PRELIMINARY RESULTS OF A DEEP-BOTTOM FISHING TRIAL WITH 'Z' TRAPS IN VANUATU

by

Michel Blanc
ORSTOM
Pt. Vila
Vanuatu

SUMMARY

From March to June 1987, the Research Section of the Vanuatu Fisheries Department conducted deep fishing trials with traps on the outer-reef slope of north Efate.

Ninety-four 'Z' trap sets were made at depths between 50 m and 430 m.

The best catches were obtained in the second part of the trials on bottoms ranging from 100 m to 215 m, the cpue being 7.4 kg of fish per trap per set.

Two hundred and fifty-eight fish, totalling 393.5 kg, were caught. Most of the catches were of commercially valuable species: jobfish *(Pristipomoides* spp.), sea perches *(Lutjanus malabaricus),* breams (Pentapodidae) and groupers *(Epinephelus* spp.).

These trials also resulted in introduction to the market of a new species *(Conger* sp.). One hundred and fourteen nautilus *(Nautilus pompilius)* were also taken, usually at great depths.

This paper describes the fishing methods used, gives the major results obtained, and underlines the problems associated with the use of this new technique in Vanuatu.

INTRODUCTION

Trial fishing with deep traps was started in April 1987 by the Research Section of the Fisheries Department in Vila.

The project, funded by the French Embassy, was largely based on a similar trial carried out in 1985 in New Caledonia by a commercial fisherman.

Between April and June 1987, 94 trap sets were made.

The first results, recorded on the fishing forms shown in Appendix I, were analysed by the Research Section of the Fisheries Department.

FISHING GEAR AND METHODS

Gear

Boat

We used the *Etelis*, a 10 m launch with a 35 hp diesel engine and a crew of four men.

The hydraulic line hauler was powered from the main engine.

Traps

The traps used were 'Z' types with two openings. The frames, made of iron rods, 10 mm in diameter, were covered with galvanized wire netting, mesh size 50 x 25 mm. Trap measurements were 200 x 150 x 70 cm.

We started off with six traps, two of which were lost during the period of the trials.

Methods

Trap setting and recovery

Traps were moored individually, instead of in groups on the same mooring line, because the latter technique caused many traps to be lost in New Caledonia.

Each trap was attached to a polypropylene line 12 mm in diameter, the total length of which varied with depth and current strength (length of one roll of line = 110 m).

The top part of the line floated on the surface of the water attached to three buoys 10 metres apart: two small, hard, pressure-resistant buoys, and an inflated marker buoy at the end of the line (Figure 1).

Once the depth had been determined with an echo-sounder, the baited trap was let down and the line run out, the boat going ahead at 4-5 knots against the wind.

