SMALL-SCALE PRAWN TRAWLING IN WESTERN PROVINCE, PAPUA NEW GUINEA: A PILOT STUDY

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INTRODUCTION

Over the past few years a small scale prawn fishery has operated in the Daru area of Western Province. The fishery is based on the use of beach seine nets. The kind of prawn caught most often is the Banana prawn (*Penaeus merguiensis*), with smaller amounts of Black Tiger prawns (*Penaeus monodon*), Endeavour prawns (*Penaeus endeavouri*) and Coral prawns (*Parapenaeopsis sculptilis*). The fishery is seasonal, with the largest numbers of prawns being taken between January and May. Over the past 3 years, the total catch has been from 1.5 tonnes to 3 tonnes per year.

Although most areas along the Western Province coastline are suitable for beach seine fishing, up until now, local fishermen have tended to fish only those areas close to the market at Daru (Western District Seafood Ltd.).

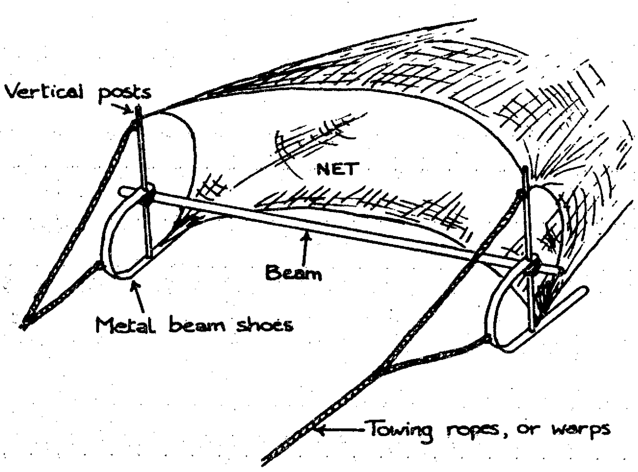
Since 1982, the Fisheries Research and Surveys Branch has carried out some trial trawling for prawns in the Daru area. In November 1984, a prawn specialist from the Fisheries Division of Queensland, visited Papua New Guinea on a 3-week assistance programme. The visit was funded by the South Pacific Commission. The main purpose of the visit was to demonstrate how to make and use the type of simple trawling gear, which is used by small-scale beam trawl fishermen in Queensland. The demonstrations and trials were carried out on the mainland opposite Daru Island.

BEAM TRAWLS

'Beam trawls' are trawls in which the net is held open by one or more beams. The beams can be lengths of wood or bamboo, or metal bars.

Beam trawls offer less resistance than other trawls which use otter boards. Therefore a larger net can be pulled using a smaller engine. However, the beam design cannot be used after a certain size when the extra strain on the beam will cause it to snap. Hence, beam trawling is usually done from small vessels. Beam trawls are also easier to handle than otter boards, and require less skill to operate.

The main parts of a beam trawl are shown in the diagram below. The metal beam shoes' prevent the vertical posts from digging into the bottom by acting as a sledge. The ring trawl shown in the diagram on page 56, has two beams, and beam shoes are not needed.



