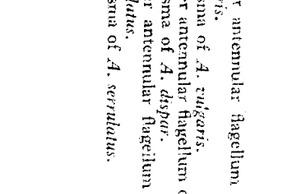


FIG. 42

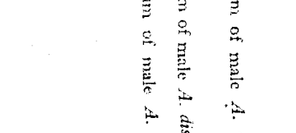


FIG. 43

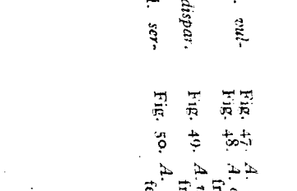


FIG. 44

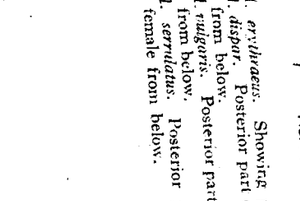


FIG. 45

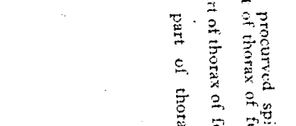


FIG. 46

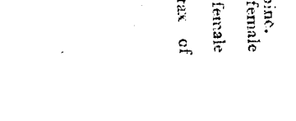


FIG. 47

FIG. 48

FIG. 49

FIG. 50

Fig. 41. Outer antennular flagellum of male *A. vulgaris*.
Fig. 42. Petasma of *A. vulgaris*.
Fig. 43. Outer antennular flagellum of male *A. dispar*.
Fig. 44. Petasma of *A. dispar*.
Fig. 45. Outer antennular flagellum of male *A. serrulatus*.
Fig. 46. Petasma of *A. serrulatus*.
Fig. 47. *A. erythraeus*. Showing procurved spine.
Fig. 48. *A. dispar*. Posterior part of thorax of female from below.
Fig. 49. *A. vulgaris*. Posterior part of thorax of female from below.
Fig. 50. *A. serrulatus*. Posterior part of thorax of female from below.

14

PRAWN FISHERY OF EAST PAKISTAN

by

N. Ahmad*

ABSTRACT

Prawns are found everywhere in East Pakistan, viz., in tanks, beels, Khals, estuaries and the foreshore. Wild stocks are caught by nets and traps, sketches of some of which are appended to the paper. In some districts prawns are regularly cultured. When these cannot be utilised in fresh condition they are preserved in ice, sun-dried, boiled and sun-dried and smoked. A list of the common species of prawns is given, and a fisheries map of East Pakistan (East Bengal) is attached.

*Deputy Director of Fisheries, Comilla, East Bengal, Pakistan.

15

THE EFFICACY OF SOME NET PRESERVATIVES ON COTTON TWINES

by

J. I. Sulit[1] and P. Panganiban[2]

INTRODUCTION

Although the chemical preservation and care of fish nets are quite advanced in some countries, Firth (1944, 1948), Carrothers (1949) and Farrar (1950), the Philippino fishermen, in general, still preserve their fish nets according to methods handed to them by their ancestors (Rasalan, 1940); that is by the use of tan bark extracts and ox blood. Barks of the *bakawan* (*Rhizophora apeculata* and *R. mucronata*) and *nigi* (*Xylocarpus granatum* and *X. molluccensis*) are commonly used to preserve various local fishing gear (Villadolid and Sulit, 1932).

Trawl and light nets are usually tanned after every 4 to 6 days' use, a practice that is not only costly and requires more man labour hours than by tarring or the use of other chemical net preservatives, but also impractical especially during inclement weather. Trawlers plying far-distant fishing grounds, in order to operate efficiently, should be equipped with two or more nets, the extra ones to be used as reserves for emergency cases, such as when hitting snags, net mending and drying, etc. However, when cutch tar net preservative is used for tanning, one or two trawl nets are sufficient.

The purpose of this study is to determine the efficiency of some net preservatives for the purpose of improving the methods of net preservation in this country. It is hoped that the practical application of the results could lessen the cost of preservation, lengthen the intervals and reduce the number of net treatments and shade drying without sacrificing the durability of the fishing gear.

MATERIALS AND METHODS

Materials

1. *Coal tar.* The brand is master miners' coal tar distributed by a local firm. It is highly soluble in some organic solvents, principally gasoline.

2. *Cutch.*—Its commercial trademark is calda cutch, a dried brown extract from the bark of various tan bark trees. This is different from true cutch which is dried extract of *Acacia catechu*.

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3. *Rosin.*—It is a plant exudation product of trees, the chief constituents of which are certain esters, resin acid, etc. It is soluble in organic solvents but insoluble in water.

4. *Cotton twine.*—The size of this trawl net cotton twine is No. 18, 3-ply. It is available in 1-lb bundles of the International Seine Twine brand, and is manufactured by the International Company, U.S.A.

5. Potassium dichromate ($K_2Cr_2O_7 . H_2O$)—The commercial potassium dichromate commonly known as red stone was used. This is available in many pharmaceutical houses in Manila and other cities of the country.

Methods

The cotton twine was cut into equal lengths of 100 centimeters and tied into eighteen bundles, each consisting of 125 pieces of twine. The eighteen bundles were divided into three groups designated as follows: (1) A - for weathering; (2) B-for intermittent submersion in brackish water, and (3) C - for continuous submersion in brackish water.

Each of the groups A, B and C consisted of six bundles of twines preserved with various preservatives and knotted accordingly as follows:

	No. of knots
0. Control	None
1. Cutching followed by treatment with potassium dichromate	1
2. Cutching followed by treatment with coal tar	2
3. Cutching followed by treatment with coal tar and rosin	3
4. Treated with coal tar	4
5. Treated with coal tar and rosin	5

The increase in total weight and the initial breaking strength of the control and treated twines are shown in Tables I and II.

Exposure and sampling

The schedule of exposure and sampling is enumerated as follows:

(a) *Weathering*

Group A, consisting of six bundles, was exposed to atmospheric weather to determine the effect of weathering on the treated and non-treated twines. Sampling was done once a week.

(b) *Intermittent submersion*

Another group B, consisting of six bundles, was submerged intermittently and sampled in the following manner:

1. Saturday, 9.00 a.m. —submersion
2. Monday, 4.00 p.m. —removal from water and hanging to dry
3. Tuesday, 8.00 a.m.—submersion
4. Thursday 4.00 p.m. —removal from water and hanging to dry
5. Friday, 8.00 a.m. —sampling and submersion
6. Monday, 4.00 p.m. —repetition of same process of last week.

(c) *Continuous submersion*

The same number of bundles as in A and B were continuously submerged in brackish water. Sampling was done once a week also. In sampling, five twines were removed from each bundle; then washed thoroughly with fresh water and dried in the shade.

Weekly cutching was applied to experimental bundle No. 1 of A, B and C in order to approach as near as possible the common practice among our fishermen of net treatment after every six days' use.

Treatment

1. Treating the twine with cutch and potassium dichromate - 828 grains of calda cutch was dissolved in 14.85 litres of tap water (5-1/2%). To the mixture 1.8 kilograms of twines were added and boiled for at least one hour. The boiled mixture was set aside to cool and then the twine was hung to dry. The dried cutched twines were then treated with potassium dichromate solution prepared as follows:

Dissolve 662.9 grams in 1,687 litres of water (5 lbs potassium dichromate in 100 gallons of water). Heat the mixture for 25 minutes at 70° C; then remove the twines and hang in the shade to dry.

In commercial practice the following proportions may be used in cutching fish nets:

(a) Cutching:	
Calda cutch	50 lbs
Water	100 lbs
Temperature (boiling)	100°C
Fishing nets	100 lbs
Length of boiling	1-2 hours
(b) Potassium dichromate treatment:	
Potassium dichromate	5 lbs
Water	100 gallons
Temperature	70°C
Length of treatment	25 minutes

2. *Cutching and tarring.*—The dried cutched twines were treated with coal tar solution prepared as follows:

Coal tar	3 parts
Gasoline	5 parts

The twines were allowed to stay in the coal tar solution for 5 minutes. The excess coal tar removed, the twines were then hung in the shade to dry. Drying time was four hours.

3. *Cutching and tarring with rosin.*—The dried cutched twines were immersed for five minutes in coal tar solution previously mixed with 1% fine powdered rosin.

4. *Tarring.*—The untreated twines were immersed for five minutes in coal tar solution and hung to dry.

5. *Tarring with rosin.*—The untreated twines were immersed for five minutes in coal tar solution previously mixed with 1% fine powdered rosin.

RESULTS AND DISCUSSION

Color.—The twines after treatment with cutch were light brown in color, and changed to dark brown when acted upon by potassium dichromate solution. Those treated with cutch and coal tar or coal tar and rosin were dark in color.

Increase in weight.—Table 1 shows the average increase in weight of twines treated with various net preservatives. It is very apparent that the average increase in weight of the twines treated with cutch and potassium dichromate was very insignificant as compared to those treated with other preservatives. One of the reasons why the increase was small was due to the fact that potassium dichromate, acting as a mordant, fixed only a certain amount of cutch in the twine, thereby eliminating some excess cutch. However, the coal tar holding capacity of the twines materially increased in the presence of cutch and rosin (Table 1).

Intermittent submersion

For brief classification and identification, the various preservatives were designated as follows:

1—cutch plus potassium dichromate
2—cutch plus coal tar
3—cutch plus coal tar plus rosin
4—coal tar
5—coal tar plus rosin

Table 2 shows the average breaking strength, in kilograms, and stretch, in centimeters, of twines treated with various preservatives. It is very significant that the twines treated with cutch and potassium dichromate (No. 1) registered the highest breaking strength and stretch after intermittent submersion in brackish water for 126 days. The breaking strength efficiency of the preservatives was arranged as follows: Nos. 3, 2, 4 and 5, and for stretch, according to Nos. 2, 3, 4 and 5. It is likewise evident that rosin exhibits an added preserving quality as shown in Table 2. The elongation or stretching property was practically the same in preservatives Nos. 2 and 3.

The previous work conducted by the senior author (Suht, 1950) gave similar results with coal tar containing a small amount of rosin.

Continuous submersion

With twines continuously submerged, preservative No. 1 still showed a breaking strength of 90.58% after 126 days exposure, and the stretching quality increased from 7.8 cm to 8.5 cm. The breaking strength and stretch efficiencies are followed by preservatives Nos. 2, 3, 4 and 5 (Table 3).

Weathering

The twines exposed to atmospheric weather deteriorated very slowly and gradually. Those treated with preservative No. 1 showed the least deterioration followed by Nos. 4, 2, 3, 5 and 0.

In the light of the foregoing experiments preservative No. 1 showed definitely an excellent preserving quality irrespective of the manner of exposure, namely: weathering and continuous or intermittent submersion in brackish water. According to Farrar (1950) deterioration of nets is much faster in brackish water than in sea water. It is also quite evident that cutching followed by tarring showed efficient preservation of the twines, much better than by tarring alone. The advantage, of course, of the latter preservative is its property to render the twines or nets impervious to water thereby facilitating or lessening the time of drying besides protection against abrasion. Such preservative may be recommended therefore for preserving heavy nets, namely: heavy seines, pound and trap nets. But for light nets, that are necessarily tarred, preservative No. 1 appears definitely recommendable.

The average increase in weight of the tarred twines is 51% as compared to the previous study of 50% increase in weight.

The study conducted by Ikunosuke et al. (1952) on the efficacy of some net preservatives; showed that pentachlorophenol and santobrite and coal tar gave the most preserving quality.

SUMMARY AND CONCLUSION

Potassium dichromate lowers the weight of the cutch-treated twine because the chemical acting as a mordant fixed a definite amount of cutch, thereby eliminating some excess preservative. The cutch-treated twines, whether exposed to atmospheric weather or submerged intermittently and continuously in water, have still more than 90% breaking strength after 126 days. It proved that the local practice of net preservation with tan bark preserves the net longer than any of the net preservatives provided the preservation is applied once a week, a practice commonly done in this country. The advantage of the cutch-tar treatment is the longer interval of its application and the shorter drying time of the net aside from its protective property against abrasion.

In conclusion, cutching with potassium dichromate may be recommended for light nets while cutching followed by tarring would be the ideal preservative for heavy nets.

Table 1.—Increase in weight of cotton twines after treatment with various preservatives.

Preservatives	Weight		Total Increase in Weight	
	Before Treatment	After Treatment		
	Gm	Gm	Gm	Per Cent
A. *Weathering:*				
0. Control	200.00	..	..	..
1. Cutch + $K_2Cr_2O_7$	209.00	225.16	16.16	7.73
2. Cutch + coal tar	197.70	331.00	133.30	67.44
3. Cutch + coal tar + rosin	195.30	320.70	135.40	69.30
4. Coal tar	205.30	280.80	76.50	37.26
5. Coal tar + rosin	212.20	304.50	92.50	43.59
B. *Intermittent:*				
0. Control	197.40	..	..	..
1. Cutch + $K_2Cr_2O_7$	225.10	242.50	17.40	7.73
2. Cutch + coal tar	200.00	308.80	108.70	54.24
3. Cutch + coal tar + rosin	188.40	309.00	120.60	64.00
4. Coal tar	201.00	277.80	76.80	38.21
5. Coal tar + rosin	209.20	300.80	91.60	43.73
C. *Continuous:*				
0. Control	102.00	..	..	..
1. Cutch + $K_2Cr_2O_7$	196.00	211.00	15.00	7.65
2. Cutch + coal tar	200.20	318.30	119.10	59.50
3. Cutch + coal tar + rosin	198.90	330.20	131.30	66.00
4. Coal tar	198.20	273.50	75.30	37.99
5. Coal tar + rosin	196.50	276.50	80.00	40.71
Average:				
1. Cutch + $K_2Cr_2O_7$	..	..	15.00	7.65
2. Cutch + coal tar	..	..	119.10	59.50
3. Cutch + coal tar + rosin	..	..	131.30	66.00
4. Coal tar	..	..	75.30	37.99
5. Coal tar + rosin	..	..	80.00	40.71

Table 2.—Change in breaking strength and stretch of cotton twines treated with various net preservatives and intermittently submerged.

Preservatives	Initial			After 7 Days			After 14 Days		
	Breaking Strength		Stretch	Breaking Strength		Stretch	Breaking Strength		Stretch
	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm
0. Control (No preservative) ..	13.80	100	7.20	13.90	100.72	8.60	10.20	73.91	6.80
1. Cutch + $K_2Cr_2O_4$ ..	14.40	104.34	7.80	14.10	102.18	9.20	14.80	107.25	8.00
2. Cutch + coal tar ..	10.40	75.36	6.00	12.20	88.40	7.20	12.80	92.03	7.40
3. Cutch + coal tar + rosin ..	11.05	80.00	10.30	11.80	85.50	6.20	11.70	84.71	6.80
4. Coal tar ..	11.17	80.94	6.66	12.10	87.68	6.20	12.00	86.91	9.00
5. Coal tar + rosin ..	10.42	75.50	7.83	11.80	85.50	6.40	10.60	76.81	7.40

P	After 21 Days			After 28 Days			After 35 Days			After 42 Days		
	Breaking Strength		Stretch	Breaking Strength		Stretch	Breaking Strength		Stretch	Breaking Strength		Stretch
	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm
0	3.63	2.61	4.60	0.20	..	2.60	..	..	..	..	..	..
1	12.20	88.40	9.00	11.80	85.50	10.20	11.60	84.08	9.00	11.60	84.08	8.00
2	9.50	68.84	7.60	11.20	81.16	6.60	11.00	79.71	6.80	10.00	72.46	6.20
3	9.20	66.67	7.60	11.00	79.71	6.20	10.00	72.46	5.20	9.80	71.02	5.00
4	8.20	59.42	8.80	8.00	57.71	7.20	8.00	57.97	8.20	6.00	43.48	7.20
5	7.00	50.72	7.20	8.60	63.32	5.80	8.60	63.32	5.60	7.20	52.18	5.40

P	After 49 Days			After 56 Days			After 63 Days			After 70 Days		
0	0	0	0	0	0	0	..	..	..	..	..	..
1	14.2	102.89	9.6	14.2	102.89	9.0	14.5	105.07	9.4	14.2	102.89	8.8
2	11.4	82.61	8.6	12.8	92.03	7.8	8.6	63.32	5.2	8.0	57.97	5.6
3	12.6	91.30	8.4	12.4	89.85	8.6	12.8	92.03	5.6	12.8	92.03	5.8
4	9.2	66.69	6.2	5.4	39.13	5.6	4.4	31.06	4.6	4.6	33.33	4.0
5	4.8	34.71	4.0	5.4	39.13	5.8	11.8	85.50	5.8	11.4	82.6	3.4

P	After 77 Days			After 84 Days			After 91 Days			After 98 Days		
0	..	..	..	..	..	..	..	..	..	..	..	..
1	12.9	93.47	6.6	14.0	101.45	10.5	14.0	101.45	10.0	12.75	92.39	9.0
2	7.7	55.80	4.2	11.5	83.33	8.5	11.25	81.52	7.5	10.5	76.81	6.5
3	12.0	86.91	5.2	13.5	97.82	7.0	13.0	94.20	6.5	11.5	83.33	5.5
4	4.4	31.06	3.2	2.0	14.49	4.75	4.25	30.79	2.5	3.5	25.36	2.5
5	11.0	79.71	5.4	1.5	10.87	1.5	0.5	3.62	1.25	..	..	..

P	After 105 Days			After 112 Days			After 119 Days			After 126 Days		
1	14.5	105.07	11.5	14.5	105.07	11.5	12.75	92.39	9.5	13.5	97.82	9.5
2	12.0	86.91	6.5	10.5	76.81	7.5	5.4	39.13	5.5	5.80	39.13	5.5
3	12.75	92.39	6.5	10.5	76.81	7.5	7.6	55.07	5.5	6.80	49.27	5.0

Table 3.—Change in breaking strength and stretch of cotton twines treated with various net preservatives, continuously submerged.

Preservatives	Initial			After 7 Days			After 14 Days		
	Breaking Strength		Stretch	Breaking Strength		Stretch	Breaking Strength		Stretch
	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm
0. Control (No preservative) ..	13.80	100	7.2	13.6	98.55	8.4	10.0	72.46	5.8
1. Cutch + $K_2Cr_2P_4$ ..	14.40	104.34	7.8	14.0	101.45	8.8	14.1	102.17	8.8
2. Cutch + coal tar ..	10.40	75.36	6.0	12.1	87.68	6.1	11.4	82.61	7.2
3. Cutch + coal tar + rosin ..	11.05	80.00	10.3	11.6	84.08	6.2	11.6	84.08	5.6
4. Coal tar ..	11.17	80.94	6.66	12.2	88.40	6.2	11.2	81.16	7.4
5. Coal tar + rosin ..	10.42	75.50	7.83	11.6	84.08	6.4	10.6	76.81	6.4

P	After 21 Days			After 28 Days			After 35 Days			After 42 Days		
	Breaking Strength		Stretch	Breaking Strength		Stretch	Breaking Strength		Stretch	Breaking Strength		Stretch
	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm	Kilograms	Per Cent	Cm
0	0.4	2.89	2.0	..	..	..	..	..	..	..	..	..
1	11.0	79.71	8.4	12.0	86.91	10.4	11.4	82.61	6.4	10.5	76.81	6.0
2	8.8	63.77	6.6	10.6	76.81	6.0	10.6	76.81	5.6	10.4	75.36	5.4
3	9.0	65.22	6.6	10.6	76.81	6.0	10.4	75.36	5.6	10.0	72.46	5.6
4	5.2	37.68	5.9	4.2	30.43	4.8	3.8	27.53	4.5	3.4	24.64	4.2
5	5.4	39.13	5.2	3.0	21.74	4.8	1.6	11.60	3.0	1.2	8.69	2.0

P	After 49 Days			After 56 Days			After 63 Days			After 70 Days		
0	..	..	..	..	..	..	..	..	..	..	..	..
1	14.4	104.34	9.4	14.2	102.89	8.8	..	101.45	7.2	13.6	98.55	7.2
2	11.7	84.71	5.5	9.8	71.02	5.6	6.8	49.27	4.4	6.3	45.65	4.6
3	12.5	90.58	5.6	11.2	81.16	5.8	5.8	39.13	4.8	5.8	39.13	4.6
4	6.0	43.48	4.8	..	..	..	..	..	..	..	..	..
5	2.2	15.94	3.2	..	..	..	..	..	..	..	..	..

P	After 77 Days			After 84 Days			After 91 Days			After 98 Days		
0	..	..	..	..	..	..	..	..	..	..	..	..
1	13.0	94.20	6.0	..	..	..	..	..	..	..	..	..
2	5.7	41.20	5.7	13.5	97.82	9.5	13.5	97.82	9.5	12.5	90.58	7.5
3	5.4	39.13	5.4	4.5	32.60	2.5	4	29.00	2	2.5	18.12	1.5
				..	..	..			..			

P	After 105 Days			After 112 Days			After 119 Days			After 126 Days		
1	13.5	97.82	10.5	13.5	97.82	9.5	11.5	83.33	7.5	12.5	90.58	8.5

TABLE 4.—Change in breaking strength and stretch of cotton twines treated with net preservatives continuously exposed in the atmospheric weather.

Preservatives	Initial			After 14 Days			After 28 Days		
	Breaking Strength		Stretch	Breaking Strength		Stretch	Breaking Strength		Stretch
	Kilo-grams	Per Cent	Cm	Kilo-grams	Per Cent	Cm	Kilo-grams	Per Cent	Cm
0. Control (No preservative)	13.80	100	7.2	10.2	73.91	8.2	9.5	68.84	6.2
1. Cutch + $K_2Cr_2O_4$	14.40	104.34	7.8	11.3	81.88	8.4	10.4	75.36	7.4
2. Cutch + coal tar	10.40	75.36	6.0	8.4	60.87	4.8	8.0	57.97	4.6
3. Cutch + coal tar + rosin	11.05	80.00	10.3	7.9	57.25	4.8	7.6	55.07	4.6
4. Coal tar	11.17	80.94	6.7	9.2	66.67	6.4	9.0	65.22	6.2
5. Coal tar + rosin	10.42	75.50	7.8	9.6	69.56	5.8	9.2	66.67	4.4

	After 42 Days			After 56 Days			After 70 Days			After 84 Days		
0	11.0	79.71	9.2	10.6	76.81	8.4	10.4	75.36	7.8	11.5	83.33	7.5
1	14.3	103.62	10.4	13.6	98.55	9.0	13.7	99.20	8.8	14.0	101.45	9.5
2	10.7	77.53	5.8	11.1	80.43	6.4	11.6	84.08	6.2	12.0	86.91	5.0
3	11.6	84.08	7.4	12.0	86.91	5.6	11.6	84.08	6.0	11.0	79.71	5.0
4	11.6	84.08	8.6	10.8	77.01	5.8	10.6	76.81	5.8	12.5	90.58	6.0
5	11.7	84.71	8.2	11.8	85.50	6.2	11.4	82.61	6.0	11.0	79.71	6.0

	After 98 Days			After 112 Days	
0	11.5	83.33	9.5	11.5	83.33
1	13.5	97.82	11.0	13.0	94.20
2	12.5	90.58	6.5	11.7	84.71
3	12.0	86.91	6.5	11.5	83.33
4	12.7	92.39	9.0	12.5	90.58
5	12.0	86.91	8.5	11.5	83.33

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16

THE RELATION BETWEEN THE FISH LANDINGS AND THE REFRIGERATION INDUSTRY IN JAPAN

by

S. Watari*

The history of refrigeration in Japan is outlined from the days when natural ice was harvested and utilized in Northern Japan up to the days of post-war recovery. Details of the commencement and growth of mechanized refrigeration are given. The fluctuations in ice making capacity, refrigerated warehouse accommodation and freezing capacity are furnished and their correlations with fish landings and fishing vessels are indicated.

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VALEUR ALIMENTAIRE DES SAUCES DE POISSON

par

R. Lafont*

Les Sauces de poisson, (*Patis* des Philippines, *Nuoc-Mam* d'Indochine *Nam-pla* de Thailande,) sont obtenues par macération de poissons entiers (non vidés) en présence de 20 à 25% de leur poids de sel. Le temps de macération dure environ de 3 a 6 mois au minimum, mais il y a tout avantage pour la qualité du produit a le prolonger pendant un an ou même plus. Le résultat de cette macération est de solubiliser une partie des matières protéiques du poisson. qui sont peu à peu désintégrées en éléments plus simples solubles: polypeptides et acides aminés.

MM. et Uyenco, et Lawas, et Briones, et Tarue ont étudié l'action des enzymes et des bactéries dans cette désintegration des protéines du poisson (1), aussi nous pensons inutile de traiter ici de cette question. Notre but est actuellement d'attirer l'attention du prochain Conseil Indo-Pacifique des Pêches sur les deux points stivants:

1° Les sauces de poisson correctement préparées constituent un aliment azoté de grande valeur.

2° La fabrication de sauces de poisson est probablement le procédé le plus simple et le plus économique de récupérer pour l'alimentation humaine les tonnages énormes de poisson actuellement perdus ou utilisés seulement pour la production d'engrais et d'huile.

I Valeur Alimentaire Des sauces de Poisson

(a) Au point de vue qualitatif, les sauces de poisson apportent à la ration alimentaire des polypeptides et des acides aminés. C. Poirier (2) a indiqué une méthode pour doser les polypeptides et les acides aminés dans le nuoc-mam. Il a trouvé que dans un bon nuoc-mam pour 100 d'azote total il y avait 13% d'azote ammoniacal et 87% d'azote organique (dont en moyenne 40% sous forme d'acides aminés et 47% sous forme de polypeptides). A ma connaissance on n'a pas encore déterminé la teneur des sauces de poisson en chacun des acides aminés qui s'y trouvent; par contre, on connait déjà avec précision la composition en acides aminés de la chair de différentes espèces de poisson. Or, les sauces de poisson proviennent de la digestion enzymatique des protéines du poisson et il est connu que cette digestion, moins brutale qu'une dissociation chimique, ne modifie profondément aucun des acides aminés indispensables à l'alimentation humaine (3). Parmi ceux-ci la forte teneur en lysine de la protéine du poisson a une trés grande valeur sur le plan alimentaire, car cet acide aminé indispensable est fortement déficitaire dans les céréales base principale de la ration de nombreuses populations. La richesse en lysine de la chair de poisson comparée à celle de l'oeuf de poule (dont la protéine est la mieux équilibrée au point de vue efficacité de croissance) lui est supérieure de + 8 à + 30 selon les espèces de poisson; au contraire, elle accuse un déficit de-72 dans le maïs et de-52 dans le riz blanc (6). Dans les sauces de poisson on retrouve la protéine du poisson sous forme plus digestible puisqu'une partie de cette protéine, celle qui est déjà transformée en acides aminés, est directement assimilable par l'organisme humain. Les sauces de poisson apporteront en outre à la ration phosphore et calcium, et très probablement certaines vitamines; aussi n'est il pas étonnant qu'en Indochine le bon nuoc-mam ait la réputation d'être un fortifiant.