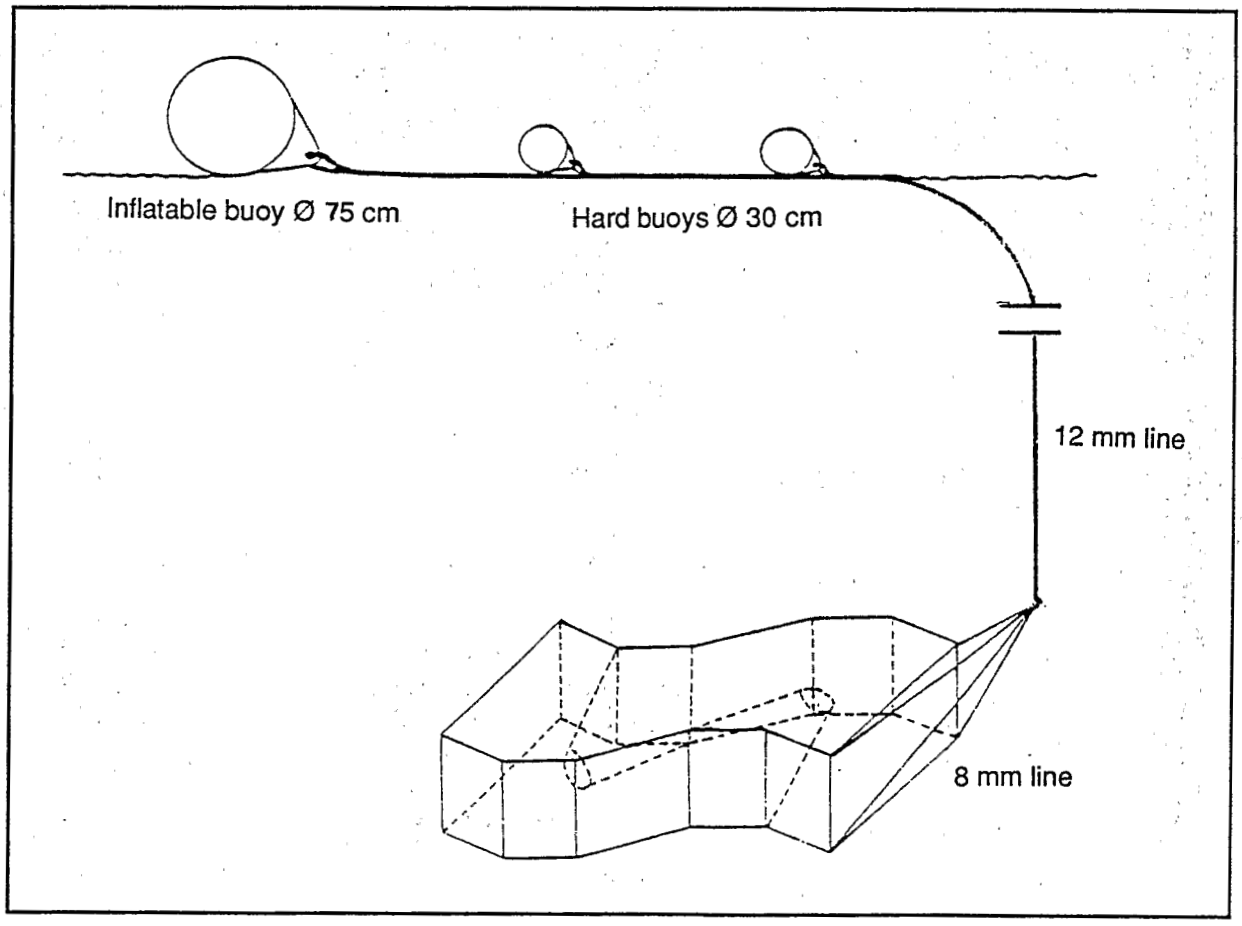

Figure 1. Trap and mooring arrangement

Since our traps were usually moored close to the shore, we had little trouble spotting the buoys. For recovery, the boat was moved towards the marker buoy with the wind or the

current flow, the buoy was hooked and the slack of the line pulled in. The trap was then brought up, with one man at the wheel keeping the boat steady against the wind, another at the line hauler, and a third rolling up the line onto the after-deck. When the trap appeared, it was hoisted onto the gunwale and its contents emptied out. The trap was then rebaited and re-set, after the boat had been taken a little way further.

Bait used and set time

The main problem encountered in the course of our trials was obtaining a regular supply of good quality bait. At the rate of one kilogram per trap, the quantities needed are quite large. This is one of the drawbacks of the trap-fishing technique.

We were therefore compelled to use a wide variety of baitfish: fresh or frozen skipjack *(Katsuwonus pelamis)*, fresh or frozen yellowfin tuna *(Thunnus albacares)*, mackerel *(Selar* sp.), Spanish mackerel *(Euthynnus affinis)*, fresh sardines, saury imported from Japan *(Cololabis)*, guts of skipck and other tuna, and even canned fish in oil!

The best catches were obtained with fresh skipjack, which is generally regarded as the best bait. Yellowfin tuna, saury and canned fish (a bait that retains its attractive capacity for several days) also gave good results.

The bait was placed in a bag made of galvanized wire netting (mesh size 5 mm) hung in the middle of the trap; this kept the bait in good condition longer and made for far easier rebaiting.

We initially planned to make two sets per day per trap (one day-time set and one night-time set). The day-time sets were soon discontinued however, because the day-time catches were too small and the fishing grounds too remote (two return trips per day instead of one). Subsequently the minimum set time was 24 hours.