The main parts of a beam trawl

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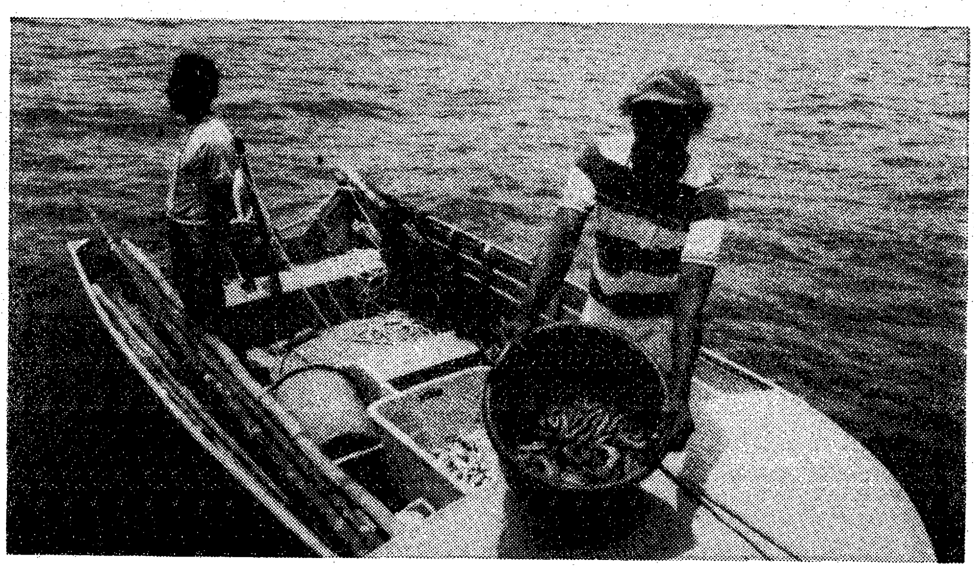
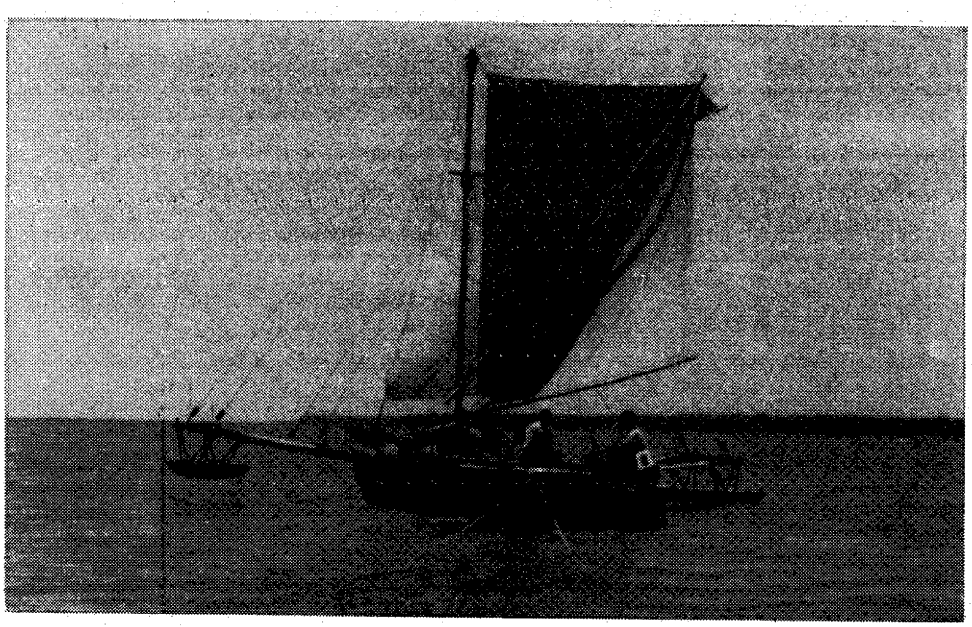
THE THREE VESSELS USED IN THE SURVEY

The 'F.R.V. Moore - a 7.3 m plywood dory



A 4.7 m aluminium dinghy with a 35 hp outboard motor



The 'Masela' a single - masted, double outrigger sailing canoe

THE VESSELS USED IN THE SURVEY

Three types of vessels were used during the recent 3 week survey:

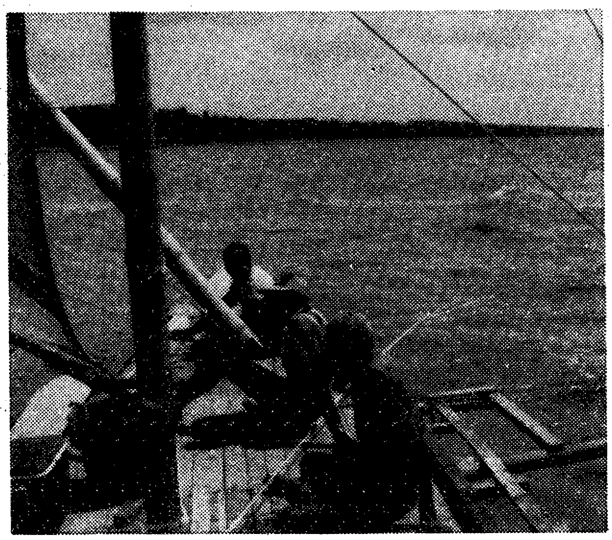
1. A 7.3 m plywood workboat, or dory, the 'F.R.V. Moore'. The 'F.R.V. Moore' is planked below the waterline and is powered by a Yanmar 3QM 30 hp inboard diesel engine. This was the largest vessel used. Its current value when new would be about K16,800. The 'F.R.V. Moore' was fitted with two small hand powered boat winches bought in Australia at $89 each (about K65). These were each fitted with 45 meters of 4 mm wire cable. The winches were bolted to a plank which was lashed across the deck of the vessel amidships. Also fitted was a simple trawl gallows. Stainless blocks (pulleys) were used to lead in the trawl warps (ropes). Beam shoes, weighing 10 kg, were made from scrap iron, and were lashed to a 5 m beam of bamboo.