(b) Au point de vue quantitatif la matière azotée apportée à la ration par les sauces de poisson n'est pas négligeable. L'opinion la plus répandue est que les sauces de poisson constituent simplement un condiment. Nous pensons nous aussi que cette opinion est justifiée lorsque la teneur en matières azotées des sauces de poisson (qui s'exprime habituellement en gramme d'azote total par litre) est trés faible. Or, l'azote total des sauces de poisson est très variable: au Nord Viêt-Nam le nuoc-mam ne titre ordinairement que 5 grammes d'azote par litre, au Sud Viêt-Nam 11 grammes, et les qualités supérieures à 15–18 grammes sont vendues très cher; un échantillon de *Pati* (Philipppines) que nous avons analysé titrait 17 grammes par litre. A notre avis, jusqu'à 10 grammes d'azote total par litre, les sauces de poisson peuvent être considérées comme un condiment, entre 10 et 18 grammes elles ont déjà en partie la qualité d'ali-

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ment azoté, enfin de 18 à 25 grammes il nous paraît indéniable que les sauces de poisson doivent être considérées comme un véritable aliment azoté. Nous ferons simplement remarquer qu'un poisson frais de 1 kilogramme donnera en moyenne 70% de chair comestible contenant de 2,5 à 3% d'azote, soit pour 1 kg de poisson frais de 17,5 à 21 grammes d'azote, quantité qui correspond exactement à l'azote organique (alimentaire) contenu dans 1 litre de sauce de poisson à 20–24 grammes d'azote total par litre.

En conclusion nous pensons que l'on peut admettre que les sauces de poisson constituent un véritable aliment azoté lorsque leur teneur en azote total est voisine de 20 grs par litre ; de plus elles représentent un intérêt alimentaire particulier pour les populations dont les céréales sont la base principale de nourriture car elles apportent alors un supplément en certains acides aminés indispensables à l'homme qui sont justement déficitaires dans les céréales.

II LA PREPARATION DES SAUCES DE POISSON EST UN EXCELLENT PROCEDE DE RECUPERATION DES EXCEDENTS DE LA PECHE

Assez souvent des quantités importantes de poisson ne peuvent être utilisées pour des raisons diverses qui se retrouvent à peu près identiques dans toutes les régions où la pêche est abondante :

(*a*) Poissons immangeables, soit parce que leur chair n'est pas appréciée des consommateurs, soit en raison de leur petite taille et du grand nombre de leurs arêtes.

(*b*) Poissons dont les prises peuvent atteindre certains jours, des tonnages énormes dépassant les capacités d'utilisation des lieux de pêche. Sardine par exemple pour la pêche en Mer, bancs de *Thynnichthys thynnoïdes*, *Dangila siamensis*, etc. . . . pêchés en grande abondance à certaines époques de l'année dans les fleuves du Cambodge

(*c*) Poissons déjà avariés au moment de leur débarquement. Ceci arrive fréquemment dans les régions chaudes où le poisson se gâte en quelques heures, surtout lorsque les bateaux de pêche sont à voile et dépendent du vent pour regagner leur port.

La récupération de tout ce poisson est un problème difficile : on peut le transformer en farine de poisson, ou en engrais, ou en extraire de l'huile si c'est du poisson gras. Mais pour pouvoir traiter rapidement de grandes quantités de poisson il faut disposer d'un matériel important et coûteux : cuiseurs, presses, séchoirs, broyeurs, etc. . . Pour être rentable une telle usine doit pouvoir travailler de façon régulière une grande partie de l'année, ce qui suppose un ravitaillement presque continu en poisson ; en cas d'arrivage très abondant, la capacité de traitement de l'usine reste limitée par le débit horaire de ses machines.

Si on examine maintenant le procédé de préparation des sauces de poisson, on constate qu'il présente les avantages suivants :

1° Il ne nécessite aucun matériel coûteux, il suffit de posséder des cuves pour la macération du poisson et du sel ; ces cuves peuvent être de simples jarres en terre de 20 à 50 litres de capacité (fabrication familiale), ou des cuves en bois de 2 à 5.000 litres (industrie du nuoc-mam au Viêt-Nam), ou des cuves en béton armé de 15.000 litres et plus (expérience de fabrication industrielle de nuoc-mam au Cambodge).

2° Il faut très peu de main d'œuvre ; le poisson est mis à macérer ENTIER, sans qu'il soit besoin de le vider et de l'écailler ; ceci permet en particulier d'utiliser les poissons de très petite taille. Pendant la période de macération (de 3 à 6 mois et plus) le poisson ne subit aucune manipulation. En fin de fabrication on doit effectuer le lessivage avec une solution salée du mélange poisson et sel, de façon à extraire toute la matière azotée soluble qui pourrait rester dans le poisson. Ce lessivage peut se faire sans main d'œuvre en utilisant une motopompe de 1/3 de C. V. à condition que le corps de pompe soit en alliage spécial résistant aux solutions salées.

3° On peut traiter du poisson pêchés depuis plusieurs jours en lui ajoutant 15% de son poids de sel au moment de sa capture ; ce salage préliminaire peut se faire à même la barque, le sel ne gêne pas, il suffira de tenir compte de la quantité déjà ajoutée lors de la mise en cuve et de récupérer la saumure qui se sera formée. Il devient alors possible de ravitailler la fabrique de sauce de poisson avec des poissons provenant d'une zone de pêche très étendue sans craindre de les voir se gâter au cours du transport.

4° La quantité de poisson qu'une fabrique de sauce de poisson peut traiter dans une seule journée n'est pratiquement limitée que par la capacité de ses cuves disponibles ; il est évident que plusieurs cuves peuvent être remplies simultanément s'il se produit un arrivage de poisson très abondant.

5° Il n'est pas nécessaire de recevoir du poisson régulièrement, une fabrique de sauce de poisson peut très bien se ravitailler pour une année en quelques jours seulement.

6° Less auces de poisson correctement préparées peuvent se conserver plusieurs années. A part

es conserves de poisson en boîtes stérilisées aucune autre préparation telle que : poisson séché, poisson salé-séché, poisson fumé, farine de poisson, etc. . . ne se conserve aussi bien que les sauces de poisson.

III—UN ESSAI DE FABRICATION INDUSTRIELLE DE SAUCE DE POISSON AU CAMBODGE EN VUE DE RECUPERER DU POISSON INUTILISE

Au Cambodge, lorsque les eaux se retirent des zones inondées, pendant les mois de Décembre à Mars, des bancs énormes de petits poissons sont capturés à l'aide de barrages ou de filets spéciaux (*Days*). Cette pêche a été décrite en détail par MM. Sao Leang et Dom Savœun (4). Elle est caractérisée par les points suivants :

(*a*) prises constituées surtout par des poissons de petite taille (de 10 à 25 cm.) avec prédominance des espèces suivantes :

Thynnichthys thynnoïdes, Cirrhinus jullieni Dangila siamensis, Cirrhinus auratus.

(*b*) pêche très abondante pendant la phase croissante de la lune, entre le 10 et le 15 du mois lunaire, de Décembre à Mars. Pendant ces courtes périodes, il n'est par possible d'utiliser tout le poissons pour l'alimentation humaine : une partie est consommée frais, une autre partie sert à la préparation de pâte de poisson (Prahoc), le reste est simplement mis à bouillir pour en extraire l'huile, le résidu étant ensuite abandonné. D'après les statistiques indiquant la production des huiles de poisson au Cambodge, on peut évaluer à environ 30.000 tonnes la quantité de poisson ainsi perdue chaque année pour l'alimentation humaine. Nous avons exposé dans une précédente note les difficultés qui s'opposent à la création au Cambodge d'une industrie moderne préparant huile et farine de poisson : pêche très abondante mais pendant de trop courtes périodes, dispersions des lieux de pêche augmentant les frais et les délais de transport, etc. . . . (5)

Aussi avons-nous pensé que la fabrication de sauce de poisson serait le meilleur procédé pour récupérer ce poisson perdu et nous avons essayé de l'utiliser pour préparer du nuoc-mam. Le nuoc-mam est une sauce de poisson très appréciée des populations indochinoises. Le nuoc-mam est préparé traditionnellement avec du poisson de mer ; les principaux centres de fabrication se trouvent sur la côte d'Annam (Phanthiêt). La production totale de l'Indochine était estimée en 1935 à 65 millions de litres par an. Il existe bien au Sud Viêt-Nam et au Cambodge quelques fabriques de nuoc-mam utilisant du poisson d'eau douce, mais en général la qualité de ce nuoc-mam est assez médiocre.

Dans une première expérience nous avons pu démontrer qu'il était possible d'obtenir un bon nuoc-mam avec du poisson d'eau douce à condition de concentrer au maximum sa richesse en matière azotée soluble. On peut dire que l'odeur et le goût particulier du nuoc-mam de poisson de mer sont en partie compensés par l'augmentation du taux d'azote total d'un bon nuoc-mam de poisson d'eau douce. Or, au Cambodge on a pour fabriquer le nuoc-mam du poisson très bon marché (10 fois moins cher que le poisson de mer sur la côte d'Annam) ; il est donc possible sans élever le prix de revient de produire du nuoc-mam de poisson d'eau douce à haute teneur en azote.

Au point de vue valeur nutritive, il n'y a pas de différence entre un nuoc-mam de poisson de mer et un nuoc-mam de poisson d'eau douce ayant la même teneur en azote.

En 1952, le Directeur de l'Institut National des Recherches Piscicoles au Cambodge décidait la création d'une fabrique de nuoc-mam à l'échelle industrielle dans le but :

1°/ d'étudier s'il serait possible de récupérer le poisson d'eau douce actuellement inutilisé en préparant du Nuoc-Mam.

2°/ d'établir quel serait le bilan économique de cette fabrication.

Nous allons exposer les premiers résultats de cette expérience.

1° Fabrication

(*a*) *Materiel.*—Nous avons utilisé des cuves en béton armé recouvertes intérieurement d'un enduit spécial devant isoler parfaitement le béton du contact de la sauce de poisson très salée. Nous avons choisi le béton de préférence au bois en raison des avantages qu'il présente : rapidité de construction, solidité, économie, possibilité d'utiliser des cuves de grande capacité. Pour la première campagne nous disposions de 5 cuves de 10 M3 et de 2 cuves de 15 M3, soit au total de 80 M3.

(*b*) *Poisson.*—Nous avons reçu :

1° 44 tonnes de poissons entre le 21 et le 29 Janvier (dont 22 tonnes en 36 heures les 27 et 28).

2° 23 tonnes entre le 26 et le 28 Février.

En dehors de ces deux courtes périodes, qui correspondaient aux passages des bancs, il n'a plus été reçu de poisson.

(*c*) *Main d'Oeuvre.*—Le personnel de la fabrique comprend 3 coolies et un contremaître. Ce personnel est suffisant pour effectuer la mise en macération du poisson et du sel. Le transport du poisson de la barque jusqu'aux cuves est fait par des coolies travaillant à la tâche.

Pendant les 5 mois de macération il n'y a eu besoin d'aucune main d'oeuvre. Lors du soutirage du nuoc-mam pour la vente, il faut lessiver les cuves avec une solution salée. Ce travail est fait par une moto pompe d'1/3 de C.V.

2°/ Bilan Economique

(*a*) *Prix de Revient.*—Pour obtenir un litre de nuoc-mam de poisson d'eau douce ayant 20 grammes d'azote, les dépenses peuvent s'évaluer au Cambodge comme suit:

POISSON.—1,5 kilo à 0,50 piastre le kilo.		0,75
SEL.— 0,5 kilo (y compris perte dans les déchets) à 1,80 le kilo		
MAN D'OEUVRE	...	0,90
MATERIEL.—(Amortissement sur 5 ans).	...	0,70
Report	..	2,65
IMPOT ET TAXES—	...	0,20
DIVERS—	...	0,40
Total	...	3$25

(*b*) *Prix de vente.*—Au Cambodge le prix de vente au détail du nuoc-mam de poisson de mer à 15 grammes d'azote est de 12 à 15 piastres le litre.

Nous avons fixé à 6$50 le prix du litre de nuoc-mam de poisson d'eau douce à 20 grammes d'azote que nous fabriquons, ce prix nous paraissant suffisamment rémunérateur étant donné notre prix de revient très bas (3$25). Depuis le mois de Juin, début de la production, nos ventes ont dépassé rapidement 3.000 litres par mois, et actuellement la demande est supérieure à notre capacité de production (40.000 litres par an).

CONCLUSION

Cette expérience de fabrication de nuoc-mam au Cambodge confirme ce que nous avons exposé ci-dessus à savoir que la préparation des sauces de poisson permet:

1° de récupérer pour la consommation humaine le poisson inutilisé lorsque la pêche est trop abondante.

2° de traiter en quelques jours seulement tout le poisson nécessaire pour la fabrication d'une année entière.

3° d'utiliser n'importe quelle espèce de poisson en particulier ceux de très petite taille.

4° d'obtenir un produit de valeur dont la fabrication est très rentable.

Nous pensons qu'il y aurait intérêt à encourager la fabrication et la consommation des sauces de poisson dans tous les pays de la région Indo-Pacifique. Cela permettrait de mieux utiliser les poissons pêchés en abondance à certaines époques, tout en fournissant aux populations un aliment azoté de grande valeur et de très bonne conservation.

L'Institut National des Recherches Piscicoles au Cambodge reste à la disposition des membres du Conseil, que ce produit pourrait intéresser, pour leur fournir des renseignements complémentaires s'ils le désirent, ou leur adresser des échantillons de la sauce de poisson préparée actuellement au Cambodge.

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THE DRIED FISH INDUSTRY IN CAMBODIA

by

Dom-Saveun*

ABSTRACT

Dried freshwater fishes constitute an important source of national revenue and one of the few exportable products of Cambodia. There is an important Co-operative Society established and controlled by the State based on this industry.

After an initial critical period due to unsatisfactory organization, staffing and marketing arrangements, the Freshwater Fishery Co-operative Society was recently re-organized on a more rational basis and has, during the period September 1, 1952, to July 31, 1953, made a profit of about 13 million piastres on a production of 7,113 tons. This success is largely due to the re-organization of the relations between the producers and the directors of the Co-operative and the creation of export markets, e.g. Singapore and Djakarta.

While the tonnage exported to these markets is still small, a large exportable surplus exists, and it is hoped that in the near future export of dried fish may be greatly increased.

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ON THE INSHORE FISH POPULATION OF THE STRAITS OF SINGAPORE

by

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The Fisheries of Malaya, during their whole process of development, have been concentrated mainly in an area from the littoral zone to a few miles offshore. No restrictions have so far been imposed on the types of gear employed, localities or seasons, so long as they do not interfere with navigation or defence projects. The use of explosives or poison for fish capture is, however, prohibited.

It is not necessary to stress the importance of these inshore fisheries to Malaya where large amounts of animal protein have to be imported even in normal times. World War II brought out very clearly the value of inshore fisheries to the country as they were responsible for a valuable supply of protein even when all the sea lanes converging on Malaya were closed. In times of emergency they do not require any elaborate and costly scheme of protection which would no doubt be necessary for offshore fisheries.

The population of Malaya has increased considerably in the last half century and the intensity of inshore fishing has increased proportionately. In marine fisheries no sowing of seed is possible on a commercial scale, but unless the harvesting is properly managed, depletion of existing stocks will result sooner or later. In order to manage the harvesting of our fish stocks rationally, a knowledge of the composition and extent of our fish stocks, their growth, their natural and fishing mortality rates, their migrations, their food and the factors which influence the production of fish food, among other things, is necessary.

Hardenberg (1938) with his extensive knowledge of fishery problems in the neighbouring islands of the then Netherlands East Indies has rightly stressed that in the tropics (i.e. Southeast Asia) the large number of species in most genera, together with the fact that most of them spawn throughout the year, makes the study of tropical fisheries difficult for the biologist. According to him, year-rings have not been ascertained so far and because of this, as well as the fact that for most species there are many broods in a year, year-classes are not distinguishable. It appears, then, that in the study of fisheries in the tropics an approach, different from that which has so far been successful in temperate countries, might have to be adopted.

In Malaya, as in other tropical countries, the fish population is made up of a very large number of species and the inter-relationships between the species present a rather complex picture to the investigator. Different species make different contributions to the population and these contributions in turn vary from time to time. This paper describes some of the characteristics of the fish population within the 5 fathom line and forms the first of a series of contributions towards the study of the fish population of the Singapore Straits.

MATERIALS AND METHODS

It was thought that catches made by a beach seine would approximate sufficiently closely to a random sample of the inshore population. Beach seines with a fine mesh in the cod-end are operated up to a mile from the beach along the coast of Singapore. They catch all fish from a length of about 30 mm upwards enclosed by the net. An unselected sample representing one-twelfth of the whole of the haul with a beach seine was taken at intervals varying from a few days to a month depending on the complexity of the catch. The catch was immediately preserved in a solution of formaldehyde and studied later in the laboratory.

The fishes were separated into species and their standard lengths, measured to the nearest millimetre, recorded. At the same time the state of maturity was noted and recorded. Owing to the large number of specimens which had to be examined, a very rough classification for the state of maturity had to be adopted. They were classified under three stages of maturity, viz: Stage I refers to those whose gonads were rudimentary or not readily visible to the naked eye; stage II to those females whose gonads were developed and readily visible to the naked eye but the eggs were not visible to the naked eye; stage III to those females whose gonads were well-developed and the eggs were visible to the naked eye. The males were classified by the size of the gonads and put into the same stages as those females of the same species whose gonads were of the same size. This method of classification of goand stages is admittedly rough but considering that the object of this investigation is only to delineate the main features of the population, it is considered sufficient.

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All the samples were taken at random from beach seine catches made at different points of a three mile stretch along the south coast of Singapore. The question may now be asked if catches made at the same time at different points of this three mile stretch of coast are from the same population. To test this, two unselected samples were taken from catches made at two different points by nets of similar dimensions and compared. The length-frequency distributions of the fishes in the two samples were determined. The significance of the differences between (1) the two sample co-efficients of variation and (2) the two means (length) was determined by methods given in Ferber (1949). Null hypothesis was set up that the differences were not significant, i.e. that the samples were from the same population. The sample data are as follows:—

	Sample I	Sample II
Mean	$\bar{X}_1 = 50.28$ mm	$\bar{X}^2 = 53.70$ mm
Variance	$V_1^2 = 379.02$	$V_2^2 = 541.66$
Frequency	$N_1 = 300$	$N_2 = 280$
Co-efficient of Variation	$V_1 = 38.72\%$	$V_2 = 43.33\%$

$$\frac{T}{\bar{X}_2 - \bar{X}_1} = 1.913$$

$$\frac{T}{V_2 - V_1} = 1.905$$

With a confidence co-efficient of 0.95, the hypothesis may be confirmed if T is less than 1.96. In both cases, therefore, the differences may be considered as not significant, so that it may be assumed that the samples were drawn from the same population.

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE ENVIRONMENT

In order to give an approximate picture of the physical and chemical characteristics of the environment, two graphs showing the temperature and salinity variations throughout the year 1948 at a point two to three miles seawards from the area of this investigation are reproduced in Figs. I and II.

SPECIES EXAMINED AND THEIR DISTRIBUTION THROUGHOUT THE YEAR

The species examined number over 110 and fall into 13 orders and 47 families and are listed in Appendix I.

The number of species in the aggregate catch for each month was found to vary from 25 to 54 with an average of 36. Table 1 gives the number of species found each month.

It is interesting to note that 50% or more of the species represented in the catches each month belong to the order Percomorphi, about 10% to each of the orders Isospondyli and Heterosomata, whilst members of the orders Hypotremata, Apodes, Ostariophysi, Gobiomorphi and Discocephali were not common.

Table 1. Number of species found per catch per month

Order / Month	Hypotremata	Isospondyli	Iniomi	Apodes	Ostariophysi	Solenichthyes	Synentognathi	Heterosomata	Percomorphi	Gobiomorphi	Scleroparei	Discocephali	Plectognathi	Monthly Total
January ..	0	6	1	0	0	2	2	4	31	0	5	0	3	54
February ..	1	3	1	1	0	0	1	2	17	0	1	0	1	28
March ..	1	4	1	0	0	1	1	7	30	1	2	0	1	49
April ..	0	5	1	0	0	1	1	4	25	0	3	0	2	42
May ..	0	4	1	0	1	2	1	3	18	1	3	1	4	39
June ..	0	2	0	0	0	0	0	3	18	0	1	0	2	26
July ..	0	2	1	0	0	0	0	2	18	0	0	0	2	25
August ..	2	4	0	1	1	0	1	4	25	0	2	0	3	43
September ..	0	2	1	0	0	1	1	0	21	0	1	0	2	29
October ..	0	2	1	0	0	3	2	2	20	1	0	0	4	35
November ..	0	2	1	0	0	2	1	2	26	0	1	0	2	37
December ..	0	3	0	0	0	3	2	1	14	0	1	0	1	25

ONTRIBUTION OF INDIVIDUAL SPECIES IN NUMBERS THROUGHOUT THE YEAR

The number of samples taken per month varied rom one to three. The raw data obtained from ach catch were adjusted to give the estimated umbers of each individual species per catch per nonth. If there were X individuals of a certain pecies in a sample which was 1/Y of the particular atch and N samples were taken during that month, hen $X_1Y_1 + X_2Y_2 + \ldots\ldots - XnYn$ would epresent the number of individuals of that species recorded for that month. These figures are only comparative and do not in any way indicate the absolute numbers of any one species.

From Table 2 it is clear that the average number of individuals per catch rises very rapidly from January to a maximum in February, thereafter falling sharply at first and then gradually as the months go by until a minimum is reached in August. Between August and the end of the year it fluctuates at a comparatively low level. The first quarter of the year, January to March, contributed 70% of the total frequencies for the year; the second quarter 13%; the third quarter about 10%, and the last quarter about 7%. It is shown in Table 2 that in the total numbers for the year, members of the order Percomorphi again make up about 45% of the total for all orders and the order Isospondyli about 12%. The order Plectognathi, however, is outstanding in that whilst the number of species involved is never much more than 10%, the number of individuals make up about 40% of the year total. A closer study of the frequencies of occurrence of individual species revealed that out of a total of about one hundred species, only eight species are responsible for about 83% of the total frequency for the year, another eight species about 7% and the remaining species, more tha 80 in number, for the remaining 10% of the total frequency for the year. Table 3 gives details of the above observations.

It will be noted from Table 4 that more than 40% of the total number of species fall in the category which has a total frequency of less than 50 for the year, i.e. an average frequency of about 4 per catch per month. The total numerical contribution of about 85% of all the species found amounts to about 10% of the catch. The data in Table 3 therefore indicate that from the point of view of numbers the eight species with the highest frequencies composing about 15% of the total number of species, play a significant part in the ecology of the inshore area.

RELATION BETWEEN NUMBER OF SPECIES AND NUMBER OF INDIVIDUALS

The fluctuation in the total number of species from month to month is not accompanied by a similar fluctuation in the total number of individuals per catch per month, and there is no statistically significant correlation between these two sets of data.

Fisher, Corbet and Williams (1943) in analysing the catches of certain insects found that the relation between the number of species and the number of individuals in a random sample can be expressed by the series

$$S = n_1\left(1 + \frac{x}{2} + \frac{x^2}{3} + \frac{x^3}{4} + \ldots + \frac{x^{n-1}}{n}\right)$$

where S is the total number of species in the sample, n_1 the number of species represented by

Table 2. Number of Fish occurring per catch per month

Order / Month	Hypotremata	Isospondyli	Iniomi	Apodes	Ostariophysi	Solenichthyes	Synentognathi	Heterosomata	Percomorphi	Gobiomorphi	Scleroparei	Discocephali	Plectognathi	Monthly Total	%
January ..	0	3,247	27	0	0	7	12	23	1,418	0	49	0	187	4,970	7
February ..	5	1,760	225	5	0	0	10	50	14,480	0	60	0	17,260	33,855	45
March ..	8	1,059	241	0	0	20	3	80	7,544	30	54	0	4,818	13,857	18
April ..	0	1,972	17	0	0	24	60	97	2,580	0	28	0	688	5,466	7
May ..	0	230	30	0	60	33	60	21	1,627	30	40	3	647	2,781	4
June ..	0	150	0	0	0	0	0	110	1,060	0	130	0	310	1,760	2
July ..	0	240	20	0	0	0	0	35	560	0	0	0	635	1,490	2
August ..	4	205	0	1	265	0	3	16	413	0	28	0	348	1,283	2
September ..	0	180	20	0	0	10	40	0	2,380	0	30	0	1,870	4,530	6
October ..	0	2	10	0	0	10	9	8	242	13	0	0	253	547	1
November ..	0	136	15	0	0	12	2	5	810	0	3	0	2,046	3,029	4
December ..	0	114	0	0	0	12	18	3	816	0	9	0	1,173	2,145	3

Table 3. Frequencies of the more abundant species

Species	Total Frequency		Percentage of Total Frequency	% of Total No. of Species
Monacanthus spp. M	29,809			
Leiognathus spp. MM	14,688			
Stolephorus spp. MMM	7,369			
Siganus oramin	4,705	62,999	about 83%	7·3%
Upeneus sulphureus	2,232			
Pristipoma hasta	1,548			
Lethrinus sp.	1,430			
Sillago sihama	1,218			
Clupea fimbriata	839			
Lutianus lineolatus	768			
Clupea dispilonotus	685			
Apogon margaritophorus	664	5,352	about 7%	7·3%
Upeneus sundaicus	650			
Saurida gracilis	605			
Leiognathus ruconis	589			
Pentaprion longimanus	552			
Remaining species	7,362		about 10%	85.4%

M Mainly *Monacanthus chinensis*
MM Young *Leiognathus*, unidentified
MMM Mainly *Stolephorus pseudoheterolobus*

Table 4. Distribution of Species in Frequency Ranges below 500

Ranges of total Frequency for the year	*Number of Species*
Below 50	48
50-100	8
101-200	15
201-300	6
301-400	7
401-500	0

one individual in the sample, x is a constant slightly less than unity and n represents the different levels of abundance in the sample. Further

$$S = -\alpha \log_e (1-x)$$

and $$N = \left(\frac{\alpha x}{(1-x)}\right)$$

where N is the total number of individual specimens in the sample and α is a constant independent of the size of the sample.

When the 19 samples from the haul seine catches were analysed in the same way as Fisher, Corbet and Williams (*loc. cit.*) had done with insects, it was found that only in some of the samples did the observed values approach the calculated values, but if all the samples were averaged then the observed values of the different terms of Fisher's series approached quite closely the calculated values.

DISTRIBUTION OF LENGTH OF FISH THROUGHOUT THE YEAR

The average monthly catches are distributed in different length intervals in Table 5 and a fairly clear picture of the length-frequency composition is obtained. The highest frequency is underlined.