Fishing grounds

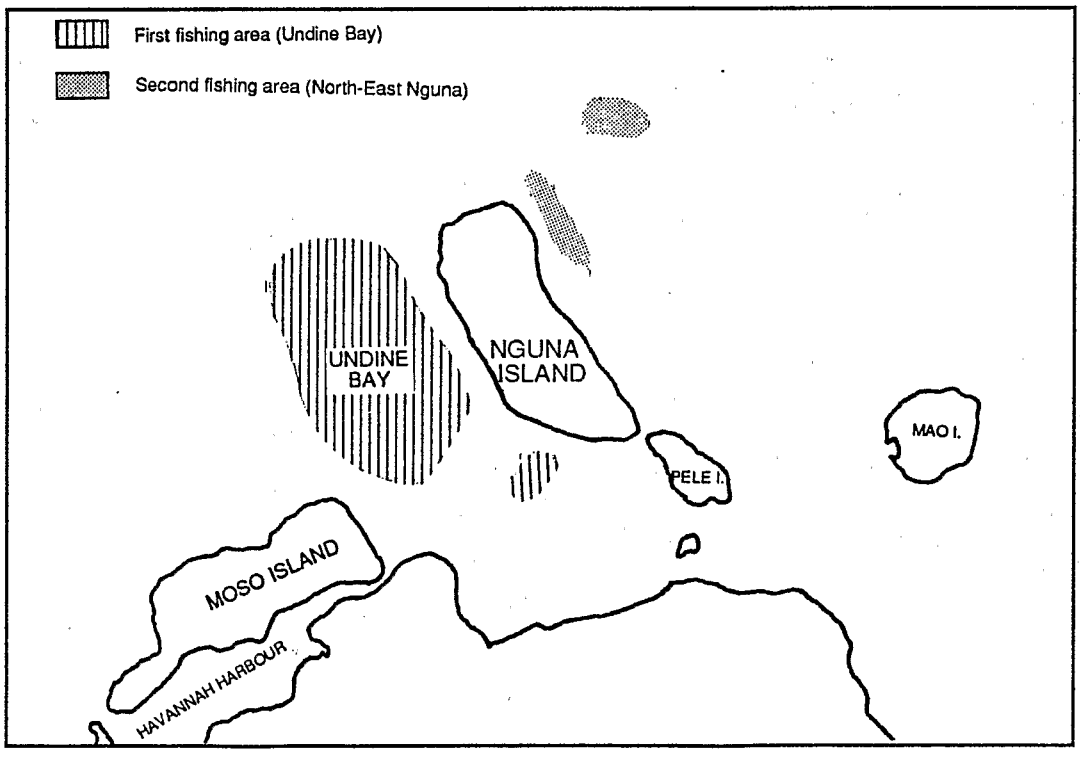

Figure 2. The fishing grounds

The fishing trials were held from 27 April to 19 June 1987 at Emoa, a fishing village in north Efate and the home port of the *Etelis* (see Fig.2).

At first our traps were set out in Undine Bay on bottoms between 50 and 430 m in depth. Seventy trap sets were made in this area.

The poor results obtained in Undine Bay led us to look for an area where fish were more abundant.

The second part of our trials was conducted off the north-east of Nguna Island, at depths ranging from 100 to 215 m. Twenty-four trap sets were made there.

RESULTS

Catch composition

Table 1 shows catches by species of commercial value, in numbers, live weight, percentage of total weight, and minimum and maximum depth of capture.

Two hundred and fifty-eight fish, totaling 393.5 kg, were captured in the period considered.

Species of high commercial value made up most of the catches: jobfish *(Pristipomoides* spp.) (20% of total weight), perches *(Lutjanus malabaricus)* (16.4%), breams (Pentapodides) (15%), groupers *(Epinephelus* spp.) (21.8%). The mean weight of these species ranged from 0.5 to 4.2 kg, which are useful sizes for the market.

Conger eels *(Conger* sp.) were captured at depths from 200 to 400 m and accounted for 16.3 per cent of the total catch. This species, new on the local market, has good quality white flesh suitable for smoking.

Selling price at the Natai Fish Market was Vatu 200/kg for fresh fish and Vatu 400/kg for smoked fish.