2. A 4.7 m aluminium dinghy was used with a 35 hp Evinrude petrol outboard motor using a standard propeller. A towing bracket, attached to the middle seat, was used to make steering easier.

3. A local canoe, named 'Masela' and skippered by Narua of Kadawa village, was used to tow beam trawls under sail power only. The canoe was 11 m in length and was fitted with a 25 hp outboard to cut down time spent travelling between the trawls. This canoe proved to be a good fishing platform from which to work. It also had the advantage of being able to fish the shallow waters to depths of as little as 0.45 m.

The fishing trials from the canoe used only one 3.7 m trawl. However, later tests showed that in winds of 15 knots, the canoe could pull both a 3.7 m trawl and a 4.6 m trawl at the same time, at a speed of about 2 knots. The trawl warps were fastened to the base of the mast. When a course dead ahead was required the ropes were led out over the stern. To change course, the rope was unhitched from the stern and thrown out to one side. This pulled the boat around. The amount of turning effect was controlled by a lazyline' around the warps.

The dugout hulls of canoes like Masela are made from a red timbered species of tree, with small leaves. The local name is 'sida'. It was said to be fairly easy to obtain logs of this tree locally for canoe building purposes. Many of the fastenings on the canoes are lashings using bush materials or rope. The sails can be made of low-cost



The 'Masela' pulling two trawls in a 15 knot breeze

Steering the canoe using a 'lazy-line' around the trawl warps polypropylene tarpaulins, or rice bags sewn together. Altogether, you would probably not need much more than K500 to build a large canoe, including the sails and rigging.

Depending on the quality of materials used to build the canoe, and the level of care and maintenance it receives, a canoe may last from 4-10 years. During this time it is often rebuilt once or twice as the wood used to plank it up does not last as long as the hull.