In January, 63% of the catch belongs to the 30 mm—39 mm length range and 20% to the 10 mm —19 mm length range. The remaining 17% are distributed in the other length ranges. *Stolephorus* spp. form the bulk of the 63% in the 30 mm—39 mm length range and *Leiognathus* spp. form the bulk of the 20% in the 10 mm—19 mm length range. In February, 80% of the catch belongs to the 10 mm—19 mm length range and 13% to the 20 mm—29 mm length range, the remaining 7% being distributed among the other length ranges. *Leiognathus* spp. and *Monacanthus* spp. form the

bulk of the 80% in the 10 mm—19 mm length range. In March, 86% of the catch belongs to the four lower length ranges viz :— 10 mm—19 mm ; 20 mm —29 mm ; 30 mm—39 mm ; and 40 mm—49 mm in the proportion of 8: 33: 27: 18, respectively. The numbers in the 10 mm—19 mm range are due mainly to *Siganus* sp. This species together with *Monacanthus* spp. contribute substantially to the other three length ranges whilst *Leiognathus* spp. also contribute to the intermediate length ranges viz :— 20 mm—29 mm and 30 mm—39 mm. For the month of April, 85% of the catch is spread over four length ranges viz :— 40 mm—49 mm ; 50 mm—59 mm; 60 mm—69 mm ; and 70 mm—79 mm in the proportion of 15%, 30%, 25% and 15% respectively. Species of *Stolephorus*, *Upeneus*, *Siganus* and *Monacanthus* contribute substantially in numbers. In May and June the picture is more or less the same except that in May the length ranges with higher frequencies have shifted one step lower and species of *Upeneus* and *Monacanthus* are the most notable contributors. In June there is no notable contributor among the species. In July about 40% of the catch is grouped under the two length ranges 20 mm—29 mm and 30 mm—39 mm and the remaining 60% is distributed among the other length ranges. From August to December inclusive, the picture is more or less the same, from 65% to 85% of the catch being distributed among the four length ranges 20 mm—59 mm. In August the largest contributors are species of *Tetrodon* and *Plotosus* : in September species of *Apogon*, *Lethrinus*, *Siganus* and *Monacanthus* and in October, November and December species of *Monacanthus*. Looking at the year totals for the different length ranges in Table 5 it will be seen that the number decreases as the length increases. More than one third of the total frequencies fall within the lowest length range 10 mm—19 mm ; another one-third within the second and third lowest length ranges viz :— 20 mm—29 mm and 30 mm—39 mm ; the remaining third is distributed among the higher length ranges in decreasing numbers. From the analysis it would appear that, from the point of view of numbers, fishes of the lower length ranges preponderate throughout the year, 70% of the total frequencies falling within the length ranges 10 mm to 39 mm.

Table 5. Distribution of length of fish throughout the year

mm	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 79	80 to 89	90 to 99	Over 100	Total for month
January	1,052	157	3,155	198	153	71	38	20	29	97	4,970
February	26,970	4,325	1,165	485	430	375	25	20	15	45	33,855
March	1,160	4,635	3,727	2,535	951	532	124	64	63	66	13,857
April	24	143	225	819	1,654	1,360	801	374	15	51	5,466
May	85	164	489	652	700	392	145	72	18	64	2,781
June	0	40	130	300	290	310	420	80	90	100	1,760
July	0	315	345	100	190	120	185	115	80	40	1,490
August	3	229	125	296	220	74	201	86	35	14	1,283
September	10	480	1,040	880	900	570	250	130	170	100	4,530
October	11	115	143	49	51	48	28	23	30	49	547
November	25	867	935	552	349	134	90	27	15	35	3,029
December	57	345	717	261	351	291	84	12	3	24	2,145
Total for length range	29,397	11,815	12,196	7,127	6,239	4,277	2,391	1,023	563	685	75,713

Total for the year=75,713.

DISTRIBUTION OF MATURITY STAGES THROUGHOUT THE YEAR

Table 6 shows the manner in which the different maturity stages are distributed throughout each month of the year. From the table it will be seen that, with the exception of June, July and August, fish of maturity stage I represent well over 90% of the monthly catches and in the first quarter of the year they represent 99% and over of the monthly catches. Fish of maturity stages II and III are each, with the exception of June, July and August, below 5% of the monthly catches. For the whole year, stage I represents 97% of the monthly catches and stages II and III, about 1.5% each.

DISTRIBUTION OF FISH ON THE BASIS OF THEIR FEEDING HABITS

One of us (Tham Ah Kow, 1950) found that the inshore fish of Singapore could be divided into six groups on the basis of their feeding habits, viz :— (1) Phytoplankton and Zooplankton feeders, (2) Zooplankton feeders, (3) Polychaetes and Zooplankton feeders, (4) Zooplankton and *Stolephorus* feeders, (5) Predators and (6) Benthos feeders. For the purpose of this paper the first four groups have been condensed into one, viz :— Plankton feeders. The data relating to feeding habits are given in Table 7.

Table 6. Distribution of Maturity Stages throughout the year

Maturity Stage / Month	I	II	III	Monthly Total
January	4,907	55	8	4,970
February	33,815	40	..	33,855
March	13,817	19	21	13,857
April	5,163	262	41	5,466
May	2,599	83	99	2,781
June	1,210	170	380	1,760
July	1,135	180	175	1,490
August	926	80	277	1,283
September	4,170	210	150	4,530
October	510	10	27	547
November	2,887	121	21	3,029
December	2,091	24	30	2,145
Total	73,230	1,254	1,229	75,713

Besides, many of the larger plankton organisms also feed on the smaller ones and their requirements are also unknown. But it is interesting to note that whilst plankton feeders are represented by appreciable numbers of many species, one species viz : *Monacanthus chinensis* predominates in numbers among the benthos feeders.

Table 7. Distribution of Fish on Basis of Feeding Habits

	Plankton Feeders	*Benthos Feeders*	*Predators*
January	4,550	312	108
February	15,955	17,680	220
March	5,103	8,136	618
April	4,058	1,385	23
May	1,751	1,020	10
June	1,070	690	0
July	630	810	50
August	608	675	0
September	1,910	2,470	150
October	233	311	3
November	803	2,201	25
December	819	1,212	114
Total	37,490	36,902	1,321

The data with respect to plankton and benthos feeders in Table 7 reveal that a rise or fall in the numbers of plankton feeders from month to month is reflected in the frequency of benthos feeders. The correlation co-efficient between these two sets of data is about 0.92 which (n = 12) may be considered statistically significant. A balance between these two large groups of the nekton is thus indicated. A constant ratio between the numbers of the groups cannot be expected as their lengths, and therefore their sizes, are not constant. Consequently their food requirements are not constant.

PROPORTION OF NON-EDIBLE FISHES

It is very difficult in a country like Malaya to define the term "non-edible fishes." The Asian population do not mind eating small fish so that what would be classed as non-edible or trash fish in other countries are widely consumed in Malaya. This has been brought about largely by the low wage level among the labouring classes before the war as compared with the position in European countries. During the last war even members of the middle classes learnt to utilize small fishes as

food because of the extreme scarcity and high prices of protein foods and now some of them continue to eat small fish. Small fish are usually fried crisp so that all the bones can be eaten at the same time. This has the advantage of increasing the intake of calcium which is so important from the nutritional point of view. For the purpose of this paper, non-edible fish is defined as fish which are not normally eaten by the Asian population. They belong to the Orders Solenichthyes, Gobiomorphi, Scleroparei, Discocephali and Plectognathi. Some of them are Percomorphi. In the inshore area of Singapore there are more than twenty species of non-edible fishes. It should be emphasized, however, that these non-edible fishes are not wasted but are used as duck food and it is only a matter of converting one form of fish protein which is difficult to utilize into duck protein for ultimate human consumption. Although *Monacanthus* spp. are not normally eaten, large specimens of standard length greater than say 80 mm, are relished by some people. *Tetrodon* spp. are extremely poisonous and should be avoided, although some people are able to remove the poisonous parts of the fish and relish eating the flesh. The Japanese people, for instance, have restaurants which serve these puffer fishes on their menu, but even then, from time to time, cases of fatal Tetrodon poisoning have been reported among those who frequent these restaurants.

Of the species classed non-edible, it was found that in five months of the year more than half of the catches are non-edible fish and in another four months more than one-third of the catches are non-edible. In the remaining three months the proportion of non-edible fish varies from more than one twentieth to one fifth of the catches.

SUMMARY

1. The fish population consists of over 110 species belonging to 47 families and 13 orders.

2. Only 5% of the total number of species studied contribute substantially to the population in numbers.

3. The bulk of the population consists of small fish about 70% being less than 40 mm in length and only 1% being more than 100 mm in length.

4. Almost the whole population is made up of immature fish, only about 1.5% being anywhere near maturity.

5. There appears to be a balance in numbers between plankton feeders and benthos feeders.

6. The percentage of non-edible fish in the catch varies from 6 to 70. On the average it is about 42.

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APPENDIX I

List of species of the inshore fish population

TRYGONIDAE
- *Marcine* sp.
- *Trygon* sp.

CLUPEIDAE
- *Chirocentrus hypselosoma*
- *Dussumieria hasselti*
- *Dorosoma chacunda*
- *Engraulis* spp.
- *Stolephorus* spp.
- *Clupea (Harengula) dispilonotus*
- *Clupea (Harengula) fimbriata*
- *Clupea (Harengula) perforata*

SYNODONTIDAE
- *Saurida gracilis*

MURAENESOCIDAE
- *Muraenesox cinerus*

OPHICHTHYDAE
- *Pisodonophis cancrivorus*

PLOTOSIDAE
- *Plotosus anguillaris*

FISTULARIIDAE
- *Fistularis petimba*

SYNGNATHIDAE
- *Syngnathoides biaculeatus*
- *Hyppocampus kuda*

BELONIDAE
- *Tylosurus strongylurus*

HEMIRHAMPHIDAE
- *Hemirhampus quoyi*

EXOCOETIDAE
- *Cypsilurus* sp.

PSETTODIDAE
- *Psettodes erumei*

BOTHIDAE
- *Pseudorhombus* spp.
- *Bothus* spp.

SOLEIDAE
- *Synaptura quagga*
- *Achiroides* sp.
- *Paraplagusia bilineata*
- *Cynoglossus bilineatus*
- *Cynoglossus puncticeps*

SPHYRAENIDAE
- *Sphyraena jello*

MUGILIDAE
- *Mugil* spp.

ATHERINIDAE
- *Atherina calenciennesi*
- *Atherina duodecimalis*

APOGONIDAE
- *Apogon frenatus*
- *Apogon margaritophorus*
- *Apogon ellioti*
- *Apogon singapurensis*

CENTROPOMIDAE
- *Psammoperca waigiensis*
- *Ambassis gymnocephalus*

LOBOTIDAE
- *Lobotes surinamensis*

LUTIANIDAE
- *Lutianus vitta*
- *Lutianus lineolatus*
- *Lutianus kasmira*
- *Lutianus erythropterus*

POMADASYIDAE
- *Plectorhinchus* sp.
- *Pristipoma hasta*
- *Scolopsis* sp.

THERAPONIDAE
- *Therapon puta*
- *Therapon theraps*
- *Therapon jarbua*
- *Pelates quadrilineatus*
- *Helotes sexlineatus*

LETHRINDAE
- *Lethrinus* sp.

SPARIDAE
- *Synagris* sp.

SILLIGINIDAE
- *Sillago sihama*
- *Sillago maculata*

CARANGIDAE
- *Caranx (Selar) mate*
- *Caranx (Selar) boops*
- *Caranx (Carangoides) preustus*
- *Caranx (Carangoides) armatus*
- *Caranx (Caranx) sexfasciatus*
- *Caranx (Selaroides) leptolepis*
- *Caranx (Gnathanodon) speciosus*
- *Alectis indica*

MONODACTYLIDAE
- *Psetius argenteus*

LEIOGNATHIDAE
- *Leiognathus insidiator*
- *Leiognathus ruconis*
- *Leiognathus fasciatus*
- *Leiognathus equulus*
- *Leiognathus splendens*
- *Leiognathus* spp. (juvenis)
- *Leiognathus bindus*
- *Leiognathus berbis*
- *Leiognathus lineolatus*
- *Gazza minuta*
- *Gerres* sp.
- *Gerres macrosoma*
- *Gerres kapas*
- *Pentaprion longimanus*

MULLIDAE
- *Upeneus sulphureus*
- *Upeneus sundaicus*

SCIAENIDAE
- *Johnius* sp.

LABRIDAE
- *Choerodon* sp.
- *Halichoeres nigrescens*
- *Halichoeres biocolor*
- *Halichoeres hyrtlii*

PLATACIDAE
- *Platax pinnatus*

EPHIPPIDAE
- *Drepane punctata*

SCATOPHAGIDAE
- *Scatophagus argus*

CHAETODONTIDAE
- *Parachaetodon ocellatus*

SIGANIDAE
- *Siganus oramin*

TRICHIURIDAE
- *Trichiurus savala*

SCOMBRIDAE
- *Scombevomorus guttatus*

GOBIIDAE
- *Gobius* spp.

SCORPAENIDAE
- *Minous* sp.
- *Amblyapistus* sp.
- *Pelor* spp.
- *Polycaulus* sp.
- *Scorpaenopasis* spp.

PLATYCEPHALIDAE
- *Platycephalus* spp.

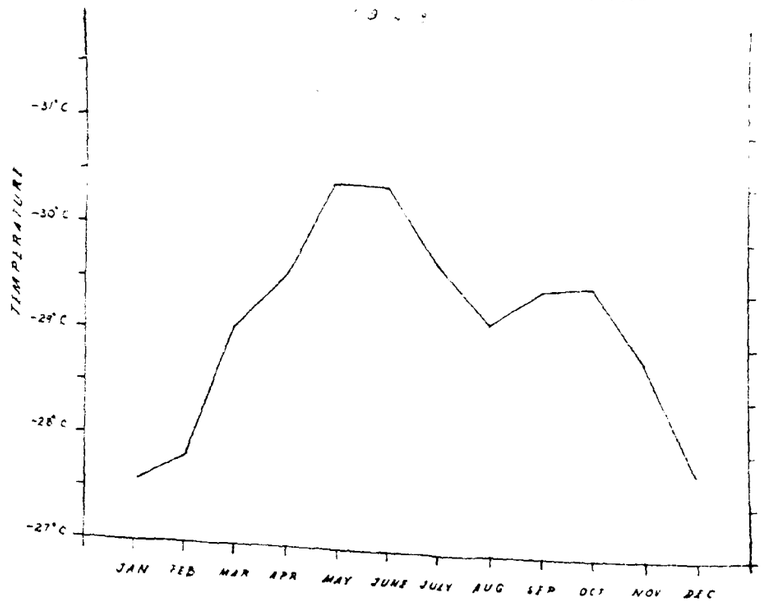
ECHENEIIDAE
- *Echeneis naucrates*

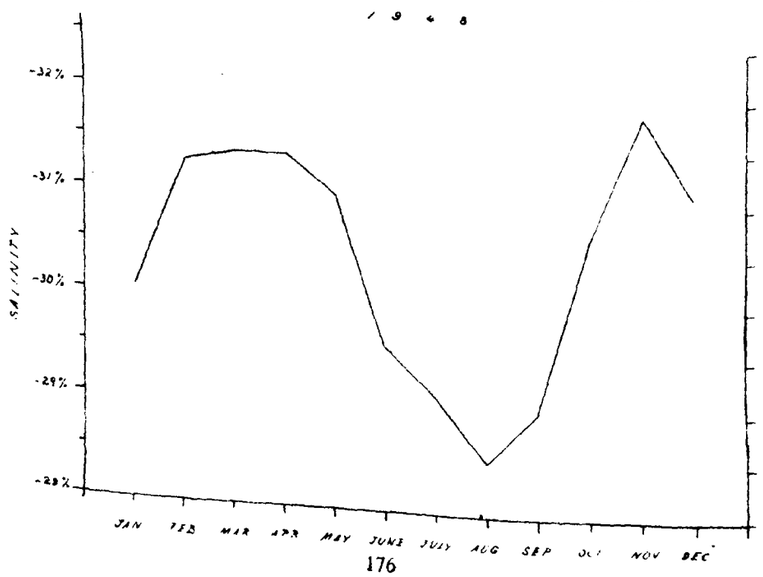
TRIACANTHIDAE
- *Triacanthus* spp.

MONACANTHIDAE
- *Monacanthus* spp.
- *Chaetodermis penicelligerus*

OSTRACIIDAE
- *Ostracion* spp.

TETRODONTIDAE
- *Tetrodon* spp.





FISHERIES RADIO NETWORK IN JAPAN

by
K. Kimura*

The fisheries radio network in Japan plays a most important role in the promotion of efficient fishing operations, especially as regards the location of schools. More than 3,000 fishing vessels have radio equipment and communicate between themselves as well as with the fixed stations. There are 77 fisheries radio stations on land throughout the Japanese islands forming together with fishing vessels the radio net-work.

Some of these stations are owned by the National Fisheries Research Laboratories, many by the prefectural fisheries institutions and a few by private companies.

The number of frequencies allocated to the fisheries radio communication is now 56, and the allocation is made according to districts and the type of fisheries.

Though the fisheries radio network is mainly utilized by large fishing boats operated on the pelagic waters, some coastal fishing boats, e.g. seiners and trawlers, also derive great benefit from the network. Above all, the network makes the most significant contributions to skipjack and tuna fishing, trawl fishing on the continental shelf of the East China Sea and Yellow Sea area and to whaling operations. The radio stations for the fishing in the East China Sea and Yellow Sea areas are located at Shimonoseki, Tobata, Fukuoka and Nagasaki, and these stations belong to the Shimonoseki Fisheries Radio Association, Tobata Radio Fishermen's Cooperative Association, Fukuoka Prefectural Research Institution and Nagasaki Prefectural Fisheries Institution, respectively.

Except for the Nagasaki and Fukuoka stations, the above licensees are private companies, and communication is made with their own companies' boats. The communications for the Antarctic whaling fleets are handled by the general coastal radio stations, and the three mother-ships of the Japanese whaling fleets closely communicate with catcher boats of their own fleets.

The main fishing fields (coastal whaling) are the waters adjacent to the Bonin islands and off Sanriku district, and most of the catcher boats operated in these waters belong to the Taiyo Fisheries Co. Ltd. and the Nippon Fisheries Co. Ltd. Two land stations owned by private companies are utilized for these communications, namley the Ayukawa station of the Taiyo Fisheries Co. Ltd. and Onagawa station of the Nippon Fisheries Co. Ltd. These stations are not, however, equipped with transmitters, so they cannot themselves communicate with catcher boats, although the boats communicate mutually at any time.

The biggest radio network in Japan covers the skipjack and tuna fishing fields. The number of these boats all over the country reaches 1,000, and all prefectures facing the Pacific Ocean have one to three land stations and communication with these fisheries is continuous throughout the day on many frequencies.

Radio communication makes it possible to know the conditions of the fishing grounds and promote efficient production, as well as the location of each boat, and prompt action is taken if any boat is in distress. It also has countless other functions, such as communications regarding preparations for landing and marketing the catch or the preparation of fishing gear and materials for the next voyage.

These communications are carried on between stations and fishing boats, or between these boats from a purely commercial view point, but there is another government network for the guidance of fishing craft, namely the prefectural land stations which receive information from their fisheries guidance boats, and such information is broadcast to the commercial fishing fleets. However, the scale of this network is not large at present.

The only systematic analysis of these functions is carried on by the Tohoku Regional Fisheries Research Laboratory under the Fisheries Agency. The oceanographic environments, circumstances of the fishing grounds and other valuable information along the north-eastern sea area of the Japanese Pacific coast are sent via the Ishinomaki fisheries

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radio station, and in the high season of skipjack and albacore from April to June around the Izu peninsula. Similar information is sent to this sea area via the Yaizu fisheries radio station. One of the major functions of the Tohoku Regional Fisheries Research Laboratory is the research on skipjack fisheries, and the research covers the whole Pacific waters. The above-mentioned system will be expanded in the near future to the waters around Kyushu and Formosa, via the Makurazaki fisheries radio station.

The main work of this fisheries guidance system is to broadcast the synoptic isothermal chart, which is made up from data sent in daily from many skipjack fishing boats or whalers operating in these waters, together with the oceanographic data sent from the fisheries guidance boats of each prefecture and marine observation boats of the National Fisheries Research Laboratories, Central Meteorological Observatory, Hydrographic Office etc. The results are then broadcast and are interpreted by the fishing vessels which make up their own isothermal charts on board so that they may study and investigate the daily oceanographic environmental conditions, such as the distribution of the water mass, ocean currents, up-wellings, current rips etc.

The Tohoku Regional Fisheries Research Laboratory trains fishermen to plot and interpret the isothermal chart, and fishermen have shown great interest in this study.

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FISHERIES EDUCATIONAL SCHEMES IN JAPAN

by

S. Konda*

The need for increased fish production and the consequent demand for a large number of skilled fishery workers has prompted Japan to organize and maintain fisheries education on a fairly extensive scale. Before the war, averaging the five years 1930 to 1934, the daily protein consumption per person in Japan was 66.7 grs., of which 11.7 grs. were animal protein (aquatic animal protein, 9.5 grs. or 81.2% and terrestrial animal protein, 2.2 grs. or 18.8%). Since it is desirable to take as much as 200 grs. of fish (100 grs. of which is edible, containing on an average 18 grs. of protein) per person per day, the amount of fish to be supplied for the population of 83,000,000 would be 6,059,000 tons a year.

The mechanization and capitalization of Japanese fisheries commenced around the end of the nineteenth century, and soon there grew a demand for trained workers for the industry. In 1898 and 1908 the steam whaler "Orga" (125 G.T.) and the steam trawler "Henne Castle" (169 G.T.) were brought out from Norway and Great Britain, respectively. In 1913 the number of steam trawlers in Japan amounted to 139 vessels. The total number of motor fishing boats was 1,000 in 1912; 8,000 in 1919; 15,000 in 1926; and, increasing rapidly, it amounted to 40,000 in 1932.

As early as 1895, some local fisheries schools were inaugurated, e.g. the Fukui Prefectural Obama Fishery School and the Iwate Prefectural Miyako Fisheries School; and thereafter, the number of such schools increased rapidly. In 1897, the Fisheries Institute of the Ministry of Agriculture and Commerce was inaugurated; this was the origin of the Tokyo University of Fisheries. In 1907, a Department of Fisheries was established in the Sapporo Agricultural School, which has developed into the present Fisheries Faculty of Hokkaido University. In 1908, a Department of Fisheries was instituted in the Agricultural Faculty of Tokyo University.

As of October, 1953, there were altogether fifty-six high schools in which fisheries courses were established. All of those high schools were located at fisheries centres, and the boys passing from local middle-schools entered, as a matter of course, the fisheries high school, which was sometimes the only high school in the area. The total number of such pupils, mostly sixteen to eighteen years of age, was 8,497 in April 30, 1951. All the fisheries high schools were public, mostly being financed by the respective prefectural governments. Fifty of the above fifty-six were full-day schools, the fisheries course of which usually included the three sub-courses, i.e. fishing, propagation and processing; though in some cases the arrangement was different.

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As of January, 1953, six of the fisheries high schools were being installed with training boats larger than 100 G.T. The training boats, workshops for processing of products, as well as piscicultural facilities of the high schools, are being rapidly improved and expanded.

At present there are thirteen universities in which Faculties or Departments of Fisheries are established. The list below shows the names of those universities and the details of the Faculties and Departments concerned with fisheries.

Candidates who have passed the high school can, after an entrance examination, be admitted to any one of these departments according to their choice.

Training fishing vessels of not less than 500 G.T. are attached to the Hokkaido University (Oshoro maru), the Tokyo University of Fisheries (Umitaka maru), the Kagoshima University (Kagoshima maru) and the College of Fisheries, Ministry of Agriculture and Forestry (Shunkotsu maru). The students connected with navigation in those Universities are trained to satisfy the requirements provided by the Enforcement Regulation for the Ship's Officers Law.

Biological study has been the major object of the Department of Fisheries established within the Faculty of Agriculture. There are more than fifteen marine biological laboratories and similar facilities for training the students belonging to the Department or Faculty of Fisheries. Besides these, there are several marine laboratories and similar facilities attached to the Faculty of Science in some universities.

Aquatic chemistry and practical processing of aquatic products are taught in the major universities. Aquatic chemistry is deemed to be an independent field of fisheries science. In the Graduate School of Agriculture, Kyoto University, fisheries chemistry is included in the Doctor's course.

Name of University	Faculty	Department	Fixed No. of Fresh Students	Financed by
Tokyo University of Fisheries	Fisheries	Fishing	100	Central Government
		Propagation	50	
		Processing	70	
Hokkaido University	Fisheries	Fishing	40	do
		High Seas Fishing	40	
		Propagation	40	
		Processing	80	
Kagoshima University	Fisheries	Fishing	80	do
		Processing	40	
Nagasaki University	Fisheries	Fishing	30	do
		Propagation	30	
		Processing	30	
Mie-Prefectural University	Fisheries	Fisheries	90	Mie Prefectural Govt.
Tohoku University	Agriculture	Fisheries	30	Central Govt.
Tokyo University	do	do	20	do
Kyoto University	do	do	45	do
Kyushu University	do	do	10	do
Miyazaki University	do	do	20	do
Hiroshima University	Fisheries and Stock-farming	do	30	do
Nippon University	Fisheries and Veterinary	do	150	Private
College of Fisheries		Fishing	50	Central Government
		Engineering	30	
		Propagation	30	
		Propagation	50	

Two examples of university curricula in fisheries are given below:

The general scheme of educational courses in Japan (*vide* Article 63 of the School Education Law and Ordinance No. 9, 1953, of the Ministry of Education) is as follows:— the Primary (Elementary) School Course of about 6 years, the Middle School (Junior High School) Course of 3 years, the High School (Senior High School) Course of 3 years and the University Course of 4 years leading up to the Bachelor's title (Gakushi). A further advanced course of 2 years would lead one to the Master's degree (Shyshi) while a thesis on its own merits could win a Doctorate (Hakushi).

Curriculum of the Department of Fishing, Faculty of Fisheries, Hokkaido University (Bachelor's Course).

Subjects	Units (Compulsory)
Outline of Fisheries	3
Outline of Deep Sea Fisheries	6
Special Treaties on Fisheries	8
Theory of Fishing	4
Theory of Aquatic Resources	4
Fisheries Policy and Exercise thereon	4
Fisheries Legislation and Exercise thereon	4
Outline on Maritime Affairs	4
Fisheries Mechanics	4
Dynamics of Fishing Net	4
Designing of Fishing Gear	4
Fishing Boat Engineering	2
Electric Wave Engineering	4
Sound Engineering under Waters	2
Special Exercise of Fishing	2
Special Exercise	4
Designing and Drawing of Machinery	3
Practical Exercise on Board a Vessel	2
Graduation Thesis	5
	4
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Subjects	Units (Optional)
Outline of Marine Zoology	4
Outline of Marine Botany	2
Planktonology	3
Biological Statistics	4
Oceanography	4
Meteorology	2
Conditions of the Sea and of the Catch	2
Dyes for Fishing Net	2
Special Lecture on Mechanics	4
Management of Fisheries and Exercises thereon	4
Cooperative Societies	2
Processing of Marine Products	2
Aquatic Propagation	2
Experiment on Aquatic Resources	2
do on Oceanography	2
do on Meteorology	2
do on Fishing Methods	1
do Fishing Net Dynamics and Net Designing	2
do Fisheries Mechanics	2
do Fisheries Electric Engineering	2
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Curriculum of the Department of Fisheries, Faculty of Agriculture, Tokyo University (Bachelor's Course).