Table 1 does not show sharks, which formed a sizeable fraction of the total catch. Several unidentified species were also captured.

A number of very large specimens of *Lutjanus bohar* were fished in fairly shallow waters. They were thrown back because of their toxicity and therefore not taken into account.

Lastly, a few other species of no commercial value were captured: one *Beryx splendens* at a depth of 215 m, two *Anomalops* sp. at the same depth, two butterfly fish *(Heniochus acuminatus)* at 125 and 130 m.

Table 1. Species composition of catch

Species	Number	Live weight (kg)	Average weight (kg)	Percentage total weight	Depth range (m)
Etelis:					
Etelis carbunculus	4	12.6	3.2	3.2	285-430
Pristipomoides:					
Pristipomoides multidens	10	20.1	2.0	5.1	125-190
Pristipomoides flavippinis	53	37.6	0.7	9.6	110-215
Pristipomoides filamentosus	16	20.0	1.3	5.1	105-130
Total:	79	77.7	1.0	19.7	
Lutjanidae:					
Lutjanus malabaricus	41	64.6	1.6	16.4	105-180
Lutjanus rufolineatus	26	4.7	0.2	1.2	110-150
Aprion virescens	1	10.2	10.2	2.6	110-
Lethrinus miniatus	1	4.0	4.0	1.0	130-
Lethrinus chrysostomus	1	1.2	1.2	0.3	125-
Lethrinus variegatus	7	1.9	0.3	0.5	50-130
Total:	77	86.8	1.1	22.0	
Pentapodidae:					
Gymnocranius japonicus	7	11.0	1.6	2.8	110-180
Gymnocranius lethrinoides	2	3.7	1.9	0.9	120-
Gymnocranius rivulatus	15	22.2	1.5	5.6	130-150
Gnathodentex mossambicus	13	22.4	1.7	5.7	125-215
Total:	37	59.3	1.6	15.1	
Serranidae:					
Epinephelus morrhua	9	22.4	2.5	5.7	175-310
Epinephelus magniscuttis	7	29.2	4.2	7.4	220-350
Epinephelus septemfasciatus	7	18.4	2.6	4.7	220-350
Epinephelus chlorostigma	3	12.1	4.0	3.1	140-185
Epinephelus areolatus	3	1.4	0.5	0.4	130-140
Epinephelus maculatus	1	1.8	1.8	0.5	125-
Cephalopholis formosanus	1	0.3	0.3	0.1	125-
Total:	31	85.6	2.8	21.8	
Miscellaneous:					
Seriola rivoliana	1	2.8	2.8	0.7	125-
Priacanthus blochii	1	1.4	1.4	0.4	210-
Ostichthys japonicus	5	3.0	0.6	0.8	200-315
Parupeneus pleurospilos	2	0.2	0.1	0.1	125-
Total:	9	7.4	0.8	1.9	
TOTAL:	258	393.5	1.5	100.0	

Catch per unit of effort (cpue)

Tables 2 and 3 give cpue in kilos per trap per set, for the two trial areas.

Table 2. Catch per unit of effort at Undine Bay in 70 trap sets

Species	Live weight (kg)	Percentage of total weight	cpue (kg/trap/set)
Etelis carbunculus	12.6	5.8	0.2
Pristipomoides spp.	35.6	16.5	0.5
Lutjanus malabaricus	15.2	7.0	0.2
Gymnocranius spp.	19.1	8.8	0.3
Epinephelus spp.	67.1	31.1	1.0
Conger spp.	64.3	29.8	0.9
Other species	2.2	1.0	0.0
TOTAL:	216.1	100.0	3.1

Table 3. Catch per unit of effort at north-east of Nguna in 24 trap sets

Species	Live weight (kg)	Percentage of total weight	cpue (kg/trap/set)
Pristipomoides spp.	42.1	23.7	1.8
Lutjanus malabaricus	49.4	27.8	2.1
Gymnocranius spp.			
Gnathodentex mossambicus	40.2	22.7	1.7
Epinephelus spp.			
Other species	27.5	15.5	1.1
TOTAL:	177.4	100.0	7.4

Cpue values were low in Undine Bay; 3.1 kg of fish per trap per set, with congers accounting for 0.9 kg. These poor results are mainly due to over-fishing in this area since the establishment of the Emoa fishery.[1]

North-east of Nguna Island much better results were obtained, with 7.4 kg per trap per set. This area, where bottoms are from 100 to 215 m deep, is virtually unfished at present.