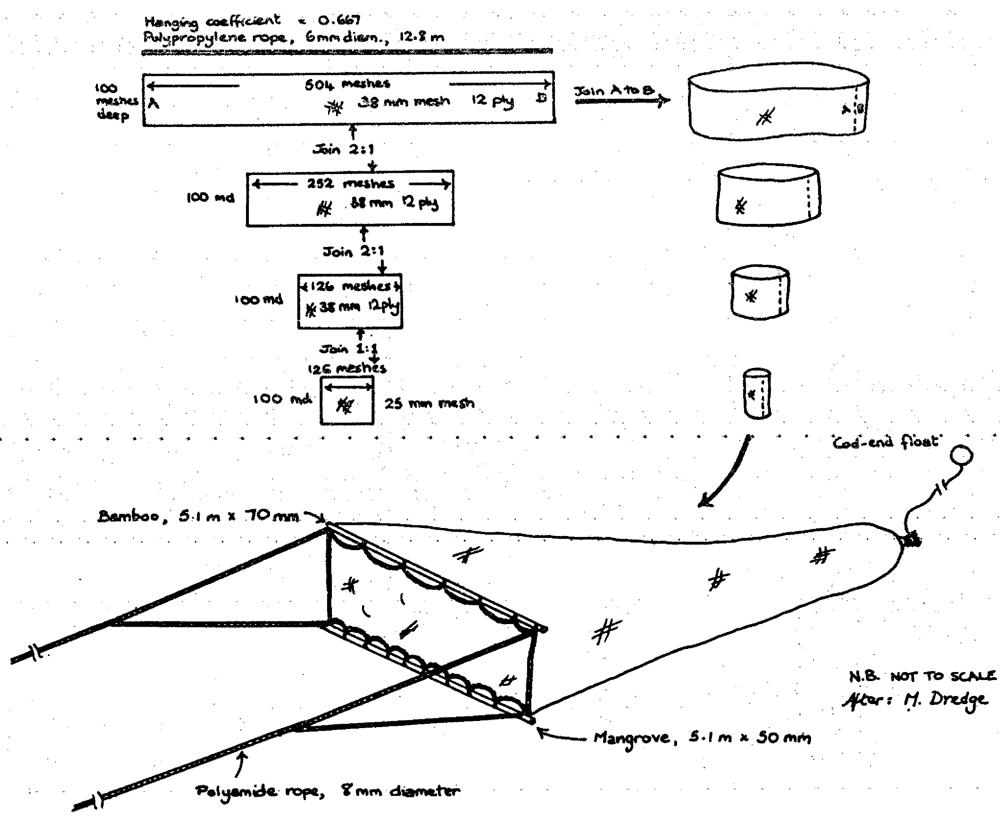
GEAR CONSTRUCTED AND USED

During much of the 3 week visit by the prawn specialist, the construction of different types of beam trawls was demonstrated to the local fisheries officers. During the remainder of the time these nets were used in fishing trials from the three vessels.

A Siebenhausen trawl and a ring trawl were made using plans supplied from the Queensland Fisheries Division. A 4-seam beam net, similar to the design used for prawn trawling in Cochin, India, was also made. Of these 3 designs, the 4-seam net is the most complex, and the ring trawl is the simplest.

In the fishing trials, we used the Siebenhausen trawl from the dory, and the ring trawl and the 4-seam trawl from the dinghy and the canoe. There was not enough time to find out whether there was any difference in effectiveness between these 3 nets. However, in the time available, all 3 appeared to fish fairly well.

The ring trawl deserves special mention because it is both simple to make and easy to operate as well as being effective. Only very basic net hanging skills are needed to make it. The design is shown in the diagram below. This design was developed by Mike Dredge, the visiting prawn specialist. It is considered to be the most suitable for construction by local fishermen at this stage. Further tests are needed to find out how effective it is under various conditions, compared to the more complicated designs.



The two beam ring trawl used in the survey

CATCH RATES

We had about 2 weeks to carry out fishing trials in the Daru area. During this time, the construction of nets and training of staff continued.

During the first week, when all 3 vessels were fishing in approximately the same area, most hauls made by the canoe were larger than most hauls made by the dinghy or the dory. The canoe's best haul of 9.5 kg in one hour was made in shallow water with the canoe occasionally bumping the bottom.

Why did the canoe seem to be the most effective trawling vessel? Possible reasons include:

a) It can operate in shallower water than the other 2 vessels;

b) The disturbance caused by the propeller on the motorised craft in shallow water could have a scattering effect on the prawns.

More trials are needed to find out whether these are the real reasons.

During the second week, catch rates were much lower than in week 1. This is thought to be because of very heavy rainfall on Monday 19 November which reduced the salinity (saltiness) of the water. For example, along the shoreline off Kadawa village, prawns had been numerous in depths of 0.45 to 0.6 m in week 1. However after the rain, the water tasted almost fresh on Wednesday 21 November, and there were very few prawns present. By Friday 23 November, fishermen reported that the prawns were numerous once again, and that the water was salty again.

The catches for which data was collected for each of the 3 vessels are shown in Table 1.

VALUE OF THE CATCH

As long as the prawns are kept in good condition, the income from the catch will depend on:

- the quantity caught
- the species
- the size
- the price paid for each grade of prawn.