Subjects	Units (Compulsory)
Outline of Fisheries	1
Aquatic Vertebrates	2
Aquatic Invertebrates	2
Theory of Fishing Operation	2
Theory of Aquatic Resources	1
Theory of Pisciculture	2
Experiments on Aquatic Zoology	6
Fishery Oceanography	2
do Experiments	1
Fishery Bacteriology	1
do Experiments	3
Aquatic Botany	2
do Experiments	2
Theory of Utilisation of Aquatic Products	3
Outline of Fishery Chemistry	1
Fishery Chemistry of Nutrition	2
Experiments on Fishery Chemistry	6
Theory of Fishing Boat	1
Fishery Mechanics	1
Fisheries Laws	1
Marine Practices	4
Graduation Examination Thesis	6
	52

Subjects	Units (Optional)
Fish Pathology	1
Aquatic Animal Physio-Ecology	2
Planktonology	2
Aquatic Plant Physio-Ecology	1
Limnology	2
Marine Meteorology	1
Navigation and Seamanship	2
Training of Fisheries	6
Genetics	2
Aquatic Animal Histology and Embryology	2
Inorganic Chemistry	2
Organic Chemistry	4
Bio-Chemistry	4
Applied Mathematics	2
Agricultural Economics	2
Comparative Agriculture	2
Bio-Statistics	1
Food Hygiene	1
	42

At present facilities for the degrees of Master and Doctor are available in five universities as stated below :—

University	*Subject*	*Degree*
Hokkaido	Fisheries	Doctor
	do	Master
Tohoko	Agriculture, Fisheries	Doctor
	do	Master
Tokyo	Biology, Fisheries	Doctor
	do	Master
Kyoto	Agriculture, Fisheries, Chemistry	Doctor
	Fisheries	Master
Kyushu	Agriculture, Fisheries	Doctor
	do	Master

Thanks to the development and maintenance of fisheries education and research, the fisheries industry of Japan has been able to keep abreast of the progress in the other industries of the country.

Most of the personnel who receive fisheries education in Japan generally continue to serve the industry directly or indirectly. Thus, of the total 809 graduates of Tokyo University of Fisheries who are living in Tokyo, 244 are now employed in fishing or related companies ; 95 in universities and other research organizations ; 49 in societies and associations relating to fisheries ; and 100 are officials of the Fisheries Agency and of the Fisheries Section of the Tokyo municipal government. Besides these, several are members of the Fisheries Standing Committee of the Diet, and many are businessmen managing their own fisheries trade.

The increase of fisheries production and consumption with a view to raising the levels of nutrition and standard of living is an important measure more or less common to the Indo-Pacific countries. Mechanization and organization of the fisheries industry are hence being planned and earnestly pursued in all these countries. It is for this reason that the Expanded Technical Assistance Programme of the specialized agencies of the United Nations and other schemes of international cooperation are active in the field of fisheries of the Indo-Pacific region.

The training of personnel is one of the most fundamental steps in fishery development. International cooperation in the matter of fisheries education and training, and exchange of students and fishery workers would prove highly valuable in the achievement of this object.

It is noteworthy that as of 1 July, 1953, there were 97 foreign students of 10 nationalities studying in Japan. Among the subjects studied were fisheries, boat building, etc. Some of them had been admitted to the Tokyo University of Fisheries and to other universities.

The main difficulty confronted by students from abroad is that of language, and they are advised to study Japanese at the International Students' Institute, Tokyo. Japanese language classes are held by this Institute to meet the needs of students from abroad, and as of September, 1953, seventy-six students of six nationalities were studying in such classes. I know several cases of young foreign students who studied one year at the Japanese language class of the above Institute, who were admitted to a fisheries college, and graduated from it with good record.

The above Institute also operates the International Students' House. According to information, the two-storey main building can provide the students with twenty-five clean, bright, comfortable living rooms together with other facilities. The monthly fee for each student for room and board, two to a room, is ¥10,000 (about US $28), subject to change according to circumstances.

Qualifications for admission to the university are provided for by the School Education Law and by the Enforcement Regulation of the same Law as follows :

> Article 56 of School Education Law : Those who can enter the university shall be those who have graduated from high school or completed the twelve-year schooling with the regular course (including those who have completed schooling equivalent to this, with a course other than the regular one), or those who have been recognized to have the scholastic attainments equal to the persons mentioned above under the provisions laid down by the competent authorities.
>
> Article 69 of Enforcement Regulation of School Education Law : Regarding the admission into the university, those who are recognized to have scholastic attainments equal or superior to high school graduates will, in accordance with the provision of Article 56 of School Education Law, be those who come under one of the following categories :
>
> 1. Those who have completed 12 years schooling in a foreign country.
> 2. Others designated by the Education Minister.
> 3. Those who are recognized by the university concerned as having scholastic attainments equal or superior to high school graduates.

Some universities are giving special consideration to the admission of students from abroad. There is growing enthusiasm in university circles in Japan to welcome foreign students who desire to pursue fisheries education in this country.

State of Employment of the Graduates of certain Universities and Fishery High Schools.

	Fishery Faculty, Hokkaido Univ.	Obama Fishery High School	Otaru Fishery High Shool	Yaizu Fishery High School
Total number of graduates except deceased.	2,496 (100)	1,645 (100)	965 (100)	1,577 (100)
Fisheries owners	18	73	147	..
Employees of companies relating to fisheries.	736	313	283	..
Employees of fisheries societies, etc.	93	95	96	..
Total	847 (33.9)	481 (29.2)	506 (52.4)	511 (34.9)

Section III

FISH MARKETING AND FINANCING IN AUSTRALIA

by

The Commonwealth Fisheries Office

FISH MARKETING

Within State boundaries, fish marketing is a function of State Governments. The Commonwealth Government is concerned with overseas marketing, including trade promotion and export quality control. This report will deal, however, only with marketing of fish, mainly in fresh form, for local consumption.

Methods of marketing in each State will be given separate treatment. There are wide variations in practices. These have been dictated mainly by geographical considerations including climate, population in relation to supply, differing structure of the industry in each State, predominant species fished, and partly by traditional local attitudes.

Catch by species in 1951-52 is shown in the March, 1953, issue of Fisheries Newsletter. Table 1 appended shows utilization of the catch by species groups and Table 1 a. gives the same information in respect of principal species. Table 2 shows processed products.

It will be seen that only a small proportion was frozen or otherwise processed, the great bulk of locally produced fish being marketed fresh. The freezing of fish fillets is done mostly in South Australia where fish is prepared for the Melbourne market, and in some of the more remote centres practically the whole of the catch is converted to frozen fillets.

New South Wales

The following description of the present system and its development has been extracted from the report of a Committee appointed to inquire into Fish Marketing, which was presented on 2nd September, 1953.

The 1942 Act.—In 1942, the Fisheries and Oyster Farms Act 1935-1938 was amended to make provision for the constitution of fish districts and to require all fish sold for human consumption to be first brought to and sold in the markets established in such districts. It also provided, *inter alia*, for the cancellation of agents' licences and the conduct of markets by the Chief Secretary as a corporation sole. In particular, the Minister was empowered and authorised :—

(*a*) to undertake and carry on in any district the business of the getting, preparation, purchase, sale, supply and distribution of fish and all products and by-products c the same and of the storage of fish and othe foodstuffs, products and by-products an for or incidental to that business to establish maintain, regulate and control markets, an such shops, depots and other establishment as he may deem necessary ;

(*b*) to arrange for the purchase and disposa of inedible fish, offal and other matter, in cluding the application of any manufactur ing process thereto to convert it into a mer chantable article ;

(*c*) to cause arrangements to be made for the receipt at the markets of oysters and prawns, and for the purchase, storing, selling, supplying and distribution of oysters and prawns ;

(*d*) to demand, collect, and receive in respect and for the use of any property or any service performed under this Act in connection with the business of fish supply or in connection with the sale of any fish, ice or other product such rents, commissions, tolls, dues, rates, fees and charges as may be prescribed, or where no such rent, commission, toll, due, rate, fee or charge has been prescribed such reasonable rent, commission, toll, due, rate, fee or charge as may be agreed upon ;

(*e*) to pay sums from the proceeds of the sale of fish supplied by any licensed fisherman in reduction or liquidation of any amount proved to the satisfaction of the Minister to be owing by the fishermen to a person who is or was a licensed fish agent and who holds a lien or other encumbrance as security for payment of such amount over any property used by the fisherman in his operations as such ;

(*f*) to make advances to licensed fishermen for the purchase of boats, gear or equipment necessary for carrying on the calling of a licensed fisherman on such security and subject to such terms and conditions as to repayment of the advance and interest thereon as may be approved by the Colonial Treasurer either generally or in any particular case.

A Fish Marketing Fund was to be established, into which all fees or sums of money received were to be paid, and out of which were to be defrayed the expenses and other charges incurred by the Minister.

As far as we can ascertain, the provision made requiring fish to pass through a market had four main objectives, namely, certification of the fish as fit for human consumption, conservation of the fishery by facilitating the detection of undersize fish, more equitable distribution, and improved and better marketing processes. In this respect, the Committee understands that there were serious complaints as to the practices and methods of certain agents in the Sydney Market, whilst in Newcastle the marketing conditions were primitive and disorderly, to say the least.

Action was taken in November, 1943, under the relevant sections, to constitute the Newcastle Fish District and to establish a market in such district.

Prime Minister's Request in 1944.—Following a request by the then Prime Minister in 1944 for the support of the New South Wales Government in the organisation of the fishing industry on a co-operative basis for the purpose of rationalising the marketing and distribution of fish, a Committee was set up in January, 1945, to investigate the proposals and report upon them.

This Committee recommended that the fishermen be encouraged to form co-operative societies under the Co-operation Act for receiving, handling and distributing fish, and that the financing of depots be guaranteed by the Government under the Government Guarantees Act. A central co-operative distribution organisation in Sydney was also recommended.

A Bill was introduced in Parliament to give effect to the recommendations but, although passed in the Legislative Assembly, it was rejected by the Legislative Council.

On 17th September, 1945, the provisions of the 1942 legislation were invoked and control of the Sydney Fish Market was assumed by the Chief Secretary as a corporation sole. The 17 agents who had been operating in the market for some years ceased operations on 16th September and were subsequently compensated from the Fish Marketing Fund in accordance with the provisions of Section 41 E of the Fisheries and Oyster Farms Act 1935-1942.

As the supply of fish was below requirements and the price of fish was controlled, it was found necessary to institute a quota system for the allotment of supplies available. This quota system operated until December, 1951, when the price of fish was decontrolled.

Report of 1946 Committee.—In November, 1946, a further Committee was appointed by the then Premier to inquire into fish marketing and to submit recommendations as to the most appropriate authority to take control of the marketing distribution of fish.

The majority report of this Committee recommended that a corporate body, appointed by the Governor, should conduct fish marketing and that fish distributing districts should be proclaimed. It also recommended that all proclaimed species of fish for human consumption be vested in and be the property of the authority. A minority report submitted by Mr. A. B. Sheldon, Registrar of Co-operative Societies, recommended that a co-operative organisation should take over the central market.

Neither the majority nor minority report was implemented.

Local Co-operative Societies.—In the meantime, co-operative societies were being formed at the major fishing centres along the coast. A full list of the co-operatives now functioning and an indication as to the extent of their operations and financial position is being included in this report.

On the 3rd October, 1947, the Newcastle Branch of the Market was taken over by the Newcastle District Fishermen's Co-operative Society Limited.

These co-operatives were permitted to sell fish for local requirements, which amounted to the discharge of marketing functions. This practice was successfully challenged in the courts in respect of the operations of the Newcastle Society and the case established that there was no legal authority for co-operative societies to conduct fish markets.

Legislation Passed in 1949.—Faced with the difficulties which were confronting co-operatives in conducting markets, the Government towards the end of 1949 decided in favour of complete co-operative machinery for the organisation of the fishing industry, subject to a measure of supervison in the public interest.

The decision to hand over the Sydney Market to co-operative control was endorsed unanimously in January, 1950, by representatives of all sections of the fishing industry.

Legislation had been passed providing for the granting of approval by the Governor, subject to certain conditions, to the establishment, operation and control of fish markets by co-operative trading societies.

A provision inserted in the Co-operation Act read as follows :—

(4) The Governor may, after a report and recommendation furnished to the Minister by the advisory council or advisory committee referred to in sub-section two of this section, by notice in writing to a trading society—

(a) suspend for such period as he may determine or revoke any approval given to such society pursuant to this section in respect of any market so established, controlled or operated by such society ;

(b) from time to time vary or amend the terms, conditions or stipulations imposed in granting his approval to the establishment, control or operation by such society or any market for the sale of fish.

New South Wales Trading Society Limited.—A co-operative society was formed to take over the functions of the central market. In relation to finance it was proposed that a Government guarantee to the extent of £100,000 should be available and that each of the co-operatives and each steam trawler company should take a qualifying share holding of £500 subject to the long term repayment of the loan made under guarantee. Each of the co-operative societies outside Sydney was then granted approval, on a recommendation of the Advisory Council, to conduct fish markets under the conditions specified.

A formal application for a Government guarantee was made to the Treasury with a view to the Sydney market being taken over by the newly formed co-operative on 1st May, 1950. However, the guarantee was not forthcoming by that date and the Treasury advised that the financial and capital proposals for taking over the Market were not satisfactory. It submitted alternative proposals which were not acceptable to the Board of Directors of the Trading Society. The Co-operative has since submitted other proposals, but acceptance of them has not yet been signified by the Treasury, and the Sydney Fish Market is still conducted by the Chief Secretary.

Approvals granted to societies to operate fish markets included a condition that no society should sell fish to any trader unless and until approval to supply such trader had been given by the Chief Secretary. One of the objects of this condition was to overcome an undesirable development whereby fish was being sent to the metropolitan area without first passing through the Sydney market.

Special Arrangements Affecting Marketing of Fish in Sydney and Newcastle.—A factor of some importance in any review of marketing is the special arrangement existing in respect of Cam and Sons and Red Funnel Trawlers Pty. Ltd., in Sydney, and Hanlon's in Newcastle. The two former are producers of fish with well-equipped establishments on the waterfront, while the latter is a firm which has been engaged in the wholesale buying and selling of fish in Newcastle for many years. The trawler companies have been permitted to retain a portion of their catch for direct sale to persons holding contracts with them. Commission at the rate of 6¼% is paid on all fish whether it is brought to and sold at the market or not. The fish is weighed, sorted and packed before being consigned to the market. Prior to the Co-operative conducting marketing in Newcastle, Hanlon's were allowed to handle fish on behalf of certain fishermen subject to certain conditions, which required all fish to be taken to the market in Newcastle and the proportion of fish which might be purchased from the market by the firm to be determined by the Manager of the market. Commission at the rate of 10% was payable and a rebate of 2½% allowed on all fish if graded, packed, weighed, sorted and boxed, and the other conditions complied with.

Commission on fish consigned to the Sydney Fish Market by Hanlon's is now subject to a rebate of 5% for boxing etc., and the commission payable in such circumstances is 6¼%.

Certain matters affecting the arrangements are now in dispute between Hanlon's and the Co-operative Society which conducts the Market. In respect of fish required by the firm for its own provision business, an arrangement has been proposed by the Newcastle Co-operative whereby a similar commission concession of 5% will be allowed provided the firm sorts and boxes it before taking supplies to the Co-operative Market where the proportion of fish which may be purchased back by the firm for its business requirements will be determined by the Manager.

The Sydney Fish Market

Prior to 1941 this market consisted of a single-storeyed inadequate building at the site of the present market which is situated in a location bounded by Thomas, Quay and Little Thomas Streets, and covers an area of slightly more than one half acre ground space. This market was rebuilt by the Sydney Municipal Council in 1941 and opened for trading on 13th October, 1941. It consists of a main selling floor, a basement and a mezzanine balcony used for offices. Prior to the Chief Secretary taking over this market, the Council obtained revenues from agents and other tenants on a weekly rental basis.

The market as it stands has several unsatisfactory features amongst which are (a) location, i.e. distance from wharf facilities and railways terminals ;

(*b*) layout, and (*c*) complete lack of refrigeration facilities. This latter is a serious disadvantage in periods of peak fish supplies, mainly occurring in the summer months when fish has to be transported by rail to Sydney from far North Coast centres over distances of several hundred miles in unrefrigerated vans. No cool storage or proper holding facilities are available in the market premises to keep such stocks until they are sold.

In 1952-53 the Sydney City Council charged an annual rental of £10,049 in respect of the selling floor and box yard, which rental the Council now proposes to increase by a further £9,000 per annum. The Fish Market Management rents a small refrigeration chamber at one of the proprietary cold stores at a rental of £10 per week. When this room is in full use, additional cold storage capacity is rented as and where available.

Branch Markets.—Branch Markets conducted by the Corporation Sole are also in operation at Wollongong and Bateman's Bay, but again, in neither place are cold storage facilities installed, these markets being regarded as temporary rather than permanent establishments. These depots function mainly to weigh, sort and pack the catch of local fishermen, providing services which otherwise would not be available, but they also conduct wholesale selling functions to the extent of the local demand, the surplus over local sales being forwarded to the Sydney Market floor. The depot at Bateman's Bay is inadequate and its retention scarcely justified in view of the smallness of the local catch.

Methods of Selling.—The Sydney Market and its two small South Coast branches are conducted by the Chief Secretary as a Corporation Sole, under a Manager who is a Public Service employee. The Act prescribes that all fish shall be sold by auction (unless the Minister otherwise approves) and in the result all fish must, if possible, be sold on the day it is received, unless consignors impose reserves. Only one auction is carried on at one time in the market. The auctioneer finishes selling in one bay before he moves to one of the bays in which supplies are placed as they arrive at the market. There are four selling bays in all, and the staff in each bay are responsible for the individual bay's receivals. The accounting system in force is very detailed and covers the ownership and contents of each box handled. A considerable amount of criticism has been levelled at the accountancy system in force and the individual box docketing of which it forms a part, on the grounds that the system is so elaborate that sales are held up. The present practices have been reviewed, but it is difficult to see that any less detailed methods could be employed in a Government conducted selling organisation.

Commission Charges.—The Sydney Fish market earns its revenues from commission charges. This is at the standard rate of 11¼ per cent. However, a rebate of 5 per cent, making the actual commission paid 6¼ per cent, is allowed to the two steam trawler companies, fishermen's co-operatives and Hanlon's Newcastle provided that consignments received by the markets for sale are packed in cases appropriately marked with guaranteed weight and description of contents, and that the co-operative concerned undertakes to account to its individual members for consignments, the market in effect, forwarding one return only to a co-operative in respect of each trading day's total receivals.

Finances.—The Market operates with a Treasury advance of £30,000 (increased from £10,000 in 1948/49) and an overdraft with the Bank of New South Wales under Government Guarantee of £50,000.

Organisation of Fishermen's Co-operative Societies.—As apart from the central marketing organisation which has been described, marketing facilities otherwise are available to fishermen at most of the important fishing ports through the fishermen's co-operatives functioning there. These co-operatives provide local services in the form of packing sheds in which there are facilities for the boxing of fish, icing, weighing, labelling and cartage to rail. In some of these co-operatives there is an ice-making plant and/or cold storage rooms for holding, but this position is not uniform. Generally, the directors of co-operatives are anxious to provide or extend such facilities for the benefit of members. For these services, charges are made and all co-operatives employ a manager and engage permanent and/or casual labour and secretarial assistance. Overhead is, therefore, fairly substantial and the larger co-operatives handling considerable quantities of fish are in such respects in a better position to assist their members than the smaller societies.

Co-operatives have been established at Byron Bay, Richmond River, Evans Head, Clarence River, Nambucca River, Macleay River, Hastings River, Laurieton, Wallis Lake, Hawkesbury, Newcastle, Nowra, Bermagui and Eden.

These co-operatives sell fish locally by retail and, in addition, supply other orders within the terms of trading approvals issued by the Chief Secretary. Opportunity also exists for exports of fish from far North Coast co-operatives to be made to Queensland buyers and the Clarence River co-operative, in particular, has developed a substantial interstate trade in such exports.

The relative size of these co-operatives and some further details of their operations are given in the following schedule made available by the Registry

Name	*Commenced Operating*	*Value of Fixed assets*	*Turnover 1951-52*
Byron Bay	Jan. 1947	£ 6,668	£ 51,897
Richmond River	Jan. 1948	3,592	39,635
Evans Head	July 1947	5,798	59,357
Clarence River	Sept. 1940	20,000	140,000
Nambucca River	April 1947	2,705	50,296
Macleay River	Dec. 1940	2,662	58,166
Hastings River	Mar. 1947	1,356	34,395
Laurieton	Nov. 1946	9,616	61,290
Wallis Lake	May 1947	4,468	90,790
Hawkesbury	Oct. 1950	1,704	45,453
Newcastle	Oct. 1947	5,706	219,836
* Nowra	Dec. 1947	2,015	63,076
* Bermagui	Feb. 1947	4,167	29,355
Eden	Sept. 1947	4,491	..

of Co-operative Societies. The value of fixed assets is at 30th June, 1952.

One difficulty inherent in co-operative marketing relates to the pooling of the total of all supplies received, which most of the co-operatives in the fishing industry have introduced. Under this system, the identity of the catcher is lost and fish is consigned to market in the name of a particular Society. In turn, the Government Fish Market returns one invoice only to the Society, detailing realisations made for the total consignment forwarded, but not in respect of individual boxes in the consignment which, if available, might permit the Society to pay its members separately. This system of pooling has some obvious disadvantages:

(*a*) It gives the fisherman who is careless in the handling of his product the same return as the fisherman who takes every care in the icing down of his fish after it is caught so that it reaches the market in prime condition.

(*b*) In most cases, it provides the fisherman handling a high quality product and consigning to the market outside the co-operative marketing organisation, a better return on such arrangements than suppliers to the co-operative who accept the better results pooled with the bad on a weekly basis.

(*c*) A co-operative attempting to enter into a long-term contract with buyers on an agreed yearly or seasonal price may be placed in difficulties. Supplies would be received from members at times when the co-operative is in a position to return prices equivalent to or greater than the ruling Sydney market price, but the tendency is for members to by-pass the co-operative and forward direct to market at times where there is a clear advantage to do so.

These difficulties must be taken into account in appreciating the developments which have taken place in recent years, in attempting to explain why some of the co-operatives that have been formed have failed, and why it is that local fishermen at some sizable fishing centres have not formed such societies. A great deal depends on the local circumstances present, but not least of all upon the ability of particular managers and the enthusiasm of local boards of directors. The success or otherwise of individual societies must be judged on the degree of local support received, which in turn is related to the services rendered.

Fishermen's co-operative societies, if they are to succeed and expand their operations, should be actively fostered, and assisted by the respective Government Departments concerned, particularly in regard to requests that might be made for the improvement of facilities. One of the principal reasons why an outstanding development has in fact occurred in New South Wales within a comparatively short period of time is, in the Committee's view, traceable to such past encouragement by the Registry and the Chief Secretary's Department.

Fish Marketing in Newcastle.—In 1942 a public fish market was opened by the Chief Secretary at 247 King Street, Newcastle. This market was established to ensure the equitable distribution of fish available at that time, following complaints from fishermen and the general public.

Somewhat later, in 1945, the Newcastle market was made a branch of the Sydney market, which was at this time taken over by the Government.

The operations of the Newcastle Branch of the Sydney market ceased in January, 1951, and the Newcastle Fishermen's Co-operative then took over the marketing functions in that centre.

The position at Newcastle is complicated by the fact that it is a very large centre of population drawing supplies from a number of isolated fishing centres such as Myall Lakes, Karuah, Tea Gardens,

* These Societies have operated with assistance of Government Guarantees.

Nelson Bay, Stockton, Swansea, Bungwahl and Bulladelah. Even though there has been formed a Newcastle Fishermen's Co-operative, not all fishermen in these various centres, which are scattered over a wide area, are members, an appreciable number preferring to market their fish through Hanlons and other fishermen electing to consign their fish direct to Sydney or otherwise sell it locally outside the organised framework of marketing.

The fish market conducted by the Newcastle Co-operative is also at some disadvantage in operating independently by private treaty sales, due to its close proximity to Sydney and the relative ease with which Newcastle buyers may, if they so choose, by-pass the local market and purchase their supplies in Sydney. Complaints have been made against its conduct by buyers and the market building itself leaves much to be desired. The Co-operative has been anxious to acquire more suitable premises on the foreshores of Newcastle, but so far has not succeeded in obtaining a suitable site which would have the advantages of being on the Harbour itself with facilities for boats to be tied up at an adjacent wharf. Approaches to the Newcastle Harbour Trust have so far been unsuccessful.

Queensland

In Queensland a particular form of statutory organisation has been in force for some years. This Queensland marketing position has some relevance to New South Wales conditions, from the fact that there is a substantial export trade from far North Coast centres in this State to Brisbane, of netted estuarine fish, particularly mullet. Also of interest are the operations of the Queensland Fish Board, to which there is no parallel in any other State of the Commonwealth.

The history of the creation of this Board is not without interest. In 1917 a Metropolitan Fish Market was erected by the Queensland Government in Brisbane, to replace the previous market which had been conducted in leased premises by a Board comprising representatives of the City of Brisbane and adjoining Local Authorities. The erection of the market was the outcome of a decision of the State Government to provide an effective organisation for the sale of fish on behalf of the local producers. In 1918 all auction sales ceased and the State Fishery Business commenced to buy fish from fishermen at prices fixed by a Board under "The Fish Supply Act of 1916". With the purchase by the State of the whole of the fishermen's catch, at prices fixed by the new Board so established, the production in and around Moreton Bay is reported to have been considerably increased. Soon, however, fishermen evidenced dissatisfaction with the prices received and considerable disagreements arose. Substantial losses had been incurred in the State Fishery Business, due to its inability to dispose of surplus supplies accumulated in glut periods. The Government offered to revert to the open market and subsequently after discussions with fishermen's representatives, an agreement was entered into with a Joint Stock Company, formed by the fishermen, under the name of "The Fishermen's Co-operative Company Ltd." This Company was given an Agreement of lease of the market floor as from May, 1921, which it continued to hold until 1935. The State Fish Market was declared the only place within the Brisbane metropolitan fish supply district at which fish could be sold wholesale. The State Fishery Business, as the owners of the market premises, supplied trays, weighing machines, trucks and other equipment, whilst the Co-operative Company employed the selling staff and other necessary personnel.

In 1934 an official enquiry took place into the operations of the Co-operative Company, which had suffered substantial losses in some retail business ventures and which as a result had been forced to increase its selling commission charges. The Recommendation of this Committee, which was subsequently accepted by the Government, provided, *inter alia*, for the creation of a Board with adequate powers and responsibilities to regulate the marketing and distribution of fish in the Brisbane metropolitan area, and which was to be empowered to take over the existing market at a reasonable valuation (£ 25,000).