Jobfish *(Pristipomoides* spp.), perches *(Lutjanus malabaricus)* and breams *Pentapodus* spp. make up the major part of the captures.

Catches of nautilus

A hundred and fourteen nautilus *(Nautilus pompilius)* were captured in 94 trap sets.

Table 4 gives the cpue (number of nautilus per trap per set) in relation to depth. It was found that from 100 to 200 m, the optimum depth range for fish, nautilus were seldom caught (0.8 nautilus/trap/set).

---

[1] An exploratory survey was conducted with bottom-longlines around Efate (Grandperrin R., 1983). Good results were obtained in Undine Bay and on the leeward side of Nguna Island.

On the other hand below 300 m catch figures were higher (2.6 nautilus/trap/set).

Table 4. Nautilus captures in relation to depth

Depth (m)	Number of sets	Number of nautilus	cpue (number/trap/set)
0-100	5	0	0.0
100-200	48	40	0.8
200-300	20	19	1.0
>300	21	55	2.6
TOTAL:	**94**	**114**	**1.2**

Nautilus shells in good condition (about two-thirds of the total taken) were sold locally at prices ranging from 300 and 500 Vatu each (rough, uncleaned, unpolished shells).

DISCUSSION

Comparisons with trials in New Caledonia

From March to June, 1985, 1390 'Z' trap sets were made by a commercial fisherman on the outer reef-slope south-west of New Caledonia, at depths ranging from 90 to 140 m. Mean cpue was 8.9 kg. The Lutjanidae-Serranidae group accounted for 45 per cent of the total catch, with *Lutjanus amabilis* alone making up 31 per cent. In addition, 24 traps set at a depth of 400 m gave much higher catches of nautilus *(Nautilus macromphalus)* than those set at depths between 90 and 140 m (38 nautilus per trap per set, against 1.3 in the 90-140 m range).

Cpue for fish, in numbers and by species captured

Mean cpue in the second part of our fishing trials (7.4 kg/trap/set) was close to that obtained in New Caledonia (8.9 kg/trap/set).

When making comparisons it must, however, be borne in mind that our cpue in Vanuatu was only obtained from 24 trap sets.

As regards species captured in New Caledonia, *Lutjanus amabilis* accounted for 3 per cent of the total catch, whereas in Vanuatu *Lutjanus malabaricus* was the major species. *Pristipomoides* made up 20 per cent of the Vanuatu catches (with *P. flavipinnis* predominant) against 15 per cent in New Caledonia *(P. filamentosus* predominant).

Cpue for nautilus

The species captured were different: *Nautilus macromphalus* in New Caledonia, *Nautilus pompilius* in Vanuatu.

In New Caledonia the cpue for nautilus increased considerably with depth. It did not in Vanuatu (Table 4).

The New Caledonian figure of 38 nautilus per trap per day at a depth of 400 m suggests that the stock of nautilus is much larger than in Vanuatu, where only 2.6 nautilus per trap per day were taken at depths of more than 300 m.

Problems encountered

Bait

Our main problem was to obtain an adequate supply of good quality bait. At the rate of 1 kg per trap per day, we needed about 30 kg of bait per week.

Because we were unable to obtain sufficient quantities in Vanuatu we used only 1 kg of bait per trap, whereas in New Caledonia 2.5 kg per trap were used.[2]

Loss of traps

Of the six traps initially constructed, two were lost during the fishing trials.

The first was lost on the sea-mount located north-east of Nguna. Set at a depth of 215 m, it was never found again. The most plausible explanation is that the trap drifted away to the very deep bottoms as it was being let down. This area, where fish are very abundant, proved difficult to exploit because the accessible bottoms of the sea-mounts are very narrow and the currents in the area very strong.

The second trap was lost east off Nguna at a depth of 140 m. The only possible reasons are either that the marker buoy was stolen, or that the line was cut by the propeller of a passing boat.