In the local fish plant at Daru, catches of prawns are divided into 4 grades - large, medium, small and rejects. An example of the grading and value of a sample of 57.8 kg prawns marketed through the Daru fish plant is given in Table 2. In this sample, just over 20% of the catch were rejects'. These were mostly coral and endeavour prawns which could be sold on the local

TABLE 1. CATCHES OBTAINED DURING TRIAL BEAM TRAWLING NEAR DARU

Vessel trawled	Hours	Catch (kg prawns)	Catch per unit effort (kg/hour trawling)
Week 1			
Sailing canoe	7.67	36.43	4.75
Dinghy	2.5	7.7	3.08
'M.R.V. Moore'	1.6	5.3	3.31
Week 2 (after heavy rain)			
Sailing canoe	1.67	1.35	0.93
'M.R.V. Moore'	4.0	8.1	2.02
TOTAL	17.44	59.08	

TABLE 2. THE GRADING OF A SAMPLE OF PRAWNS AND THE INCOME FROM THESE FROM DARU FISH PLANT

Grade	Weight (kg)	% of catch by weight	Price per kg	Value (kina)	% of value of total catch
Large	5.8	10	K3.30	K19.14	19.3
Medium	19.0	34.4	K2.40	K47.76	48.2
Small	20.1	34.8	K1.60	K32.16	32.5
Rejects	12.0	20.8	Nil	Nil	0
Totals	57.8 kg	100%		K99.06	100%

Average value per kg = K99.06/57.8 = K1.71.

market in Papua New Guinea. The total value of the 57.8 kg catch was K99.06, or an average of K1.71 per kg.

OPERATING COSTS

The basic operating costs involved in trawling are fuel and ice.

Fuel. We worked out the cost of fuel used per hour trawling by the dory and the dinghy with outboard motor. The costs are given in Table 3. The canoe did not use any fuel whilst trawling.

Ice. The weight of ice bought by fishermen should be roughly the same as the weight of prawns they expect to catch, if export quality prawns are to be handled. The price of ice in Daru in November 1984 was 20t per kg (sold in 50t batches). In Table 3, the cost of ice is estimated from the weight of prawns caught per hour of trawling from the 3 vessels in week 1 of the trials. The weight of ice required is the same as the weight of prawns caught.

In Table 3, the gross income is estimated from the catch per hour in week 1 x the estimated value per kg of prawns of K1.71, as calculated in Table 2. The net income is the gross income, less the cost of fuel and ice.

From Table 3, we can see that under the conditions at the time, the fishing unit which had the highest actual income whilst trawling was the canoe. The canoe's hourly earning whilst trawling was K7.17.

For a full comparison of costs, many other factors would need to be considered. For example: the number of crew required, loan repayments, depreciation, repair and maintenance costs especially for the dinghy and dory, the need for favourable winds for the canoe and the greater speed of the dinghy.

CONCLUSION

The survey described in this article lasted only 3 weeks. Part of the time was taken up in training local fisheries officers to make the trawl gear. Therefore there was time for only a small amount of fishing from the 3 vessels. However, the high catch rates obtained in the first week of fishing by the sailing canoe indicate that the present small scale fishing operation for export-quality 'Banana' prawns could be expanded. This would be possible if the Daru fish plant is prepared to handle greater quantities of export quality prawns. The expansion could take place using local craft, like the sailing canoe 'Masela', and low cost low technology methods such as beach seining and beam trawling. This would not involve spending large amounts of money. It is not necessary to wait for further research to be done before such an expansion is started, although a skilled technical person is needed to organise it.

TABLE 3. BASIC OPERATING COSTS AND HOURLY INCOME FOR THE THREE KINDS OF SMALL BEAM TRAWLER OPERATED DURING THE FIRST WEEK OF THE SURVEY

Vessel	Fuel used per hour trawling (litres)	Fuel cost per hour trawling (kina)	Ice cost per hour trawling (kina) (1)	Catch per hour (kg) (2)	Gross income per hour	Net income per hour trawling (3)
Sailing canoe	Nil	Nil	0.95	4.75	8.12	7.17
Dinghy (35 hp outboard)	4.44	3.55	0.62	3.08	5.26	1.09
Dory (3QM 30 hp diesel)	4.0 (estimate)	2.08	0.66	3.31	5.66	2.92

(1) The ice cost per hour trawling is estimated from the catch per hour (from Table 1) x the cost of ice in Daru (20 t per kg)

(2) Gross income per hour = Catch per hour (from Table 1) x Value per kg of prawns of K1.71 (from Table 2)

(3) Net income = Gross income - fuel and ice costs.