In 1935 a Fish Board was created by statute under the "Fish Supply Management Acts, 1935 to 1951" which, originally confining its activities to the Brisbane metropolitan area, has now extended its field of operations to embrace the whole State. This Board operates 19 markets in Queensland in addition to the Brisbane wholesale market. All have cold storage accommodation and nine are equipped for the manufacture of ice. These markets extend from Cairns in the north to Coolangatta in the south, and the Board sells to licensed distributors at wholesale prices fixed by the Queensland Prices Commissioner. Retail prices are also fixed for fresh fish, but not the cooled product. From markets Maryborough southwards, a proportion of all receivals are forwarded to Brisbane after local distributors have been supplied, but north of Maryborough, the Brisbane market is only used when surplus supplies cannot be sold locally.

The Board also operates a system of purchasing first grade quality fish from fishermen qualifying for contracts. Prices are determined after consultation with the Queensland Fishermen's League and with the approval of the Prices Commissioner. Fish of second and third grade quality are also received

for sale at agreed minimum and maximum prices. All fish are subject to the regulation market charges of commission, market dues and cold storage, if applicable. Some fish received on consignment is auctioned.

The total quantity of fish handled by the Queensland Fish Board at its various depots in the year 1951-52 amounted to 8,592,185 lb, realising the sum of £538,520. Total Board net revenues amounted to £ 71,561, the average cost to fishermen of Board charges representing approximately 2d. per lb. The Board meets the expenses of all transport charges north of Maryborough. In addition to the production of the Queensland fishery handled by the Board in this year, large supplies of New South Wales fish from the Co-operative depots at Ballina and Maclean were imported, the quantities declared being 1,036,119 lb, valued at £ 58,613. Special problems occur in the Queensland fishing industry because of the extensive area of its coastline, stretching from the New South Wales border northwards to Cairns and beyond. Fish is received at the Cairns depot, for example, by air from Thursday Island, Portland Roads, and Normanton.

The Board as it is now constituted comprises a Government chairman, one southern fishermen's representative, one northern fishermen's representative, one southern consumer's representative, one northern consumer's representative and a representative also of distributors, making a Board of six part-time personnel, the chairman being a senior officer of the Queensland Treasury. The Brisbane market, as operated by the Board, is conveniently located on the Harbour foreshores in a central position, and even though it is nearly forty years old, is sufficiently large for the needs of the Brisbane trade. Its layout is convenient, but by far its outstanding characteristic consists of the extensive facilities which have been installed for the cold storage of fish, on the tray system.

The Committee is in no position to offer comment on whether the Fish Board in Queensland functions to the complete satisfaction of its producer suppliers or the local distributive trades or the fish-consuming public at large. Government interest in fish marketing has been evident since 1916. Wholesale and retail price controls are maintained, even though in New South Wales such controls were lifted at the end of 1951 and have been removed also in other States. The Board, however, in its control of an extremely perishable product is required to maintain its operations in a State almost wholly within the tropical and sub-tropical zones, where transport conditions are unusually difficult, and centres of fishing and population are extremely scattered. The Board functions also alongside twenty-two other commodity boards which have been set up to supply the special needs of Queensland agricultural producers. One of its chief advantages in the economics of its administration is that it owns the Brisbane wholesale markets, so that it is not under obligation to pay rent or substantial interest rates.

Queensland production of fish, however, is less than one-third of the production in New South Wales, and the population of Brisbane is less than one-half that of Sydney. Production occurs at Sydney both to the north and to the south, but in Queensland almost wholly in the close vicinity or to the north of Brisbane. The species of fish marketed also show some differences from those in New South Wales.

Victoria

The Melbourne Fish Market is conducted by the Melbourne City Council.

In Victoria, no attempts have been made at Government organisation of the fishing industry similar to those in New South Wales or Queensland. The system followed in the Melbourne Market is one of private commission agencies, this including one agency which at one time functioned solely as a fishermen's co-operative selling enterprise, but which is now conducted as a private company. In addition, to Victorian products, large quantities of South Australian and Tasmanian fish are consigned to Melbourne and there sold. Shark and barracouta fish which are not normally sold to any extent in Sydney, comprise a high proportion of Melbourne Fish Market disposals.

In Victoria, the co-operative movement among fishermen has been beset with many difficulties. Co-operatives have been formed at some of the fishing ports and operate on lines similar to those in New South Wales, e.g. Port Albert, San Remo and Port Fairy. Some few years ago a scheme for the building of cold storage facilities for co-operatives at Victorian fishing ports was promoted by the Victorian Government and a number of such fish depots equipped with extensive cold storage facilities were built. For the most part, however, these have not proved a commercial success.

South Australia

The fish market in Adelaide is privately operated. In addition a large interstate firm buys fish from fishermen. There is also a large trading co-operative society with branches equipped with freezing plants in Adelaide and some fishing centres, which buys from fishermen, and there are four smaller co-operative societies in the other districts. Thus, apart from the private auction market in Adelaide handling mainly fresh fish for local sale, marketing is done by disposal to co-operatives or others who produce frozen fillets for disposal in Adelaide or Melbourne.

Western Australia

Marketing of fish in Western Australia is not on a statewide basis although the Superintendent of Fisheries can direct certain supplies to particular areas. There is a Public Market at Fremantle which is controlled by a cooperative of fishermen and another in Perth which is controlled by the Metropolitan Market Trust, a body corporate, which owns and controls public markets on behalf of the Government. The principal market was the Perth market where fish was displayed hygienically in a new concrete and brick building with proper cleaning facilities, but during the war price fixing and shortage of supplies caused the by-passing of the market and sales took place outside of the market area. Health inspectors are constantly in attendance during sales at the markets. Auction charges were 10% including cartage from railway yards which adjoin. The State Government is now investigating fish marketing and new proposals are expected this year.

Tasmania

There is no standard fish marketing system and no fish market. Fish buyers operate at all main centres and fishermen usually enter into agreements to supply their catch to a particular buyer at a named price for each species. Because of the small population of Tasmania relative to its fish resources, a large proportion of fish taken is marketed in Melbourne. Some of the fish reported caught in Tasmanian waters is taken by Victorian boats and landed in Melbourne.

FINANCING

In Australia, the fishing industry has never attracted the flow of ordinary investment capital. This situation at present is inhibiting the development of a tuna industry. While the tuna resources are proved, capital does not flow into the industry.

Apart from the steam trawlers operating from Sydney, the Australian fishing fleet is comprised of small vessels and the necessary finance for their construction has been provided by individuals, family groups, or the pooling of resources of a number of persons.

There are some instances of canneries and fish merchants financing fishermen to procure or convert boats, usually with an agreement as to sale of fish to the person or firm providing the finance. Neither the fishing industry nor the fish canning industry, however, possesses the necessary capital for expansion.

While various methods of financing fishing enterprises by State Governments are provided for, advances to fishermen are not frequently made. Very few fishermen can offer acceptable security. Consequently very few new boats have entered the industry since the last war. There are nevertheless some instances of Government agencies assisting fishermen to acquire boats or otherwise providing finance for the fishing industry. Details of Government financing in each State are set out hereunder.

New South Wales

The Rural Bank, a State Government Agency, has made advances to a number of fishermen. The Bank has also made advances to traders in fisheries products and to a number of Fishermen's Co-operative Societies. These Societies have received advances at concession rates of interest and in addition they have benefited by the execution of a Government guarantee enabling them to negotiate loans when their securities were insufficient to meet normal banking requirements.

South Australia

Under an amendment to the Loans to Producers Act 1927, approved in 1946, it is provided that fishermen and companies or societies of fishermen may obtain loans from the State Bank for the purchase of boats, engines and general equipment. Loans on prepared fish products are also granted to fishermen's societies.

In addition, the South Australian Government recently made substantial advances to the proprietors of a purse-seine vessel (the only vessel in Australia designed specifically for purse seining) and the Commonwealth Government has loaned a purse-seine net which had been acquired for experimental purposes.

Victoria

The Government has assisted Fishermen's Co-operative Societies at seven ports to erect refrigeration plants. In each case the Government advanced 75% and the fishermen subscribed 25%.

Western Australia

Fishermen are eligible for advances under the Industries Assistance Act.

Tasmania

Products of fishing come under the provisions of Marketing of Primary Products Act 1945. The Marketing Board set up under the Act may borrow up to £300,000 from any Bank on a Government guarantee.

Queensland

In rare instances, fishermen have applied to the Secondary Industries Division of the Department of Labour and Industry. One fisherman was assisted recently by that Department guaranteeing his overdraft.

Table 1

Utilization of catch by species groups Australia, 1951-52 ; weight unit : lb

Species Groups	1. Catch Round Weight	2. Estimated Disposition of Catch—Round Weight				
		For fresh Marketing	For Freezing	For Curing	For Canning	For other purposes
TOTAL :	100 811 413	75 908 920	12 830 737	190 760	13 432 412	5 453 305
1. All freshwater teleosteans	1 665 499	1 651 762	13 737			
2. Salmon, trout and similar	53 706				58 423[1]	
3. Teleostean Flat-fishes	214 715	214 715				
4. Cod, Hake & similar	176 774	176 774				
5. Herring & similar	418 290				150 855	267 435[2]
6. Tunas, mackerels and similar	11 511 240	5 159 701	60 000	42 086	5 779 631	469 822[3]
7. Other marine teleosteans	51 656 007	42 648 021	1 300 000	148 675	7 443 503	115 808[3]
8. Elasmobranchs	6 079 443	5 579 443	500 000			
9. Crustaceans	16 920 421	5 863 421	10 957 000			100 000[4]
10. Molluscs	7 614 998	7 614 998[5]				
11. Other acquatic fauna	4 500 320	80				4 509 240
12. Aquatic flora						

[1] Whitebait (*Lovettia seali*), includes some taken in previous year.
[2] 27,526 lb. for fish paste, balance probably for bait.
[3] For fish paste.
[4] Estimated weight of prawns for bait.
[5] Includes unknown quantity of scallops frozen.

Table 1a

Utilization of catch by principal species, Australia, 1951-52 ; weight unit : lb

Principal Species	1. Catch Round Weight	2. Estimated Disposition				
		For fresh Marketing	For Freezing	For Curing	For Canning	For other purposes
Barracouta (*Leionura atun*)	9 891 934	3 831 228	60 000	42 086	5 526 430	432,190[2]
Mullet (Mugilidae)	11 044 731	10 536 464	109 014	65 430	333 823	
Australian salmon (*Arripis trutta*)	6 591 860	(3)	78 290		6 719 009	115,808[2]
Morwong (*Nemadactylus* spp.)	2 530 309	2 504 193	26 116			
Whiting (Sillaginidae)	2 589 684	2 513 640	76 044			
Flathead (Platycephalidae)	3 001 371	2 722 875	278 496			
Leatherjacket (Aluteridae)	5 827 141	5 676 515	150 626			
Shark (Mainly *Emissola antarctica* & *Galeorhinus australis*)	4 718 830	4 689 112	29 718			
Crayfish (Mainly *Panulirus longipes* & *Jasus lalandi*)	6 078 930	5 578 930	500 000			
Prawns	14 593 979	3 636 979	10 957 000			100 000[4]
Oysters (5)	1 936 933	1 836 933				
Mother of Pearl shell (*Pinctada maxima*) (6)	6 862 424	6 862 424				
Trochus (*Trochus niloticus*) (6)	1 910 720					1 910 720
	2 589 520					2 509 520

[1] Including canned fish loaf, i.e. fish with ingredients such as cheese, vegetable, cereal etc.
[2] Used for fish paste.
[3] Some Australian salmon was consumed fresh but none shown because quantity processed exceeds quantity reported caught. This may be due to carry-over from previous year or understated catch by fishermen.
[4] Estimated quantity for bait.
[5] Weight in shell.
[6] Shell only.

Table 2

Australia : Fisheries—Output of Processed Commodities 1951—1952

F.A.O. Serial No.	COMMODITY	QUANTITY (lb)	
1.0	*Frozen Products :*		
1.21	Frozen fillets n.e.s.	716 484	
1.31	Frozen products from crustaceans	4 261 384	(a)
1.4	Frozen products for bait, animal feed and etc.		
2.0	*Cured Products :*		
2.5	Dried, salted, smoked and otherwise cured products from tunas, bonitos true mackerels and similar species	20 443	(b)
2.6	Cured products not elsewhere specified from teleostean species	771 552	
3.0	*Canned Products :*		
3.12	Canned products from Atlantic salmon trouts and similar species	50 577	(c)
3.3	Canned products from herrings, sardines and similar species	93 768	
3.41	Canned products from tunas and bonitos	66 120	
3.42	Canned products from true mackerels, Spanish makerels and similar Species	3 204 479	(d)
3.5	Canned products not elsewhere specified from other teleostean species	3 ,999 368	(e)
4.0	*Meal and Fertilizers :*		
4.23	Meals (feeding stuffs) from demersal and non-oily species	125 400	
5.0	*Oils :*		
5.1	Pharmaceutical liver oils and other oils containing medicinal or veterinary properties	44 000	
6.0	*Other Products :*		
6.1	Fish Paste	976 766	

(a) Some fish was frozen for bait but quantity unknown

(b) Includes 684,528 lb of smoked blue-cod (*Parapercis colias*) produced from 752,600 lb. of headed gutted fish imported frozen from New Zealand

(c) Whitebait (*Lovettia seali*)

(d) Includes 331,813 lb of fish loaf containing 53% of fish (barracouta)

(e) Includes 87,468 lb of fish loaf, principal fish ingredient being Australian salmon (*Arripis trutta*)

2

SOME IMPORTANT SOCIO-ECONOMIC PROBLEMS OF THE FISHERY INDUSTRIES OF JAPAN

by

N. Oka*, I. Konuma*, K. Yamamoto* and M. Abe*

With the development of fisheries, (1) the maintenance or increase of production of fish and the conservation of aquatic resources, (2) the improvement of marketing of catches and (3) the division of fisheries profits, have become some of the most important problems of the fishery industries of Japan. In the search for solutions to these problems, efforts are being concentrated upon the appropriate utilization of fishing grounds, the improved organization of fish markets and the establishment of a fisheries finance system.

Even though the system of fishing rights and the administration of fishing grounds had undergone reorganization from time to time, the fisheries system after World War II still retained vestiges of irrational and feudalistic practices. To cope with this situation, fisheries reform has been carried out recently on an unprecedented scale, involving several new lines of action. The main points involved in this reform are here recorded by I. Konuma, Secretary of the Japanese Fisheries Agency.

The functions of fish markets differ as between wholesale markets in producing places and those in consuming places, and the characteristics vary according to local circumstances. The section of this paper prepared by K. Yamamoto, Secretary, Japanese Fisheries Agency, includes a brief history of the Japanese fish markets and their organization, and an outline of the Tokyo Central Wholesale Market, Tsukiji.

Lastly, the section by M. Abè, Secretary, Japanese Fisheries Agency, gives information on the form and function of fisheries finance, which is essential to the maintenance and improvement of fisheries production.

It is a significant fact that the livelihood of a large proportion of the total population of Japan is dependent upon the fisheries and the major source of animal protein in Japan derives from the sea. It is believed that a better understanding of the present economic status of the fisheries industries, which have only a scanty accumulation of capital, will be obtained from the present study.

FISHERIES REFORM IN JAPAN

After World War II, the Japanese Government took up fisheries reform together with agricultural land reform under the guidance of the Headquarters of the Occupation Army. The fisheries reform was brought into operation a little later than the agricultural land reform, by the passage of suitable legislation through the Diet in 1949, and was completely carried out during 1950 through 1951.

(*a*) *Object of the Reform.*—The object of this reform is to establish a new system of fisheries administration on the basis that the promotion of fish production and the rehabilitation of the fisheries should be carried out as an important link in the chain of an overall democratization of Japan and reconstruction of her economy.

In the process of this reform all traditional fishing rights or fishing ground relations in coastal and inland waters established under the Fisheries Law of 1910 are to be revoked, and are to be replaced by new fishing rights or grounds established through the recommendations of democratic adjustment organizations whose membership consists chiefly of working fisheries operators and employees.

(*b*) *Steps of the Reform.*—The new Fisheries Law and its related laws are conducive to these objects and lay down procedures for the enforcement of the reform. Under these laws, in the first place all the traditional fishing rights, which existed at the time the legislation was enacted, were revoked within a fixed period not exceeding two years in maritime areas, and new fishing rights were established on democratic principles.

For the old fishing rights thus cancelled, the Government gave compensation amounting to 17 thousand million yen in government bonds redeemable in 30 years. The fees to be collected in respect of the new fishing rights and licences have been earmarked as a contribution towards this compensation. It is worthy of note that this compensation has been reduced through the so-called "capitalization of securities" so as to expedite the progress of the

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reform. In this important respect the fisheries reform differs from the agricultural land reform.

Towards the end of 1952, however, this system of payment of nominal annual fees met with a strong opposition from the fishermen. Consequently, it was repealed in 1953 by amendments to the Fisheries Law passed by the Diet on August 6, 1953.

(c) *New Fishing Rights.*—The new rights are basically different from the old and traditional ones. Most of the owners of the old rights were fisheries associations or privileged individuals who might freely lease or sell their rights, while working fishermen were not able to operate the fisheries without paying rent to the rightful owners.

The newly established fishing rights, however, constitute a sort of business right or licence. Though regarded as real rights with exclusive ownership, they are not considered to constitute the ownership of property, and consequently any new rights cannot be leased nor sold by the owners. In these conditions, new rights can be granted only to those who actually operate fisheries themselves. Thus, the idea of the absentee landlord exploiting the rent of fishing grounds or rights from working fishermen on the basis of lease contracts has been rejected, and a freer management of the fisheries has been developed. This is one of the most important points of the Reform.

The major types of the new fishing rights are fixed-net, demarcated and common fishing rights, together with common piscary rights established on the other three rights. The duration of the grant has been fixed for each type of these rights. In the case of the demarcated fishery right, for example, its term is for five years, subject to renewal. This system has been established in order to prevent the permanent ownership of fishing rights and to secure the effective management of fisheries by the fishermen.

(d) *Procedures for Granting of Fishing Rights.*—In granting fishing rights, prefectural governors determine the type of fishery, location and area of fishing grounds, fishing season etc., after hearing the opinion of the Sea-area Fisheries Adjustment Commission concerned; grants are made to applicants according to eligibility and priority as prescribed in the Law, and with reference to the opinions of fishermen at a public hearing.

Eligibility and priority vary according to the type of fishery and have been so devised that the democratization and productivity of the fisheries may be developed freely without being obstructed by domination from out-moded, vested interests.

(e) *Sea-area Fisheries Adjustment Commission.*—In order to secure an over-all rational utilization of fishing grounds and at the same time to adjust possible disputes among fishermen, a democratic organization invested with full powers called the Sea-area Fisheries Adjustment Commission has been set up in each prescribed sea-area throughout the country.

In the demarcation of the fishing grounds, the granting of fishing rights and other important matters, the Prefectural Governor should refer to the opinion of the Commission.

There are now 179 prescribed sea-areas, each of which has a fisheries adjustment commission consisting of seven persons elected from among fishermen, two persons appointed by the Governor from among persons of learning and experience and one person appointed by the Governor from among representatives of the public interests in the sea-area. With regard to inland waters, there has been established over each prefecture one Inland Waters Fishing Ground Administration Commission having almost identical organization, functions and powers to those of the Sea-area Fisheries Adjustment Commission. These two Commissions play an important role in the carrying out of the fisheries reform since they allow the fishermen's opinion to be heard.

(f) *Progress of Enforcement.*—The progress of the reform is summarized in Table I.

(g) *Present Status.*—Following the adoption of the fisheries reform in coastal and inland waters, the problem of the management of licensed fisheries such as surrounding-net fisheries, medium trawler fisheries and offshore fisheries was taken up in pursuance of the conservation of fish stocks. A program was started in 1951 for the reduction of the number of small trawlers on a 5-year plan and is now in progress.

The fisheries reform in Japan may be said, in a narrow sense, to cover a large scale transfer of fishing rights from the old to the new ownership, and a series of procedures to enforce such measures; but in a broad sense, the reform may include far-reaching projects such as the rationalization of fisheries management for the purpose of ensuring the maximum sustained productivity of the fishery resources of Japan. In other words, the transfer of fishing rights is but the first step of the reform to be followed by the re-organization of the licensed fisheries.

FISH MARKETING IN JAPAN

The organization and management of Japanese fish markets are at present based on the principle of capitalism. The fishery industries exist basically for the purpose of selling goods and specialized activities must be developed from before production right through to consumption. These activities must be supported by the capitalization of distribution especially in cities and large towns in which the sale of such perishable commodities must be organized to deal systematically with large quantities of merchandise.

Table I

History of Fisheries Reform Legislation

Date	Important Items	Remarks
January, 1947	1st draft of new Fisheries Law discussed	
June, 1947	2nd draft of new Fisheries Law discussed	
August, 1948	3rd draft of new Fisheries Law discussed	
December 2, 1948	Temporary Measure Law for Fishery Rights and Others enforced	
December 15, 1948	Fisheries Cooperative Association Law enforced	
January, 1949	4th draft of new Fisheries Law discussed	
May, 1949	Bill for new Fisheries Law submitted to the Diet	Discussion was continued during 5th and 6th sessions of the Diet
December 15, 1949	Fisheries Law and Enforcement Law concerning Fisheries Law promulgated	
March 14, 1950	Fisheries Law and Enforcement Law concerning Fisheries Law enforced	
May 13, 1950	Determination and public notification of prescribed sea-areas	49 in Hokkaido, 130 in Honshu and others
June 13, 1950	Central Fisheries Adjustment Council established	15 members: 10 representatives of fisheries operators and employees and 5 persons of learning and experience
July 8, 1950	Seto Inland Sea Fisheries Adjustment Office established	
August 13, 1950	Election of Sea-area Fisheries Adjustment Commission	
September 15, 1950	Fishery Rights Compensation Committee established	
September, 15, 1950	Inland Waters Fishing Ground Administration Committee established	
January-March, 1951	Fishing Grounds Planning determined	
April-June, 1951	Examination of eligibility and priority of applicants	
September 1951	1st switching of fishery rights from the old to the new	
January 1, 1952	2nd switching of fishery rights from the old to the new	41,457 old fishery rights cancelled, 11,782 new rights granted.
March 14, 1952	Cancellation of old fishery rights completed	49 in Hokkaido, 121 in Honshu and others
July 8, 1952	Change in prescribed sea-areas	
August 2, 1952	Ariake Bay Fisheries Adjustment Office established	
August 13, 1952	Re-election of Sea-area Fisheries Adjustment Commission	
September, 1952	Re-selection of Central Fisheries Adjustment Council	20 members: 10 representatives of fisheries operators and employees, and 10 persons of learning and experience
September, 1952	Aquatic Resource Conservation Law enforced	

In the process of channeling fishery products from the producer to the consumer, they must necessarily pass through two areas, i.e., that in which they are produced or landed, and that in which they are consumed. The markets in these areas may be classified accordingly as:

(a) markets in producing areas and

(b) markets in consuming areas.

The former are set up in areas where large amounts of fish are landed by producers, while the latter exist in areas which contain a great mass of consumers. Even though an area or place may have markets of the two categories at the same time, the predominance of either of the two functions will decide the character of the market.

The regular circulation of products through these two markets is as follows:—

A. Fishermen → wholesalers → brokers →

B. Wholesalers → brokers → retailers → consumers

A. Organization and Management of Markets in Consuming Areas

(a) *History of Marketing Organizations.*—The organization and management of markets in consuming areas are now regulated by the Central Wholesale Market Law; there was no legislation for this purpose thirty years ago.

Taking the Tokyo Central Market as an example, before the establishment of the present market there was a fish market at Nihonbashi, Tokyo. The market at that time, with imperfect facilities and unsound management, found it hard to maintain itself. Especially in the organization of the market, with an excess of wholesalers split into several factions, it failed to make fair and proper transactions in the collection, distribution and appraisal of products, which gave rise to futile competition among the wholesalers and was at the same time disadvantageous to both the producer and consumer.

As a counter-measure to such unsatisfactory conditions in Tokyo and some other cities, the Central Wholesale Market Law was enacted in March, 1923. Under this Law, forty-one central wholesale markets were designated throughout the country, and the following eleven cities now have central markets:

Kyoto (established 1927), Kochi (1930), Yokohama (1931), Osaka (1931), Kobe (1932), Tokyo (1935), Nagoya (1949), Hiroshima, Kure, Kagoshima and Sasebo.

The main objects of the Law may be summarized as follows:

(1) Futile and irrational competition is checked in the sale of fish, which is to a large extent caught by modernized fishing with appreciable capital investment;

(2) Satisfactory sanitary arrangements and facilities are provided for the handling of fish; and

(3) The market is established by public bodies which are independent of the producer and the consumer.

However, under the controlled economy during and after the war, involving the enforcement of the Price Control Ordinance and related regulations, the price and distribution of fresh fish and shell-fish were put under strict national control in March, 1940 and the brokerage system in the market was abolished in October, 1941. Consequently, fish wholesale markets in Japan ceased to carry on their proper functions for ten years until the over-all control on fishery products was removed in April, 1950.

(a) *Present Conditions of Markets.*—A central wholesale market consists of a management, wholesalers, brokers and retailers. Transactions in the market are made between the wholesaler and the broker, and between the broker and the retailer. In the former case, fish is sold by the wholesaler, as consignee, to the broker by auction. In this transaction, 6% commission is charged by the wholesaler. In the latter case, however, private transactions are made on a personal basis. The broker divides up the auctioned articles and delivers them to the retailer, who in turn carries them to the consumer.

The Tokyo Central Market was established in 1935 by the Metropolitan Government, and it has now 10 wholesale firms, 1,700 brokers and 7,000 retailers. Through the transactions between the wholesaler and the broker, reasonable competitive prices are established by species of fish, and the inter-relationship of demand and supply is automatically adjusted. The Central Market thus performs important economic functions, such as the collection, distribution and appraisal of fishery products, including the encouragement of their consumption, on the one hand, and expansion of their production, on the other.

B. Organization and Management of Markets in Producing Areas

Fish markets in producing areas vary in scale from very small and temporary markets in fishing villages to those of large size in big towns where voluminous landings are made throughout the year, thus representing a cross-section of the economic structure of the fisheries of Japan. The size of these markets depends upon their location and transport facilities as well as upon the development of fisheries production in their vicinities.

Japan has now more than 4,000 fish markets throughout the country, mostly established by public bodies or fishermen's cooperatives.

The management of these markets is usually entrusted to wholesalers. In the large markets in producing areas, the great majority of the wholesalers consists of firms, including a few fishermen's cooperatives, while fishermen's cooperatives predominate in the small markets. In either case, the wholesaler in the market of a consuming area is functioning for the benefit of producers.

The fish market in a producing area is organized by wholesalers and brokers. Fisheries products are here sold at auction by the wholesaler to the broker or bid for on behalf of the producers. The products thus purchased by the broker are transported on his behalf to a wholesaler in a consuming place. The market price in a producing area is established on the basis of such operations. The fishermen, as producers, are very sensitive to the price and are naturally very anxious to ship their products to the most favourable markets.