Traps and lines were rarely caught up on the bottom and when this did happen we were always able to pull them free.

Choice of fishing grounds

Intensive trap-fishing can only be carried out near the boat's home-port.

In our case the choice was very limited as bottoms with really abundant fish stocks are rare around Efate. Good grounds at Forari and Eton on the east coast were too far from Vila or Emoa, as were the rich red snapper grounds at Cook's Reef west of the island of Emae. In addition the villagers of Emae are likely to object strongly to outsiders fishing in their waters.

The lack of extensive fishing grounds is a factor limiting deep bottom fishing development in Vanuatu.

Prospects

The Fisheries Department at present possesses four traps. Three more traps are being constructed at Vanuatu's National Institute of Technology.

Deep trap-fishing trials will only be resumed when the Fisheries Department has acquired a vessel suitable for this type of fishing.

The *Etelis,* which was a gift from a Canadian development agency, will henceforth be available only occasionally. The *Albacore,* a research vessel presented by Japan in 1987, does not lend itself to trap-fishing. Only the *Yasur* is suitable for use, but is too costly to operate.

---

[2] It must be noted that the c.p.u.e obtained in New Caledonia (i.e 8.9 kg/trap/set) works out to only 3.6 kg/trap/set per 1 kg of bait.

If and when the trials can be resumed, attention should be paid to the following points:

— Sufficient quantities of bait should be secured and stocked. Recently two FADS were moored off the coast of Efate and they should enable sufficient quantities of skipjack to be captured for a long period of trials. It would also be useful to compare the cpue obtained with different quantities of bait (1 kg or 2 kg of bait per trap per set).

— The efficiency of traps for fishing of red snappers (*Eteliss* spp.) should be tested. *Ad hoc* trials could be carried out with the *Etelis* when the boat goes out to Cook's Reef.

— Trapping trials in the 100 to 200 m depth range should be continued in order to determine cpue more accurately and to check the economic viability of this type of fishing.

— Attempts should be made to find a market for nautilus.

— Export of living nautilus for aquariums could be investigated, in addition to local sale of the shells.

CONCLUSIONS

The number of trap sets made during our trials was too small for final conclusions to be drawn, particularly regarding the economics of this type of fishing. The trials did, however, produce some promising results:

— The cpue obtained in the second part of our trials demonstrated the efficiency of 'Z' traps for capturing species in the upper depth range.

— These species are generally commercially valuable and of a size that is in demand on the local market.

— Capture of nautilus in the lower depth range can be a useful supplementary source of income.

— This new technique has one important advantage in that fishing gear can be left in the water for a very long time. Good catches were made in traps that were recovered two weeks after having been set out. As the bait loses its attracting capacity after a few hours, this result seems to prove the effectiveness of the straight entrances used (low rate of escape).

The constraints of this type of fishing are great:

— The initial outlay for gear is high; a trap with lines and buoys costs about Vatu 50 000.

— The vessel used must be large and fitted with expensive equipment (echo-sounder, line hauler ...).

— Large quantities of bait are required.

— There are few areas in Vanuatu where fish are very abundant, and their size is very limited.

Despite these handicaps, trapping of deep-bottom fish can be regarded as a promising technique for exploitation of Vanuatu's outer reef-slope resources.

Further trials of this technique would be useful to determine what type of boat, fishing methods, trap shape, etc., give best results, and to ascertain whether it is economically viable.

APPENDIX 1

TRAP FISHING

Form N°:

Date : Departure time : Return time :

Moon : Fishing area :

Number of traps : Total fish :

Number Nautilus :

Trap N°	1	2	3	4	5	6	7	8	9	10
Set / Recovery										
Time in water										
Location										
Depth										
Bait										
Number Nautilus										
Number fish										
Weight fish										

FISHING LOGSHEET USED DURING TRIALS

215

SOUTH PACIFIC COMMISSION

FISHERIES NEWSLETTER

NUMBER 44
JANUARY - MARCH 1988

Contents

Original text : English

B.P. D5, NOUMEA CEDEX, New Caledonia - Telephone: 26.20.00 - Cable: SOUTHPACOM NOUMEA - Telex: 3139NM SOPACOM - Fax: (687) 26.38.18