C. Forms of Circulation of Fishery Products

The relations between the market in a producing area and that in a consuming area may be classified into two types. One is the relationship between the big market in a large producing area and that in an important consuming area, which constitutes a major part of the whole circulation of fishery products in Japan. The other is the relation between the market in a small producing area and that in a farm village.

Among the markets in consuming areas, those in the Kansai and Kanto districts occupy the premier position in the east and the west of the country. The Kansai market, including the markets in Kyoto, Osaka, Kobe and other big cities, is connected directly with the rich producing places in the south-western districts of Japan such as Yamaguchi, Fukuoka, Nagasaki and other prefectures, while the Kanto market, including those in Tokyo and Yokohama and other cities, is supplied chiefly from Hokkaido and the Tohoku district. Consequently, a regular route of circulation of products has been established between the large-scale markets in important producing and consuming areas.

As to the market in a farm village, however, with its weak and scattered consuming power, the chief supply of sea-foods for the villagers is secured by small local producers or through the market of a big consuming city or town in its vicinity.

The consumption of animal protein, including fishery products, in farm villages of Japan amounts to only a half of that in cities and towns. In view of the health condition of villagers it is regarded as essential to solve the problem of supplying them with more fish at low prices and suited to their taste. Increased productivity of fish in the fishing villages, therefore, is not only very important for stabilizing the management of small coastal fisheries, but it is also a short cut to ensuring a reasonable supply of fish to farm villages. Measures are being taken by the Government to give financial aid for the construction of cold storages as well as fishing ports. Moreover, large markets in big consuming areas, such as the Tokyo Central Market, are developing a strong tendency to re-ship to farm village markets.

FORM AND FUNCTION OF FISHERIES FINANCE IN JAPAN

The form and function of finances vary according to the types of the economic system prevailing in different countries and to the stages of their development. It is also true that the economic system is greatly influenced by the function of finance.

The scale of fisheries finance in Japan has undergone several changes with the progressive stages of development of her fisheries. Until the last years of the 19th century when small-scale fisheries were operated chiefly in coastal waters, the scale of fisheries financing was comparatively small and necessary operational expenses of fishermen were provided through the aid of their relatives and friends or mutual financing associations in addition to their own funds. It can be said, therefore, that the financial problem did not in those days occupy any important position in the fisheries of Japan.

Since the beginning of the 20th century, however, with the development of large nets and other improved gear together with the mechanization of fishing boats and the construction of large and modern type vessels, the small coastal fisheries of former days developed into the larger type net fisheries and the off-shore fisheries. This made it indispensable to obtain a large supply of expensive capital materials. Such trends invited a saturation of monetary economy in our fisheries and required the investment of large amounts of money.

The financing of the fisheries at that time, however, was generally carried on with commercial capital provided by wholesalers or brokers of fish and fertilizers. Consequently, these brokers came to have a predominant power over the fishermen, who were obliged to borrow large sums of money in advance before engaging in fishing operations. Under this "advance loan" system, all the fishermen's catch was cornered and sold by the brokers and the floating debts of the fishermen arbitrarily amortized by the lenders. As might be expected, these practices resulted in the fishermen being deprived of the reasonable profits of their fishing operations, and this resulted in the prevention of a sound development of the Japanese fisheries.

A marked increase in the number of fishermen and the progressive demand for fisheries finance around [illegible] caused the Government to enforce a financing [illegible] for fisheries on the security of fishing rights [illegible] fishermen's associations and of fish[illegible] owned by fishermen's associations and of fishing boats and other property of the fishermen. This was the first step towards the evolution of the modern financing system from the former one dominated by brokers' capital. Such financial aid to the fisheries was made through low-interest, long-term loans from special banks such as the Hypothec Bank of Japan, the Agricultural and Industrial Bank and the Hokkaido Colonial Bank, as well as from the Post Office Insurance Bureau of the Government.

In those days, however, ordinary banks such as city or local banks, excluding those specially connected

with fisheries, did not engage in business relations with fishermen, who generally had only insignificant security and whose activities were usually considered to be exposed to much risk.

In 1930 and after, Japan was struck by a severe and wide-spread financial panic, in which the fisheries operators were also involved. In order to cope with the emergency, most fishermen courageously undertook counter-measures for stabilizing the price of their catch as well as for exclusion of unlawful control over their livelihood by merchants. By those measures, the economic functions of fishermen's associations, largely composed of small and medium fishermen, were greatly strengthened through the improved joint marketing of their products and enlarged and well-managed credit facilities. This credit function of the associations was further improved by their joining, through prefectural fisheries federations the Central Bank for Industrial Guilds, a special banking institution providing funds for agriculture and forestry and being the highest financing organ which has agricultural and forestry associations as its subordinate organs.

With the improvement in fishing techniques, the enlargement and improved design of fishing boats and, in later years, the extension of fishing grounds to the high seas, the scale of fisheries management was gradually expanded, with the result that the instability of fisheries production was eventually overcome.

Such expansion of the fisheries management, involving the capitalization of the fisheries, naturally gave the fishing industry an improved credit standing which in turn made it possible for fishermen to obtain loans from city or local banks like other industries.

Thus, the progress of lending operations proceeded from (1) individuals, through (2) mutual financing associations, (3) wholesalers, (4) special banks, and (5) co-operatives to (6) ordinary banks.

Although fisheries finance is now largely operated through ordinary banks, this does not mean that financial assistance from co-operatives, wholesalers or brokers, or other institutions, has become unnecessary. The large-scale fisheries are numerically far inferior to the small-scale operators, who still find difficulty in obtaining loans from banks; there is still a great need for financial aid from individuals and mutual financing associations, while financing through co-operatives continues to play an important role.

The reasons why modern financing methods are difficult to be adopted in the fishing industry may be summarized as follows :—

(i) The fishing industry is more directly influenced by weather conditions and is far more risky than is the case in other industries ;

(ii) Fisheries products are of a highly perishable nature;

(iii) The diversity of fishing seasons and the migrations of fish make it difficult to predict the outcome and therefore militate against the obtaining of loans ;

(iv) The personal and mortgage credit standing in the fishing industry is rather low because of general instability and fluctuation of the enterprise.

In order to cope with such weak points in fisheries finance, the Government of Japan is making efforts to facilitate financial assistances by establishing the Financial Bank for Agriculture, Forestry and Fisheries which is a special organ for financing fisheries and other basic industries by means of long-term, low-interest loans from national funds.

In addition to this, the Law for Insuring Small and Medium Fisheries Finance was enacted in 1953. Under this Law, the funds invested by the Government, local public bodies and fishermen are operated in a manner which will insure the repayment of fishermen's debts to ordinary banks. This system is expected to smooth the way for the fishing industry to obtain additional financial aid from ordinary banks.

A NOTE ON MARKETING AND PRESERVATION OF FISH IN SAURASHTRA, INDIA

by

K. R. Srivatsa*

1. **Importance of the Fisheries.**—The coastal fisheries of Saurashtra from Malia to Sultanpur yielded 856,000 maunds[1] of fish during 1950-51 and 955,000 maunds during 1951-52. The landings of different types of fishes along with the regions in 1951-52 are indicated below :

Table I

Fisheries	Zone	Catches in Mds.	Percentage
1. Bombay Duck (*Harpodon*)	Jaffarabad to Nawabunder	620 054	64·0%
2. Perches, Sea breams, Sharks, Rays, etc.	Throughout	140 673	14·7%
3. *Stromateus*	Veraval, Mangrol, Porbundar, Jamnagar	50 543	5·3%
4. *Sciaena* and *Polynemus*	Halar, Veraval	65 446	6.9%
5. Prawns and *Coilia*, *Trichiurus* etc.	Halar, Veraval	46 848 21 828	4·9% 2·3%
6. Mullets, etc.	Halar, South West	9 510	1.0%

The catches of the Japanese trawler, "Taiyo Maru", from December, 1951, to March, 1952, amounting to 22,500 maunds and valued at 230,000 rupees, are included in the above figures. Most of the other catches were made within 7 to 8 miles from the shore.

The total landings of 955,000 maunds were sold for Rs. 55 lakhs.

Distribution.—Only 7 to 8% of the population of the State of Saurashtra are fish eaters. Hence, only about 5% of the catch can be consumed locally, the rest being exported. The fishing industry in Saurashtra is, therefore, intimately linked with export markets and any increase in fish production by more effective exploitation of the seas and productive inland waters is always likely to give rise to a glut in the local sales centres, unless marketing facilities are considerably improved, and this in turn will adversely affect the efforts to develop and improve the fisheries.

(i) *Local Markets.*—In the important cities of Saurashtra, such as Jamnagar, Porbunder, Veraval and Rajkot, fish markets are not kept in sanitary condition. The Porbunder market is the largest and handles about 3,800 maunds of fish per year. The Veraval market is situated nearer to the landing place but it is rather small. In places like Jodiya Salaya, Malia, Nawabunder, Mangrol, etc., there are no regular markets at all.

(ii) *Outside Markets.*—As marketing of fish in Saurashtra depends mainly on export to places like Ahmedabad, Agra, Ajmer, Surat, Billimora, Baroda, Navsari and Bombay, primary attention has to be paid to the improvement of existing facilities for such trade.

The export trade of fish was and in many places still is in the hands of petty fish traders who buy the fish from landing places at rates which are fixed every season or annually. The local rates for 1950-51 and 1951-52 are given in Appendix I. Before the reorganisation of the Fisheries Department and establishment of Co-operative Societies, these petty merchants used to bind the fishermen to the established low prices by advancing them loans. This practice existed until 1950-51, but during 1951-52 a system was adopted of fixing the

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[1] *One maund* = 40 lbs.

prices by a Committee of two representatives of fishermen, two representatives of traders and the District Fisheries Officer. The benefit to the fishermen was obvious and immediate. The wholesale price per maund of assorted fish rose from Rs. 4-7-3 to Rs. 5-12-3 per maund or from Rs. 0-1-10 to Rs. 0-2-4 per lb., mainly because of co-operative marketing. The above price structure appears to be low, but in fact this was the price for *Harpodon* which amounted to 65% of the fishery. Prime fishes like "ghol" (*Sciaena*) and "Dara" (*Polynemus*) were sold at Rs. 0-3-3 per lb., wholesale, Pomfrets at Rs. 0-7-0 (average in Halar and Veraval) and "Surmai" (*Cybium*), "Palla" (*Hilsa*), etc., at Rs. 0-4-0. The price structure cannot be further increased unless faster and cheaper transport methods are made available.

Marketing has been taken up in Veraval by the fishermen's Co-operative Societies known as the Mahasagar Sahakari Mandal. Fish to the value of 130,000 rupees was marketed in 4 months of 1951. Tenders were invited for the purchase of the output of the members of the Veraval Society; the fish was delivered at the landing places and sale proceeds immediately collected. The fishermen are thus able to obtain 40% more of the sale price than was the case in 1950-51. The export trade of fish is effected by sea, rail and land routes. About 89% of the exported fish was sent by sea, out of which 81% was sun-dried Bombay Duck and *Coilia*, 9% cured fish like Jewfish, Indian Salmon, Perches, Mullets, Hilsa, etc., and about 9½% iced and chilled fish, like Pomfrets, Hilsa, Sea breams, Jewfish and Indian Salmon. Sun-dried fish, cured fish and manure were exported to Gujarat. Apart from two power vessels carrying iced fish from Jamnagar, catches from Veraval and Mangrol were taken to Bombay in country craft for which journey even carrier launches take about 28 to 30 hours.

In view of the better prices prevailing in Bombay for iced and chilled fish and since transportation is cheaper by sea than by rail, it is necessary to encourage transport by sea by providing fast carrier launches with insulated storage and cheaper ice and cold storage facilities at landing and receiving centres. The cost of transporting one maund of fish from Veraval to Bombay is as follows:

Veraval to Bombay	*Per Maund of 40 lbs*
Launch hire per trip	Rs. 2-1-0
Ice charges	Rs. 1-0-0
Landing charges at Veraval and Bombay	Rs. 0-8-0
	Rs. 3-9-0

(Based on a hired launch with a 4½ ton fish hold).

If greater sea transport facilities are afforded, the difference between the Bombay and Saurashtra prices can be reduced with increased returns for the fishermen.

The markets in Bombay can at present take only a limited quantity of fish. Even with the cold storage facilities available in the city, it is not practicable under present refrigeration conditions to move the fish inland by rail from Bombay if it has already been in transit by sea. In view of this, it is necessary to consider the export of fresh fish to the interior of the country by rail from landing places in Saurashtra itself. At present about 5% of the total catch is iced and exported by rail to Ahmedabad, Ajmer, Abu, Baroda, Surat, Billimora, Navsari and Bombay. It takes about 24 hours to reach Bombay and the condition of the fish deteriorates due to rough handling and lack of insulated storage. The normal charges for transport of fish by rail from Veraval to Bombay is as follows:

Veraval to Bombay	*Per Maund of 40 lbs.*
Rail charges	Rs. 3-13-0
Handling charges	Rs. 0-10-0
Ice	Rs. 1-0 -0
Total per md.	Rs. 5- 7-0

Even though the space available for the transport of fish by rail has been increased from 100 to 200 cases in 1952, this quota was much below the requirements of about 250 cases during the season. The high cost of transportation naturally affects the price of fish received at the producing centres. However, transport by rail is a necessity and more fish should go to Ajmer, Abu, Bikaner, Jaipur, Delhi, Dehra Dun, Ahmedabad etc. This can only be successfully effected by providing facilities at landing centres for cold storage and cheap ice, reduction of freight charges, faster and larger carriages and refrigerated cars.

Road transport, which is by country carts, is resorted to in Saurashtra only for nearby towns, although iced fish is transported from Jamnagar by carts and lorries. The cured and dried fish is exported to Ahmedabad in North Halar State by country carts and camels.

The prices ruling in Bombay for prime fish, iced and chilled, are shown in Appendix II. As fish marketing in Saurashtra depends entirely upon export of fish and fish products, the following facilities are considered highly desirable. More fresh fish must be sent with ice instead of as cured or semi-dried fish, although *Harpodon* will still have to be sundried until canning is taken up. An iced "Ghol" weighing 20 lbs. is valued in Saurashtra at Rs. 4/- and in Bombay at Rs. 7/- to 7-8-0, while

the same fish salted fetches only Rs. 2-15-0 to 3/- due to loss in weight and palatability. Ice and salting charges, labour and transportation remaining the same, curing could be eliminated to a great extent if ice factories, cold storages, refrigerated wagons, cheap transport charges and carrier launches were available at prime fish-producing centres like Veraval, Mangrol, Porbandar and Jamnagar. In the case of dried, semi-dried or salted fishes, the existing transport methods are adequate, if the charges are reduced.

Preservation of fish.—The methods of fish preservation in Saurashtra State depend mainly on the nature of the market and transport conditions and may be divided into five categories:

1. Drying
2. Salting and drying/Dry curing
3. Icing and chilling
4. Manure making
5. Processing fins, maws and oil

The quantities of fish utilised for the various methods of processing in Saurashtra in 1951-52 are presented in Appendix III.

(a) Sun-drying

The most important fishes which are sun-dried are *Harpodon nehereus, Coilia dussumierii,* and *Peneus* and *Metapenaeus* spp.

Out of the total catches of 955,000 maunds 625,500 maunds, or 65% are sun-dried. Except for *Coilia*, shore perches and small *Sciaena*, sundrying of *Harpodon* (Bombla) or Perches (Jinga) has attained a satisfactory standard.

(i) *Sun-drying of "Bombla" (Harpodon nehereus).*—The Gujrat fishermen of Kolak, Umarsadi, Daman etc., come to Rajpara, Simar, Nawabunder and Jaffarabad during the season (from November to the end of February) to fish in the inshore waters for Bombla which is then preserved. Special raised scaffoldings with wooden poles and thick coir ropes of 1 to 1½" diameter are constructed. The fish is washed well in sea water, split open into two except near the tail and hung over the ropes without any application of salt. The fish is thus sun-dried within 72 hours, with a loss of about 70% in weight. This method of drying is quite hygienic. It is then packed neatly in bundles of 1,000 fish. The total quantity of *Harpodon* dried during 1951-52 was 575,460 mds.

(ii) *Muraenesox* (Wams) require more time for drying and the finished product is not as attractive as *Harpodon*. The processing of "Bombla" and "Wams" takes much time and the fishermen therefore employ special labour, each boat tindal engaging about 10 to 12 labourers who process about 50 to 70 maunds of fish per day and are paid in kind.

(iii) *Sun-drying of Prawns.*—The Gulf of Kutch coast produces about 140,000 maunds of prawns every year. The prawns are boiled in 4-gallon kerosene tins with about 1/8 part of salt and spread on the sand or on bamboo mats for drying. This process takes about 48 to 50 hours, after which the prawns are placed in gunny bags and vigorously beaten. The shells of prawns, except the telson and part of the carapace, are completely removed by this process and the contents are then seived to obtain full grown prawns, 1½ to 2" in size, which are then finally packed in gunny bags. Seven to 7½ mds. of fresh prawns yield about 1 maund of processed prawns and 2½ mds. of prawn shell manure. Owing to the abundance of prawns and as the season lasts from August to November, each boat has to process about 20 maunds of prawns per catching day; hence pre-boiling may not always be possible. Prawns which are dried on sand without boiling are whitish and brittle and are of second class quality. During 1951-52, the Fisheries Department demonstrated to the fishermen a hygienic method of drying prawns. These prawns had a chocolate hue resembling the Karachi prawns and sold at Rs. 30 to 35 per maund, i.e., a 200% increase in price.

Semi-drying of prawns is done only by the Fisheries Department. The prawns are boiled for about 10 minutes in a saturated solution of salt and immediately cooled for about an hour. They are then shelled, dried for 24 to 36 hours and packed. Only large prawns 6 to 7" long are suitable for this kind of processing. Six lbs of fresh prawns give about 1 lb of semi-dried prawns, orange brown in colour and very attractive. During 1951-52, about 1,200 lbs of semi-dried prawns were manufactured and sold at Rs. 2/- per lb.

(b) Salt Curing

About 14% of the fish are cured by salting in this State. During 1951-52, 133,760 maunds of fish were salted, out of which 78,220 mds. were *Sciaena* and *Polynemus*, and 64,204 mds. consisted of Hilsa, Perches, Mullets, Sharks, Rays, Pomfrets, Sea breams etc.

Wet curing is the most important method. The State has two good fish curing yards at Salaya and Nawabunder but the facilities offered (which include a subsidy of 25% of the cost of salt) are not properly used and salt is usually taken on board the "Machwa" boats. The larger fish, such as the 3½ ft. *Sciaena* and *Polynemus*, are split up the

belly, gutted, washed in sea water and salted. The quantity of salt used for preservation is about 25 to 30% of the total weight of fish. The "Ghol", "Dara" and "Palla" fishermen fishing in Halar use about 23,000 maunds of salt from March to May. *Sciaena* and *Polynemus* lose about 50% of their weight when cured. They are not spread out and dried.

(c) *Chilling and Icing*

Out of the total amount of fish exported, 12% or 114,600 maunds are sent, iced and chilled, to Jamnagar, Jodiya, Salaya, Veraval Porbandar and Mangrol. A great amount of fish, especially pomfrets, is exported by sea from Veraval and Mangrol. Jamnagar exported during 1951-52 about 7,000 maunds of *Sciaena* and *Polynemus* chilled with crushed ice. The sea trade is by mechanized carrier launches or by country craft. This fish may be thus conserved for some 30 hours, as well-packed, finely-crushed ice is placed in large quantities between the layers. About 10 maunds of ice are used for 9 maunds of fish, and a profitable trade by sea is carried on between Saurashtra and Bombay city.

Iced fish is also exported by rail from Jamnagar, Salaya, Jodiya, Veraval and Porbandar, and through Bombay to Surat, Billimora, Ajmer, Ahmedabad, Abu and Rajkot. Each maund of fish is packed with an equal quantity of ice in deal wood cases. Jamnagar, Salaya, and Jodiya export about 50 to 60 cases (each containing 2 maunds) per day during the season and Veraval and Porbandar about 80 to 90 cases, which is the maximum quota allowed by railway. Only good table fishes like perches, pomfrets, sea breams, mullets, hilsa etc., are despatched to these places. These quantities might be increased with better storage and transport facilities as indicated earlier.

During 1951-52 and until June, 1952, the Japanese trawler transported about 22,500 maunds of fish preserved in her 80-ton cold storage hold to Bombay.

(d) *Manure*

During 1951-52 the State produced about 23,850 maunds of fish manure. No special technical method is used for the disintegration of the fish and the fishermen dry the unsaleable, inedible or small fish into manure. The Jaffarabad and Nawabunder fishermen make manure out of *Coilia dussumieri*, young and spoilt *Harpodon*, *Trichiurus*, *Stolephorus* and rays. The manure is coarse and contains only about 4% of nitrogen by weight. It is packed in gunny sacks and sold at Rs. 2/2/- a maund. The fishermen of Malia and Mahuva make manure out of prawn shells. This manure is not properly sieved and graded and contains considerable quantities of sand. The prawn manure made by the Department of Fisheries was of a fine variety and contained about 5½% of nitrogen. The Department demonstrated to the fishermen of Veraval how to utilise guts and gills of fish and heads of sharks and rays as manure.

As far as possible, salt curing will be discouraged, and chilling with ice and cold storage preservation promoted, as fresh fish fetch better prices.

(e) *Processing of Fins and Maws*

The Department of Fisheries has had considerable success in introducing and improving the methods of processing shark fins and fish maws (sounds). The fins of all varieties of *Rhynchobatus* and *Carcharius* above 5 feet in length are now cut off at their joints, the flesh removed, washed, given a lime application and dried for 48 hours. The State now produces 2,600 maunds of this valuable by-product which commands a good price. The dark fins fetch about Rs. 1/4/- per lb, of all sizes, and white fins of *Pristis* and *Rhynchobatus* fetch Rs. 2/- to Rs. 2/4/- a lb. The sounds of *Sciaena*, *Polynemus*, *Lates*, *Sciaenoides*, *Muraenesox* and *Arius* are detached from the fishes, immediately split, blood spots and blood vessels removed, washed in sea and fresh water and dried for 48 hours. In the case of large bladders of *Sciaena* or *Polynemus*, weights are placed over them to spread them evenly. The resulting fine isinglass has a yellowish-white, semi-transparent hue and is sold at about Rs. 3/- per lb.

APPENDIX I

Average rate for fish (wholesale) 1950-51 & 1951-52

(All zones in maunds of 40 lbs approximately)

	1950-51			1951-52		
	Rs.	A.	P.	Rs.	A.	P.
1. Pomfrets (white & black)	15	0	0	16	8	0
2. Seer, Hilsa, Surmai	9	0	0	10	0	0
3. Perches	7	0	0	8	0	0
4. Ghol & Dara (*Sciaena* and *Polynemus*)	7	0	0	6	0	0
5. Mullets	6	0	0	7	0	0
6. Fresh prawns	5	0	0	7	0	0
7. Dried prawns	18	0	0	32	0	0
8. Cured fish A.	13	8	0	14	0	0
9. Cured fish B.	10	0	0	10	0	0
10. Bomla (*Harpodon*)	5	0	0	5	4	0
11. Mixed-Dhoma etc. (*Muraenesox*)	5	0	0	5	4	0
12. Sharks	4	0	0	5	0	0
13. Rays	2	8	0	3	0	0
14. Fins (black and white)	45	0	0	90	0	0
15. Maws (class I) air bladder	45	0	0	100	0	0
16. Manure	2	8	0	2	8	0

APPENDIX II

Bombay Market for Saurashtra Fishes in 1951-52

	In season			Beginning, end and out of season		
	Rs.	A.	P.	Rs.	A.	P.
1. (a) Pomfrets	28	0	0	35	0	0
(b) Seer (*Cybium*)	21	0	0	23	0	0
(c) Ghol, Dara	12	8	0	20	0	0
2. (a) Prawns dried (i)	40	0	0	50	0	0
(b) Fins	100	0	0	120	0	0
(c) Maws (sounds)	120	0	0	150	0	0
(d) Manure	6	0	0	7	0	0
(e) Cured Ghols etc.	20	0	0	30	0	0
3. (a) Bomla dried	15	0	0	25	0	0
(b) Mullets etc.	12	0	0	15	0	0
(c) Miscellaneous	10	0	0	15	0	0

APPENDIX III

Statement of quantity of fish utilised for various methods of processing in Saurashtra in 1951-52

Sl. No.	Type of processing	Quantity of fish processed in mds.[1]	Kind of fish	%	Remarks
1.	Sun-dried	625 500	Bombay duck	59.8	
			Eel	3.25	
			Coilia	2.25	
2.	Salt-cured	133 760	*Sciaena* / *Polynemus*	8.27	
			Hilsa / Perches / Mullets	5.73	
3.	Iced and chilled fish and cold Storage.	114 600	Pomfret	5.76	
			Hilsa / Perches	3.84	
			Jap. landings	2.4	
4.	Fresh fish	52 520	All kinds	5.5	
5.	Manure, fish maws etc.	25 000		2.8	
6.	Boiled and Sun-dried	3 620	*Peneus* spp.	0.4	Most of the prawns processed are caught in the waters of Kutch.
	Total	955 000		100	

[1] md. = 40 lbs.

4

PROBLEMS OF FISH MARKETING IN THE STATE OF ORISSA, INDIA

by

G. N. Mitra*

A survey has been made over the last few years of the problems relating to fish marketing in the State of Orissa. The problems vary according to the type of industry and can be described under the following groups.

Marketing of Marine Fish

The State of Orissa has a coastline of approximately 250 miles of which 90 miles consist of estuaries having no marine fisheries; fishing villages are scattered along the remaining coastline, where seasonal fishing takes place in catamarans and "mango" plank boats. The time spent at sea depends on the weather, tide and the rate of catch. The catch is brought to the shore and disposed of to the waiting retailers who purchase it on a cash and carry basis, thereby freeing the fishermen from further marketing problems. There is a very large number of such merchants who compete with each other, thus ensuring a more or less equitable market rate to the producer. In some cases the wealthier merchants collect the fish at local market rates for export in ice to distant places. The benefit of the remunerative export business goes entirely to the purchaser, who assumes the risks involved in the fluctuations in the market rates, spoilage etc. The number of boats and nets in each centre is limited and is confined to a few owners.

There is a system of sharing the catch, whereby one share is set apart for the boat owner, one share for the net owner and the balance is distributed among the fishermen. If the boat owner and net owner are also fishermen they thus get the corresponding additional shares.

The boats and nets are purchased through credit from the local moneylender at a fairly high rate of interest, which ultimately accounts for the poor share of last retail price received by the fishermen. Since the fishermen are not experienced in financial matters, they are not considered to be a sound risk by banks and co-operatives, as a result of which the fisherman is largely dependent on the village moneylender. As the fishing is seasonal, the fishermen must depend on further cash loans from the moneylender in the off season, which are repaid at an interest varying between 19% to 24%, or even higher.

Apart from the quantity exported in ice, the rest of the fish is taken in head-loads to the villages and sold there at competitive rates. If there is a heavy catch a portion of the fish is dried and sold to wholesale merchants dealing in this commodity, who in turn carry it to village markets and sell it through retailers. It will thus be seen that marine fish marketing in this area gives a living to a larger number of men and women, none of whom is prosperous (except the largest merchants); a few of them resort to agriculture to supplement their income.

The fishing villages are mostly located at places without any communication facilities, and during the season when the boats are continuously engaged in fishing, it is not possible for them to secure their daily needs of yarn, rice etc., except through the local dealer, who usually charges them high prices. If there is scarcity of yarn, the bulk of it goes to the weavers, from whom the fishermen can only get a meagre quota through unauthorized channels. Experiments have been conducted in organizing the fishermen into co-operatives with the single object of obtaining yarn and other commodities. This was given priority over joint marketing because it was felt that the fishermen must be accustomed to the co-operative spirit before further significant steps could be taken. The fishermen, while anxious to satisfy such incidental needs at reasonable prices, do not appear to welcome any measure directed towards getting them out of the clutches of the local moneylenders and sooner or later they return to him, possibly because the moneylender is in more constant touch with the fishermen than the social or Government worker. It has also to be kept in mind that any dislocation of the existing arrangement will deprive a large number of persons of their livelihood, which might give rise to a serious problem unless some alternative occupations were found for the middlemen.

* Deputy Director of Fisheries, Cuttack, Orissa, India.

Marketing of Estuarine fish

The best developed estuarine fishing ground in the State is the Chilka Lake with an area of some 300 to 400 square miles. Here, carrier agents operate in the lake and purchase fish from the actual fishermen. The fish is taken to assembly grounds and is sold to exporting merchants, who thus collect a large amount of fish from various centres and try to get better prices by sending it in ice to distant places. In spite of inadequate refrigeration facilities, the merchant usually earns a good profit and here three distinct economic strata are noticeable. The fisherman who operates inside the lake is the poorest, and in spite of any increase in the price of fish he continues to eke out a meagre living. The carrier agent is slightly more prosperous as he maintains a number of boats which collect the fish from various centres. The exporting merchant is usually very prosperous and many of them have their own wholesale auction depots where they sell their own collections, thus earning profits at both ends. Co-operative marketing can be applied to this field and it will not involve an unemployment problem since the prosperous merchants have enough capital to take into other businesses. The State Fisheries commenced experiments in 1949-50 to develop co-operative marketing and the progress has been remarkable. The number of societies and the volume of business transacted with approximate yearly profits can be seen from the following table. Co-operative marketing in this case has only eliminated the exploiting merchants, leaving carrier agents and the auctioneers undisturbed for the present.

Table

Year of business	No. of marketing societies	Volume of business in Rupees	Approximate profits earned in Rupees
1949-50	18	26 lakhs*	184 839
1950-51	20	30 lakhs	87 034
1951-52	21	32 lakhs	96 868

It was decided not to hasten the process because even inside the co-operatives, there are many who take advantage of the lack of education among the members. It is, however, the policy gradually to eliminate or regulate all middlemen operating between the producer and consumer. Villagers who have taken to co-operative marketing have accumulated reserve capital and part of this has been utilised for communal places of meeting or worship, or for tanks. With the first stage achieved, attention is now being diverted to technical improvement and the societies are proposing to operate cold storage and carrier launches.

There are, besides the Chilka Lake, two other important estuaries in the State, but it has been possible to arrange a transport service in respect of only one of them. In such areas the producer is completely at the mercy of the salt merchants who purchase and cure fish. The price paid is naturally very low, and transport and refrigeration are the major factors in the improvement of marketing conditions.

Marketing of Inland fish

The State has a large number of inland fisheries, ranging from small ponds to the reservoirs and rivers. This industry is essentially a cottage industry in that every village has a few fishermen who engage in fishing and in some cases fish rearing. The catches are sold from door to door or brought to the nearest urban area. The fisherman is often assisted in his trade by the members of his family, but there are a few middlemen. These are usually persons owning or leasing the fishing rights, since the fishermen are unable to raise the deposit necessary for the lease. He is, therefore, compelled to fish on the terms dictated by the owner of these rights. The solution of this problem is a question of land reform. Attempts have, in fact, been made to place certain areas belonging to the State directly at the disposal of fishermen's co-operatives. with satisfactory results. In such cases, the fishermen get the benefit of the whole catch, less a reasonable amount to amortize the lease value, and the marketing is done on a family basis.

*A lakh is a hundred thousand.

A PRELIMINARY REPORT ON LANMADAW FRESH FISH MARKET, RANGOON, BURMA

by

U Ba Kyaw*

A preliminary study of fish marketing at the Lanmadaw Fresh Fish Market, Rangoon, was conducted on the initiative and under the guidance of U Khin, Director of Agriculture and concurrently Officer-in-Charge, Fisheries Bureau, Union of Burma.

The purposes of the study were primarily:

1. To prepare a background for further study of the fish market;
2. To find ways and means for the development of fresh fish marketing in Rangoon;
3. To form a model for the study of marketing of fish and fish products in the other parts of the country.

There are three fish landings within the limits of the Rangoon Municipality, viz., at Lanmadaw, Kemmendine, and Pazundaung Quarters. The study was confined to the Lanmadaw Market only for the following reasons:

1. The other two landings were comparatively much less important, their total volume of business being only a fourth or fifth of that at Lanmadaw;
2. Limited facility of the Fisheries Bureau

This study was more or less a part-time work of the Fisheries Officer and two of his Assistants as it could be conducted only when they were at Headquarters and not occupied with other duties.

It was by restricting the work to one market that they were able to intensify their efforts so as to get some results. Of course, there were many points, such as arrivals of fish by districts and by species, potentialities, socio-economic data etc., which were at first intended to be studied but later abandoned.

Methods and their limitations.—Information and data were collected by interviewing selected fish agents, by random sampling, by actual observation, and from Deputy Commissioners.

In selecting fish agents for interview, their experience as well as reliability was given first consideration. Information from one source was always checked with those from several others. But as it was impractical to get the actual figures from them, only rough estimates were obtained.

Random sampling technique was employed to get rough data for average daily handling of fish at the market. Fish arrivals at the market vary with month, tide, weather, and other causes. Variation due to the first two factors whose occurrence is regular and cyclical could be taken care of by stratification according to months and tide-days, but that due to the other causes of irregular and unforeseen occurrence had to be left out. Six days (2 high, 2 medium, and 2 low-tide days) were selected in a month. On those days two fieldmen were stationed at the market gates during regular transaction hours. While counting the total number of fish baskets (all of one size only) which passed out of the gates, they stopped every twentieth basket and recorded the amount, species, and the price of fish in that basket.

The amount of fish (W) handled at the market on a sampling day was calculated by multiplying the total number of baskets counted by the mean weight of fish in the sample baskets. The Standard Error of the mean weight, except for very few cases, was found to vary between .15 and .36. The Standard Error times the total number of baskets was taken as the limit of error in calculating W. The result was found to be less than 500 viss[1]. Therefore 1,000 viss was taken as the unit for expressing W. The number of samples will have to be increased if a smaller unit is desired. Average daily handling of fish at the market for a month was calculated as $\frac{\Sigma W}{6}$. In addition, an allowance of + 500 viss was made to include the amount of fish supplied on contract to the army, which are packed in boxes and, therefore, not recorded in the sampling. But figures for the months of June, July, and August, 1953, were calculated from the data given by the Fish Marketing Co-operative Society Ltd. (See below)

Average monthly wholesale prices of fish by species was found by $\frac{\Sigma p}{n}$, where p was the price of one kind and n the number of different prices of that kind recorded during the month. For lack of space, only wholesale prices during the 12 months from September, 1952, to August, 1953, are given here.

* Fisheries Officer Union Government of Burma, Rangoon.

[1] 1 viss = 1·65 Kg.

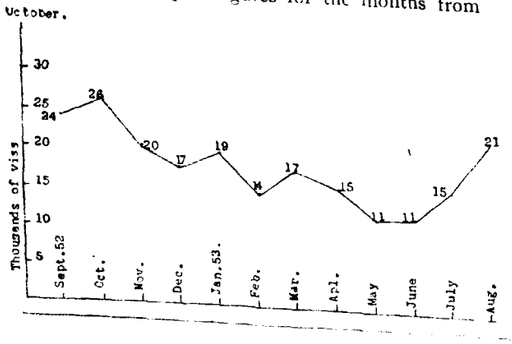
Supply of fish.—The main supply to the market is from the inland fisheries of the neighbouring districts. Arrivals of marine fishes from the Tenasserim coast are mostly during the dry season and are rather irregular. Supply of fresh fish from the following districts are regularly tapped for the market.

Table I. Sources and their importance.

Serial No.	Name of District	Revenue in Kyats as of 1951-52		Approximate annual production in Viss. (Round fresh weight)
		Leased fisheries	Open fisheries	
1.	Maubin	307 835	5 928	2 500 000
2.	Pyapon	149 231	11 198	2 400 000
3.	Myaungmya	133 776	2 195	1 050 000
4.	Pegu	149 610	50	940 000
5.	Insein	66 109	2 378	750 000
6.	Hanthawaddy	84 706	3 280	900 000
	Total ..			8 540 000

There are other irregular sources such as Amherst, Tavoy, and Mergui Districts (Tenasserim Coast), where the approximate annual production is 2,024,000, 480,000, and 3,574,000 viss, respectively. Thus the approximate total annual production from all these sources is about 15,000,000 viss of which only about 6,400,000 viss reach the market as fresh fish.

The average amount of fish handled dailyat the market by months in thousands of viss is shown by the following graph. Figures for the months from October, November, 1952, up to April, 1953, would have increased if the communications in Maubin District during the last dry season were as good as during this season. Normally, the figure for November used to be bigger than that for October.



Assembling of fish—Lanmadaw Fresh Fish Market is located very near the business centre of the city and also close to the jetties for the inland waterway launches. It is the chief reason for assembling of fish at the location. Details of transportation of fish from the sources to the market are given in Table II.

The market place is an irregular-shaped enclosure having an area of about half an acre[1]. Forty-two fish stalls (thirty of which are 10′ x 24′6″ and the other twelve 8′6″ x 18′) line the two sides of the main path-way which is 17′ in width.

Ordinary balances with pan on one side for weights and cane basket on the other for fish are used in the market.

There is no cold store for the market at present. Iced fish are stored in wooden boxes, as transported, in two godowns nearby, usually for a night before disposal. Live fish are kept in wooden tubs, also as transported, at the market place, but for a longer period if necessary.

The wooden boxes are of three sizes with usual net capacities of 80 to 60, 60 to 40, and 40 to 30 viss, depending on the length of journey. The wooden tubs, also of three sizes, have usual net capacities of 45 to 40, 35 to 30, and 25 to 20 viss, depending on the length of journey.

[1] 2·5 Acres = 1 Hectare.

Table II. Details of transportation.

Serial No.	Sources Districts	Means	Usual time of arrivals	Average cost per 100 viss Live fish Kyat	Iced fish Kyat
1.	Maubin	Launch and Motor-boat	11 a.m. to 1 p.m.	3.94	2.50
2.	Pyapon	-do-	2 p.m. to 3 p.m.	5.38	3.80
3.	Myaungmya	Launch	7 p.m. to 10 p.m.	8.20	5.48
4.	Pegu	Motor-truck	4 p.m. to 10 p.m.	15.38	8.33
5.	Insein	-do-	11 am. to 2 p.m.	2.30	1.25
6.	Hanthwaddy	Launch and row-boat	8 a.m. to 2 p.m. 4 p.m. to 6 p.m. and 10 p.m. to 3 a.m.	4.74	3.00

Five ice-plants supply 30,000 to 60,000 lbs of ice daily at K. 2.50 to 3.00 per 100 lbs to the fish agents, who again distribute it to fish suppliers in the districts at K. 3.75 per 100 lbs.

Distribution of fish.—Distribution of fish from the Lanmadaw market covers rather a wide area, reaching as far as Kyauktan (18 miles) in Hanthawaddy District and Mingaladon (12 miles) in Insein District.

At about 3 a.m. every day fish agents begin preparations at the market while the retailers also arrive in groups. Actual transactions start about half an hour later and continue up to about 7 a.m. The market is busiest between 4 and 5 a.m. Business resumes at about 11 a.m. and closes down at about 4 p.m. Activity during that period, compared with that in the morning, is much slacker.

Sale of fish is not by auction in lots as in the neighbouring countries. A fish agent names his price according to the quality of his ware and also his judgement of the supply position in the market. It is generally a seller's market, because of general shortage of supply and also because of the holding power of the agent who is financially strong *vis-a-vis* the majority of buyers who are small retailers earning a precarious living on their small daily profits.

There are about one hundred agents or over doing that wholesale business. About three hundred fish hawkers from about thirty-five retail markets come everyday to Lanmadaw for wholesale buying.

Commission rates taken by the agents vary. When loans have to be advanced by agents to suppliers, the rate is 25 pyas[1] per viss, but when no loans are taken, it is from 8 pyas to 13 pyas per viss, depending on the volume of fish supply.

Fixation of wholesale prices, weighing of fish and making accounts for the suppliers are practically in the hands of the agents, thus opening the way for malpractices.

The total gross profit of all the agents, before June, 1953, in their own estimates was about one million Kyats. But they are of widely varying capacities, a big agent getting about one lakh and a small about three thousand. A big agent employed three clerks at K. 300 to 200, a mediocre, one or two, and a small agent no clerk. The rent of one stall is K. 37 per month. The actual monthly expenditure of the agents could not be calculated for lack of proper records. But it is a negligible fraction of the gross profit in the case of a big agent. It is about K. 60 in the case of a small agent. Thus, the net profit in the case of the former can be roughly taken as one lakh while in that of the latter about two thousand. Anyway, one hundred fish agents or over with three independent organizations among them is an indication of keen competition and very profitable venture despite the risks in giving advances.

Average wholesale prices of some popular fishes at the market for the period from September, 1952, to August, 1953, are shown in Table III.

Financing.—The amount of loan issued by Government to fishing units (Kyats 150,000 as of 1952-53) is not enough even to start the initial operation. So the fishermen have to turn to the fish agents, who generally advance the money. A big agent advances as much as 2 lakhs of Kyats or a small one about ten thousand. No interest is taken on the advance, but only a condition to sell all the fish through the agent is imposed on the fishermen.

The majority of the retailers do not pay cash when buying and it is part of the agents' job to collect bills regularly from them.

[1] 100 pyas = 1 kyat. One U.S. dollar = 4. 76 kyats.

Table III. Average Wholesale Prices, 1952-53

Serial No.	Name of fish		Price per viss in Kyats.
1.	Pa-zoon-gya	(*Peneus* sp.)	5.00
2.	Pa-zoon-dok	(*Palaemon* sp.)	3.00
3.	Nga-tha-lauk	(*Hilsa ilisha.*)	4.40
4.	Nga-zin-pya	(*Ilisha sladeni,*)	3.24
5.	Nga-mwe-do	(Rhynchobdellidae)	2.14
6.	Nga-myet-san-ni	(*Labeo rohita,*)	1.92
7.	Nga-thine	(*Catla catla,*)	2.67
8.	Nga-gyin	(*Cirrhina mrigala,*)	3.35
9.	Nga-be-byu	(*Amblypharyngodon mola,*)	1.44
10.	Nga-phe	(*Notopterus* sp.)	2.23
11.	Nga-bat	(*Wallagonia attu,*)	2.37
12.	Nga-Khu	(*Clarius batrachus,*)	2.95
13.	Nga-gyaung	(*Mystus aor.*)	2.06
14.	Nga-zin-yine	(*Mystus cavasius,*)	1.67
15.	Nga-nu-than	(*Callichrous* sp.)	2.50
16.	Nga-myin-yin	(*Pseudotropheus goonwaree,*)	3.73
17.	Nga-dan	( )	2.15
18.	Nga-yant	(*Ophicephalus striatus,*)	2.39
19.	Nga-bye-ma	(*Anabas testudineus*),	2.39
20.	Nga-pot-thin	(*Sciaena* sp.)	1.29
21.	Ka-bi-lu	(*Mugil macrolepis,*)	2.54
22.	Ka-kuyan	(*Eleutheronema indicus,*)	2.96
23.	Ka-ka-dit	(*Lates calcarifer,*)	2.95
24.	Ka-tha-hmyin	(*Epinephelus* sp.)	2.91
25.	Ka-tha-bo	(*Glossogobius giuris,*)	1.75

There is considerable risk in giving advances to the fishermen, but not so much in giving credit to the retailers. Many agents have suffered severely by the loss of advances, some to the extent of total failure.

Co-operative Fish Marketing.—A fish marketing co-operative, organized by the Co-operative Department, has begun functioning since June 1, 1953. The Fisheries Officer is a member of the Supervisory Committee of Fishery Co-operatives as well as the Executive Committee of the marketing society. About 240 fish producers' co-operatives from Maubin, Pyapon, Pegu, Insein and Hanthawaddy Districts have joined the marketing cooperative. The method of operation at the market of the society is practically the same as before, the only difference being fixing retail ceiling prices of fish every week. Formerly, two different commission rates were charged, i.e. 6% for those who took loan from the society and 3% for those who did not. But from October 1, 1953, only one rate, 4%, is taken. The society receives loans from the Government, paying 6½% interest, and takes 12½% on the loans to the member societies.

The financial position of the marketing co-operative as of August 31, 1953, is as follows.

Admission fees from member societies	K.	5,875
Shares from member societies	K.	114,700
Loan from the Government ..	K.	1,500,000
Total capital ..	K.	1,620,575
Amount of loans already issued to 172 member societies	K.	692,200
Net profit for the period from June 1, 1953, to August 31, 1953, is	K.	13,091·84

Conclusion.—Results of this pilot study should be of considerable help in planning for further study of fish marketing which, of course, will have to wait till this Fisheries Bureau is adequately staffed.

At one time much hope was entertained that shortage of fish supplies in the Rangoon market could be made good by those coming from the Tenasserim Coast, but it was found later that the irregularities of Tenasserim supplies are due not so much to transportation difficulties as to the special preference of the consumers for fresh-water fish. An intensive educational campaign will be necessary to make the marine fishes generally acceptable to consumers in this area.

Potentiality of market development in respect of fresh-water fishes is not considered to be great, though there is still room for improvement. Transportation of fish and other related facilities can be further developed. A cold store is badly needed for the market to stabilize the widely fluctuating prices of fish in Rangoon.

There are 1598 leased fisheries (as of 1951-52) in the six neighbouring districts. About 240 of them are now members of the marketing co-operative and they are receiving very substantial loans from the society. The rest, of course, are still dependent on the fish agents. They will have to be brought under the co-operative system in due course.

6

THE HONG KONG FISH MARKETING SCHEME

by

Co-operative and Marketing Department*

The main primary product of the Colony of Hong Kong is fish. Probably the largest fleet of any fishing port in the British colonies is based here, with an estimated fishing population of some 50,000.

The standard of education among local fishermen is low, and for generations there has been little or no incentive for them to increase production or improve their fishing methods. This was mainly due to the "laan" or middleman system which kept the fishermen poor and constantly in debt.

A form of co-operative marketing enterprise in which the fishermen operated their own wholesale markets was obviously the ideal solution of this situation but in competition with the powerful and well-established middleman system such an enterprise was scarcely likely to succeed.

Therefore, immediately after the re-occupation of the Colony in October, 1945, Government decided to set up an organization to control the transportation and wholesale marketing of all marine fish. The introduction of this Fish Marketing Scheme was the first step in a programme to improve the lot of the local fishermen by providing them with orderly and efficient marketing and transport facilities ensuring that the fishermen would receive a fair return for their produce and so be encouraged to increase production. The Marketing Organization is self-supporting and has been so planned that eventually it may be taken over by the fishermen themselves and run as a co-operative enterprise. Towards this end, a Registrar of Co-operative Societies was appointed in 1950, and the Fish Marketing Organization was placed under his guidance in his additional capacity as Director of Marketing in the Co-operative & Marketing Department.

Legislation.—The Fish Marketing Scheme was originally instituted under Defence Regulations, 1940. In accordance with a number of Orders made under these Regulations, the movement and wholesaling of marine fish (excepting shell fish and marine fish "alive and in water") are controlled. All marine fish landed in the Colony is sold wholesale at Government organized markets.

Administration.—The Organization's administrative staff includes a small group of Government servants. All other staff are paid from the funds of the Organization. The Government servants number 30 and the permanent Organization employees 381. Seasonal fluctuations in fish landings necessitate elasticity of staffing arrangements and temporary daily or weekly-paid workers, sometimes numbering 80 or more, are employed during peak periods.

Four wholesale markets have been established; two on the Island of Hong Kong at Aberdeen and Shaukiwan; one in Kowloon; and one in Taipo, which is the main fishing area in the New Territories, on the mainland. The headquarters of the Organisation is in a building attached to the Kowloon Wholesale Fish Market.

Functions.—The main functions of the Organization are the collection and transportation of fish from Fish Collecting Depots and Posts in the Colony to the four wholesale fish markets, and the supervision of sales and financial transactions.

Briefly, these main functions operate as follows:—

(*a*) **Collection of Fish.**—A total of nine fish collecting depots and posts have been set up in the main fishing villages throughout the Colony and, from these points, the Organization undertakes the collection and transportation of fish to the wholesale markets. The majority of fishermen like to accompany their own fish to market or have a friend or agent look after it for them, but if they wish they can also leave their produce in the hands of the Organization staff who look after it till it is sold in the market.

(*b*) **Transportation.**

Land transport.—The Organization owns and maintains a fleet of 15 vehicles which, together with a number of hired commercial lorries, is operated in accordance with daily requirements.

Sea transport.—For fishermen sending in their catches to depots established on some of the islands of the Colony, sea transport services are operated by commercial transport companies on behalf of the Organization.

(*c*) **Sale of Fish.**—At the Markets, the Organization's staff sorts the fish into types and sizes, weighs it and prepares it in suitably-sized lots. The fish is then sold by public auction. Fishermen may collect the proceeds of sales (less a 6% commission charged which covers all the services rendered by the Organization) either directly after sale at the market, or, if they prefer, the Organization takes the money back to their local depot or post for them.

(*d*) **Transport for Buyer's Purchase.**—When the fish is sold at the markets, the Organization provides free transport to the buyers' place of business in the urban areas.

The sketch plan shown in Appendix "A" gives an outline of the wholesale fish market opened in 1952 at Aberdeen, the Colony's main fishing village on the Island of Hong Kong. This market has a large covered auction area of approximately 30,000 square feet, and the long water-front is provided with adequate landing facilities and equipment. Numerous services are also provided in the Aberdeen Market and these include a canteen for the use of fishermen, buyers and market staff; rest rooms for fishermen and buyers; accommodation for those members of the staff who are required to be in the market for the early morning auction; and a cold store with a capacity for some 250 tons of fish. The lay-out of the market provides for economy as well as efficiency.

An important and popular feature of the market is the provision for the sale of fuel and lubricating oils. The Asiatic Petroleum Co. has erected two large oil storage tanks on the hillside immediately above the market and the oil is piped to a convenient delivery point in the market. Owners of mechanized vessels are particularly appreciative of this service as it saves them many hours of turn-round time, it having previously been necessary for them to go to oil installations in Hong Kong Harbour.

Finance.—As stated above, the Organization is self-supporting. The costs of all services are met from the 6% commission charges.

In 1945, at the inauguration of the scheme, the Organization received from Government two separate loans of HK$ 50,000 each. These were repaid in June, 1946. The Organization is in a sound financial position. Even if Government subsidies in the way of the small supervisory staff were taken into consideration, it would still be able to pay its own way.

The analysis of expenditure for the financial year 1953/54 may be of interest. For purposes of easy comparison, the figures have been rounded off:—

Total value of fish sold		HK$ 44 900 000
Income from commission		HK$ 2 691 000
Income from sales of supplies		29 800
Income from sundry items		82 300
Total Income		2 803 100
Expenditure		
Salaries and allowances	63.99%	
Rent and rates	2.84%	
Printing and stationery	3.17%	
Light, water and telephones	1.1 %	
Maintenance of building	1.19%	
Transport and travelling	13.31%	
Baskets and Tubs	2.5 %	
Incidentals	1.46%	
Education	2.14%	
Insurances	1.4 %	
Sundry loss	.1 %	
Depreciation on capital	6.8 %	
	100.00%	2 307 400
Surplus		HK$ 505 700

*Tung Kun Street, Yaumati, Kowloon, Hong Kong.

The Organization's accounts are subject to independent audit by a firm of commercial auditors.

Trading and Progress.—From the figures given below, it will be noted that local landings of marine fish have more than doubled since 1947. This is an outstanding achievement, and is due in no small measure to the fact that efficient marketing and transport facilities have helped to provide the local fishermen with the necessary incentives to increase production.

	Fresh Fish		Salt Fish		Total	
	Piculs*	Value†	Piculs*	Value†	Piculs*	Value†
1945 (3 months only)	4 184	382 664	40 704	2 813 651	44 888	3 196 315
1946	31 998	3 120 457	211 559	18 476 431	243 557	21 596 888
1947	44 418	3 355 513	189 272	11 166 576	233 690	14 522 089
1948	121 818	8 651 356	246 368	11 941 515	368 186	20 592 871
1949	181 817	17 689 029	270 626	18 740 369	452 443	36 429 398
1950	275 948	24 414 750	237 912	13 873 411	513 860	38 288 161
1951	371 924	30 424 549	134 682	8 697 688	506 606	39 122 237
1952	443 199	30 980 433	135 306	7 537 428	578 565	38 517 861
1953	418 590	33 615 385	109 594	8 060 969	528 184	41 676 354

Prior to the Korean War, there was a large market in China for the low and medium grades of salt/dried fish; some 60-70 per cent of the total quantity of salt/dried fish sold in the Colony was exported to China. In June, 1950, however, the Chinese authorities imposed an embargo on imports of salt/dried fish from Hongkong and, in February 1951, the Chinese Customs Control was tightened up to such an extent that exports to China ceased completely.

This embargo is still in force, but local dealers are making determined efforts to find new outlets and there has been an encouraging increase in the export of salt fish during last year. The main overseas markets are now Singapore, Formosa, Macao, Indonesia, Siam and the Philippines, and there is now every indication that the U.S.A. will also become one of our main export markets.

Prices.—By far the greater part of fresh fish consumed in the Colony is inexpensive. Over 95% of fresh fish sold through the Organization last year had a wholesale price of HK$ 1.10 per catty or less. The more expensive fish (wholesale price of HK$ 1.61 per catty and more) includes Garoupa, White Pomfret and other types of luxury fish, which form only 2.52% of the total catch, and are mainly in demand by the wealthier classes.

It is significant that the wholesale prices of both fresh and salt/dried fish, given below, have not increased in conformity with the general increase in the cost of living :—

	Fresh Fish Average Price— HK$ per picul	Salt Fish Average Price— HK$ per picul
1945 3 months	91.50	69.10
1946	97.50	87.30
1947	75.50	59.00
1948	75.00	48.50
1949	97.30	69.30
1950	88.50	58.30
1951	81.80	64.60
1952	69.90	55.70
1953	83.01	73.55

* 100 catties = 1 picul = 133.33 lbs.
† HK$ 1.00 = 1s. 3d. sterling.

Ancillary activities—*Supplies to Fishermen.*—As an additional service and for the convenience of the fishermen, the Organization maintains a Supply Section for the purpose of making a number of basic and necessary supplies available for sale at depots, posts and markets. These supplies include rice, ice, fish hooks, drinking water, diesel fuel oil and lubricating oil.

Loans to Fishermen—In September, 1946, a loan of HK$ 250,000 was received from Government for the purpose of establishing a revolving fund from which to issue loans, at low interest, to fishermen for productive purposes. This loan was completely repaid in April, 1949, and the Organization now operates its own revolving fund.

Since 1946, this fund has revolved many times and to date 1,990 loans amounting to some HK$ 1,250,000 have been granted, of which over HK$ 1,000,000 has been repaid.

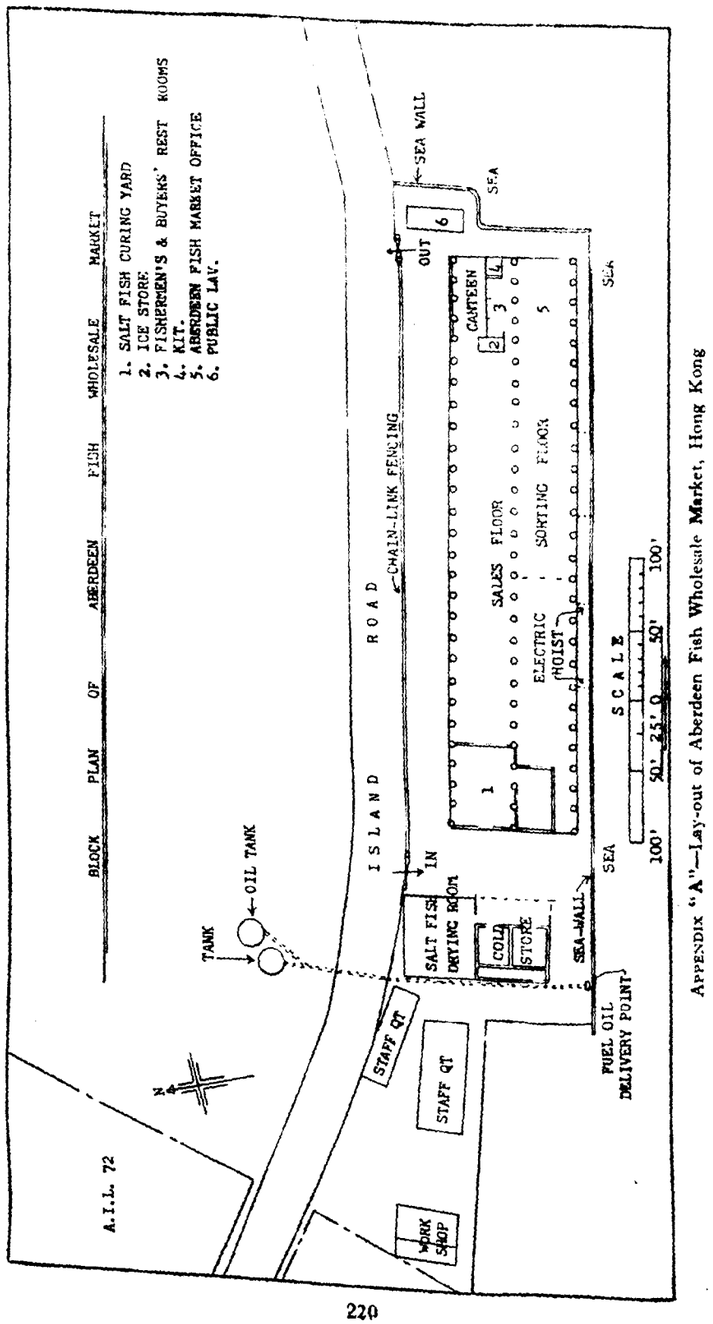
An encouraging and important development towards financial independence among local fishermen was the registration of the first Fishermen's Thrift and Loan Co-operative Society in September, 1952. The establishment of this society caused much interest, and its development was carefully watched by fishermen all over the Colony who, by nature, are extremely conservative and cautious in adopting new ideas.

The progress made by this first thrift and loan society was most impressive and a total of 17 such societies are now registered.

Education.—Education plays a large part in the welfare programme of the Organization, and there are now over 1,000 fisher-children receiving education at schools wholly or partially financed by the Organization.

Conclusion.—In Hong Kong, Government took the initiative by providing legislation which, while it gave the producer protection and a greater incentive, instituted an element of compulsion as to how he should dispose of his catches. It is, however, within this frame-work that co-operative societies will eventually be formed and, as the Organization achieves an ever greater extent of co-operation, it will be possible for Government to withdraw gradually from the scheme.

It is emphasised that this scheme was adopted to meet the particular needs of this Colony. However, it is thought that the principles of the scheme might be applicable to many other countries in the Far Eastern region, although operational practices would have to be modified in accordance with local circumstances.



APPENDIX "A"—Lay-out of Aberdeen Fish Wholesale Market, Hong Kong

7

ETUDE SUR LA COMMERCIALISATION DES PRODUITS DE LA PECHE MARITIME

par

Tran-Van-Tri*

et

P. Gaillard**

ABSTRACT (IN ENGLISH)

The fishing industry of Viet-Nam has since 1945 suffered severe damage from the war. Some fisheries cooperatives which existed before that are now inactive, and fishermen send their products through numerous middle men.

In the conviction that one of the most important factors for the success of this industry is still the good organization of fish marketing, the fisheries service of Viet-Nam devoted during 1953 a great part of its time gathering necessary information which will be used for future fish market organization. Studies on the demography of fishing provinces have been started as well as statistics of fishermen and fishing craft and this is expected to be completed within the years 1954–1955.

I

Faire actuellement un exposé sur la commercialisation des produits de la pêche maritime au Viêtnam est une tâche ardue et délicate, car l'économie de ce pays est profondement influencée par l'état de guerre qui y règne.

Les circuits commerciaux, établis en temps de paix, ont été complètement modifiés, et le seront encore, par les évènements heureux ou malheureux qui se produiront. Par ailleurs, le Service des Pêches Maritimes du Viêtnam est un service jeune qui n'a qu'un an d'existence. Son activité ne résulte pas d'un transfert de compétences entre l'Administration Francaise et l'Administration Viêtnamienne. Aucun service d'administration centrale n'avait été chargé jusqu'à présent de l'organisation des pêches maritimes. Les efforts d'une première tentative, réalisée sous la forme d'une 'Inspection Générale des Pêches' ont été détruits par les évènements résultant du coup de force nippon du 9 Mars 1945.

Le présent exposé n'aura donc pas d'autres prétentions que celles qui consistent, à examiner les bases de la commercialisation viêtnamienne des produits de la pêche dans la conjoncture actuelle, et à rechercher des solutions d'avenir.

II

La commercialisation des produits de la pêche maritime au Viêtnam fait partie d'une économie de guerre, dont les destructions ont frappé les pêches plus encore que la culture: l'ancienne production qui était d'environ 180·000 tonnes est maintenant réduite à environ 30·000 Tonnes.

Les zones de pêche côtières, qui forment tout au long des côtes une bande 20 kilomètres de large, ont été considérablement réduites par les impératifs des opérations et de la sécurité militaire. Elles ont été fractionnées en 'zones autorisées', 'zone interdites', et 'zones de guerre'. Seules, les 'zones autorisées', qui sont restreintes, permettant une production encore diminuée par l'interdiction faite aux barques de pêche de sortir ou de rentrer au port pendant la nuit. Toutefois, par rapport à la période d'avant guerre, les habitudes commerciales concernant les produits de la pêche maritime n'ont pas éte changées.

III

Pour juger de la distribution du poisson, dont la plus grande partie des bénéfices continue à aller dans les poches des intermédiaires, et plus spécialement des grossistes, il faut se débarasser de la terminologie occidentale.

Celle-ci donne l'habitude de distinguer,

le producteur,
le grossiste, et
le détaillant.

* Chef du Service des Peche Maritimes du Saigon, Vietnam.
** Expert du Service des Peche Maritimes du Saigon, Vietnam.

Et, on considère, en général, qu'à l'échelon du 'gros', le pourcentage bénéficiaire est plus restreint qu'à l'échelon du 'détail'.

Dans le commerce viêtnamien des produits de la mer:

—le pêcheur, c'est à dire le *producteur*, travaille, dans la plupart des cas, pour rembourser les avances qui lui ont été consenties par le 'mareyeur-remasseur de poisson' est aux ordres du grossiste qui, généralement, lui prête, ou lui avance, les capitaux nécessaires à son activité;

— le *grossiste* qui est dans le centre urbain, rassemble la production et en effectue le stockage;

— et le *détaillant*, au lieu d'acheter comptant au grossiste, n'achète qu'à crédit, et ne paie sa marchandise qu'après vente.

En conséquence, le mareyeur-ramasseur de poisson et le détaillant ne sont que des 'employés' du grossiste, qui est le seul et véritable intermédiaire entre la production et la consommation.

La structure du circuit commercial traditionnel présente donc un inconvénient majeur. Ses éléments sont liés par le syntèse des avances: 'avances à la production' du grossiste au pêcheur par l'intermédiaire du 'mareyeur-ramasseur de poisson'; et 'avances en marchandises' du grossiste aux détaillants. Au résultat, ce circuit est parfois aussi fermé qu'un 'club' ou qu'une 'association', où les éléments nouveaux, qui seraient susceptibles d'apporter des réformes, ne peuvent faire partie, de même qu'ils ne peuvent vivre parallèlement d'une autre manière sans entrer immédiatement en conflit.

A la production, faute d'entrepôts frigorifiques à la disposition des pêcheurs dans les centres de pêche, les prix payés par les 'mareyeurs-ramasseurs de poisson' s'effondrent dès que les apports journaliers locaux augmentent. Dans les meilleures conditions ils varient déjà de 30% en plus ou en moins à la 'mise à terre', dans chaque catégorie.

A la consommation au contraire, les centres urbains sont seuls à posseder des moyens de conservation. Mais, toutes les chambres froides disponibles sont entre les mains des grossistes. Au lieu de servir à maintenir des prix payants pour le producteur, elles sont plutôt employées à régler le débit des ventes en gros, en fonction des arrivages prévus dans les jours à venir. Et, par voie de conséquence, elles peuvent aider à faire des prix spéculatifs absorbant tout le pouvoir d'achat de la clientèle au seul profit de leurs propriétaires.

Au détail, la structure de ce circuit commercial est aussi très particulière. Elle mérite la plus grande attention. Les détaillants sont relativement très nombreux, et chacun d'entre eux vend en moyenne pas beaucoup plus de cinquante kilos par jour. Cette distribution lente et onéreuse existe pour plusieurs raisons. La plus importante tient aussi bien à la pauvreté des couches populaires de la population qu'au manque de moyens financiers des détaillants. La ménagère viêtnamienne, pas plus que sa marchande de poisson, n'a de frigidaire ou de glacière.

Elle va au marché un ou deux fois par jour. Ses revenus ne lui permettent que des dépenses très fractionnées, et elle a l'habitude de nourrir sa famille de quelques dizaines de grammes de poisson avec la plus grande quantité possible de riz. Faute de pouvoir conserver une matière essentiellement périssable, et faute d'argent, la ménagère ne fera que de très petits achats souvent répétés. Faute de pouvoir conserver sa marchandise sous froid, le détaillant cherchera au début de la journée à vendre le plus cher possible pour essayer de compenser les pertes qu'il risque, après fermeture du marché, si son stock n'est pas complètement vendu. Il s'en suit d'après marchandages qui freinent considérablement l'écoulement. Le nombre élevé des détaillants est ainsi facteur, de la façon d'acheter de la clientèle, et surtout d'un manque d'équipement des commerçants détaillants qui n'ont pas suffisamment de moyens financiers pour s'équiper.

Ainsi qu'il s'est dit plus haut, l'ensemble du circuit commercial actuel forme un tout aux éléments traditionnellement liés. La capacité d'absorption de la clientèle est limitée, non seulement par son pouvoir d'achât, mais plus encore par une distribution de gros spéculative, et par une distribution de détail qui manque de modernisme. Si la production augmentait rapidement, ses surplus ne pourraient sans doute être vendus avec profit que partiellement, à moins de multiplier aussi rapidement le nombre des detaillants; et comme toute augmentation du nombre de ceux-ci, aggraverait le prix d'une distribution déjà trop onéreuse, ou assisterait à un véritable malthusianisme économique dû à une cristallisation des activités commerciales concernant les produits de la mer.

IV

Devant cette situation, le Gouvernement Viêtnamien a créé le 10 Décembre 1952, par un arrêté du Président du Conseil, le Service des Pêches Maritimes du Viêtnam, à la Direction de la Navigation au Ministère des Travaux Publics et des Communications.

D'âprès cet arrêté, le Service des Pêches a parmi les nombreuses attributions

> 'la création et le fonctionnement des coopératives de pêches maritimes ou de transformation et de vente des produits de pêche en mer, ou des établissements similaires'
>
> et
>
> 'en liaison avec les Administrations Régionales du Viêtnam, l'organisation et le contrôle des marchés aux poissons, coquillages, crustacés et, en général, des marchés de tous les produits ou sous produits de la pêche en eau salée'.

D'ailleurs, M. Richard S. Croker, Chef du Bureau de la Pêche Maritime au 'Service de la Pêche et de la Chasse' en Californie, en 1952, dans sa conférence faite au Centre de Formation des Pêches de l'Amérique Latine à Valparaiso, a bien dit:

> —'L'une des phases les plus importantes de l'Administration des Pêches est l'organisation du marché'.

Il appartient donc au Service des Pêches Maritimes du Viêtnam d'exécuter son programme d'action pour une bonne commercialisation des produits et même des sous-produits de la mer. Il connait les données du problème. Une production très fortement diminuée par la guerre; des tonnages néanmoins en augmentation qui doivent encore grossir pour satisfaire aux premiers besoins de son marché intérieur; des exportations à reprendre pour certaines catégories seulement. Et pour arriver à une solution, il lui faudra sacrifier, dans la plus large mesure, les intérêts des intermédiaires au profit des producteurs, qui ont besoin du plus grand soutien.

V

Le Service des Pêches Maritimes du Viêtnam, sait que sa tâche est longue et difficile parce qu'elle est compliquée par plusieurs facteurs.

Son influence doit en effet s'exercer sur un territoire dont la forme, une bande côtière de 2.200 kilomètres de long, est peu propice à la centralisation des efforts. Ce territoire est divisé en provinces qui forment trois grandes régions dont les possibilités économiques sont différentes; il a donc créé: un Secteur Nord, un Secteur Centre, et un Secteur Sud, dotés chacun d'un Chef de Secteur.

Grâce aux travaux de l'Institut Océanographique de Nhatrang, l'inventaire de la faune ichtyologique des eaux maritimes a été poussé assez loin, mais jusqu'à présent, on ne s'est pas suffisamment attaché à l'étude des espèces présentant un intérêt économique certain. Sur plus de, 1.000 espèces reconnues moins de 50 sont à ce sujet vraiment intéressantes.

La masse de la clientèle qui constitue le marché n'est pas encore instruite des conditions sanitaires nécessaires à une bonne alimentation. De plus, elle est généralement pauvre et ne sait pas acheter directement à la production.

Enfin, il faut mettre au point la règlementation administrative concernant le conditionnement, le stockage, les transports et la vente.

En résumé, pour arriver à une bonne commercialisation des produits de la mer, le Service des Pêches Maritimes doit tenir compte:

—de la physionomie géographique générale du Viêtnam, et notamment, de la situation géographique des principaux centres de production

— des particularités économiques de chaque province,

— de la structure actuelle des circuits commerciaux, et principalement, du rôle joué par les grossistes

— de la structure du marché qui équivaut au caractère de la masse de la clientèle laquelle a des habitudes locales

VI

En ce moment, le Service des Pêches Maritimes du Viêtnam est en train de réunir les nouvelles monographies de chaque province pour tout ce qui concerne l'économie des pêches. Pour qu'elles soient ensuite tenues à jour, il faut former dans chaque centre de production un 'Comité de pêcheries', composé des meilleurs professionnels. De plus, il constitue un 'Fichier général des pêcheurs et des barques de pêche'.

Ces monographies indiquent:

1°/-le tonnage des produits mis à terre, centre de pêche par centre de pêche

2°-/l'énumération des produits et sous-produits de la pêche fournis par la province

(*a*)—poissons pêchés, catégorie par catégorie, suivant la liste de référence de l'Institut Océanographique de Nhatrang

(*b*)—crustacés, catégorie par catégorie

(*c*)—coquillages, catégorie par catégorie

(*d*)—production des poissons séchés ou salés, catégorie par catégorie

(*e*)—production des ailerons de requin

(*f*)—production des vessies de poisson

(*g*)—production du ' nuoc-mam '

(*h*)—production des ' mams '

(*i*)—production diverses (algues, tortues, nacre etc. . . . .)

3°/—le calendrier des pêches de la province

4°/—les prix payés à la production

5°/—l'énumération des besoins provinciaux en matériaux nécessaires à l industrie de la pêche

(*a*)—glace

(*b*)—sel

(*c*)—fournitures diverses: filets de pêche, filéts ramie, filéts coton, quincaillerie marine, cordages, nattes à voile etc.

6°/—l'énumération des commerçants fournisseurs des pêcheurs en matériaux nécessaires à l'industrie des pêches

7°/—l'énumération des moyens de conservation et de stockage (fabrique de glace—entrepots frigorifiques—chambres froides, entrepôts etc. . . .)

8°/—l'énumération et situation des marchés locaux.

9°/l'énumération des commerçants en produits dé la mer

—mareyeurs-ramasseurs de poisson

—mareyeurs-grossistes expéditeurs

—détaillants locaux

10°/—les prix payés par les mareyeurs grossistes expéditeurs

11°/—les prix à la consommation

12°/—les statistiques découlant de la taxation

(*a*)—du tonnage des produits expédiés

(*b*)—des sommes perçues.

En raison de la configuration géographique du Viêtnam, l'action du Service des Pêches Maritimes est très décentralisée. Elle tend à s'appuyer, sur l'autorité des Gouverneurs Régionaux qui ont à leur disposition les Chefs de Secteur du Service des Pêches, et sur côlle des Chefs de province, qui ont à leurs côtés les Chefs de Quartier de Centres de Pêche. Ces ' fonctionnaires d'autorité ' peuvent, jour après jour, suivre l'action déclenchée par les Chefs de Secteur des Pêches, la soutenir, et la faire aider par tous les services administratif locaux soumis à leur influence et à leur efficience.

Comme toute la distribution est encore actuellement entre les mains des ' grossistes ', et de leurs ' employés ' les mareyeurs-ramasseurs de poisson, le Service des Pêches Maritimes s'efforce, en demandant la collaboration des divers ministères, expression de la puissance publique, de faire adopter un premier texte : Ordonnance de Sa Majeste, Chef de l'Etat, ou Arrêté du President du Conseil, pour la règlementation de la profession de ' mareyeur-expéditeur ', ou plus généralement, pour le commerce du poisson et des divers produits de la mer.

La thèse du Service des Pêches Maritimes est la suivante :

1°/—A la production, nécessité d'obtenir que le poisson soit livré en bon état de conservation même pour le transformer en ' poisson sec ' ou le livrer aux usines de conserves alimentaires.

2°/—Au premier stade de la commercialisation, c'est à dire à la ' mise à terre ', obligation de le stocker en chambres froides, en attente d'expédition, d'étalage sur le marché local.

3°/—A l'échelon compris entre le mareyeur-ramasseur de poisson du centre de pêche, et le grossiste du centre urbain de consommation, obligation de le conditionner et de le transporter dans les règles prescrites par une règlementation qui corresponde à une correcte application des mesures sanitaires de conservation et une utilisation efficiente, des moyens de transport.

4°/—A l'échelon grossiste du centre urbain de consommation, obligation de stockage en chambres froides, en attente de mise en vente.

5°/—A la consommation, nécessité de vendre le poisson dans des conditions sanitaires irréprochables.

VII

En réunissant et en centralisant les judications reçues des provinces, le Service des Pêches Maritimes sera bientôt en mesure si les circonstances l'exigent :

(*a*)—de faire au besoin fixer, dans chaque province, les prix minima à la production, et les prix maxima à la vente,

(*b*)—de faire diffuser par voie de presse ou par radio les mercuriales capables de guider les transactions entre les centres de pêche et les centres urbains importants,

(*c*)—de faire établir des cotations commerciales, en unifiant, espèce par espèce, et catégorie par catégorie, du nord au sud du pays, les noms vernaculaires des poissons.

VIII

En ce qui concerne la vente au détail dans les centres urbains, le Service des Pêches Maritimes suscite la création sur les marchés de ' poissonneries à gros débit '. Par cette création il compte atteindre un triple but.

1°/—Eviter, dans toute la mesure du possible, les pertes dues à la mauvaise conservation du poisson dans toute la distribution urbaine. Ces pertes actuellement impossible à chiffrer, sont considérables et sont l'une des causes des prix élevés pratiqués au détail.

2°/—Briser le malthusianisme économique maintenu par les grossistes urbains et leurs ' employés ' détaillants.

3°/—Réduire le nombre des intermédiaires détaillants.

Dans ces ' poissonneries à gros débit ', pouvant contenir sur chaque marché urbain deux à quatre tonnes de marchandise en chambre frigorifique, le poisson sera stocké, sous glace, dans des caisses standardisées. A l'intérieur de celle-ci, le poisson sera trié pour être préparé à la vente au détail, ou même au super-détail, c'est à dire, ' à la pièce ', ou ' morçeau par morçeau '. Pour accélérer les ventes, il sera étalé par lots distincts, par pièces, ou par morçeaux, de même prix, et en conséquence, vendu à ' prix unique '.

Les prix, au kilogramme, base de référence, seront indiqués sur un tableau, catégorie par catégorie, de manière à que les clients puissent se rendre compte de la valeur de chaque ' pièce ' ou de ch que ' morçeau '.

IX

Dans le plus grand centre urbain du Viêtnam, Saigon-Cholon, il n'y a pas plus d'une dizaine de grossistes pour une ville d'un million huit cent mille habitants, mais sur les 22 marchés de ce centre urbain, il existe en total au moins 700 détaillants, vendant chacun d'entre eux une moyenne de 50 à 60 kilos de poisson par jour.

Pour l'approvisionnement de la ville les prix sont les suivants :

Famille	*Nom Scientifique*	Nom Vernaculaire	Prix par kilo à la production (piastres)	Prix par Kg à la vente au dâtail à Saigon-Cholon
Soleidae ...	*Cynoglossus* sp.	Cá lưỡi trâu	10 à 25$	40 à 75$
Scombridae ...	*Cybium* sp.	Cá thu	18 à 25$	30 à 60$
		Cá bo	16 à 24$	25 à 35$
	Auxis sp.	Cá chu	10 à 20$	20 à 30$
		Cá chàm	10 à 20$	20 à 30$
	Katsuwonus sp.	Cá ngừ	16 à 24$	25 à 40$
	Euthynnus sp.	Cá bạc mã	16 à 24$	30 à 55$
	Scomber sp.	Cá vược	10 à 24$	22 à 50$
Serranidae ...	*Lateolabrax japonicus*	Cá chem	12 à 26$	22 à 52$
	Lates Calcarifer sp.	Cá mù	10 à 15$	25 à 75$
	Epinephelus sp.	Ca đồng	10 à 16$	15 à 45$
	Nemipterus sp.	Cá hồng do	10 à 15$	15 à 40$
Lutjanidae ...	*Lutjanus sangicenus*	Cá hồng	7 à 14$	15 à 40$
		Cá rõe	—	—
	Lutjanus sp.	Cá chim den	13 à 17$	20 à 40$
		Cá chim trăng	16 à 23$	22 à 45$
Stromatidae ...	*Stromateus* sp.	Cá liệt	9 à 14$	12 à 30$
		Cá đo đa	6 à 13$	10 à 30$
Gerridae ...	*Leiognathus* sp.	Cá môi	4 à 9$	7 à 12$
Sciaenidae ...	*Pseudosciaena* sp.	Cá chẽt	8 à 13$	10 à 35$
Scopelidae ...	*Saurida* sp.	Cá môi đâu	4 à 9$	7 à 25$
Polynemidae ...	*Polynemus* sp.	Cá moi ranh	2 à 5$	6 à 20$
Clupeidae ...	*Clupea* (*Alosa*) sp.	Cá trich	2 à 5$	6 à 20$
		Cá cơm	2 à 5$	6 à 20$
	Clupea (*Harengula*) sp.	Cá bẻ, cá mao	3 à 7$	6 à 25$
	Stolephorus sp.	Cá rũa	4 à 9$	7 à 25$
	Pellona sp.	Cá đuối	2 à 9$	7 à 25$
	Chirocentrus dorab	Cá nhâm	2 à 5$	4 à 20$
	Dasybatus sp.	Cá sôn	—	—
Dasybatidae ...	*Carcharinus* sp.	Cá thiêu, cá ñe	4 à 10$	7 à 20$
Carcharinidae ...	*Apogon* sp.	Cá sao	5 à 11$	8 à 23$
Apogonidae ...	*Arius* sp.	Cá kem	6 à 12$	9 à 25 $
Ariidae ...	*Pomadasys* sp.	Cá hô	6 à 13$	10 à 30$
Pristipomatidae ...	*Plectoranubhus* sp.	Cá ngân	8 à 13$	12 à 35$
	Trichiurus sp.	Cá bẻ	5 à 10$	8 à 23 $
Trichiuridae ...	*Caranx* sp.	Cá trâc	—	—
Carangidae ...		Cá nục	5 à 12$	8 à 30$
	Decapterus sp.	Cá chuôn	—	—
	Cypsilurus sp.	Cá đối	4 à 7$	7 à 25 $
Exocoetidae ...	*Mugil* sp.			
Mugilidae ...				

D'après les sondages pratiqués par les fonctionnaires du Service des Pêches Maritimes, il n'est pas rare de constater des différences de 10 á 20 piastres au kilo, entre la production et la consommation. Entre les prix payés dans les centres de pêche aux pêcheurs et les tables des consommateurs, les prix sont majorés de 250 á 300$ et parfois plus.

Les taxes perçues, à la sortie des provinces de production, et les prix payés aux transporteurs, ainsi que les frais généraux fixes des divers intermédiaires n'expliquent pas suffisamment de différences entre la production et la consomm

Le Service des Pêches Maritimes désire donc éviter qu'une ville importante de 1·800·000 h tants ait à payer chaque jour pour la répartition de 20 à 40 tonnes de poisson, plus de 700 interm diaires et détaillants. Il estime que l'installation d dix " poissonneries à gros débit " pourraient rationnellement alimenter la population, avec un personnel réduit des 9/10 èmes en apportant toutes les garanties sanitaires voulues aux consommateurs.