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Fisheries Development in the Kingdom of Tonga*

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Introduction

Reef and lagoon fish have been traditional sources of protein for the inhabitants of the Kingdom of Tonga (Halapua 1982). These inshore resources have become increasingly reduced and cannot keep pace with present rates of exploitation.

A major limitation facing most local fishermen is the lack of suitable vessels to fish beyond traditional inshore grounds (Ottesen 1984). This paper summarizes efforts by local and foreign organizations to improve artisanal fisheries in Tonga through the introduction of improved fishing vessels and associated training programs.



Demonstration Boat Program

The Tonga Ministry of Agriculture, Forestry and Fisheries (MAFF) in conjunction with Japanese Grant Aid and the United Nations Country Development Fund (UNCDF) implemented a boat building program in 1983 to develop crafts capable of exploiting the underutilized offshore resources of the Kingdom (MAFF 1984).

The principal aim of the demonstration boat plan was to train and financially prepare promising artisanal fishermen to purchase these MAFF/UNCDF vessels (Friedlander 1984).

A 6-m diesel vessel was purchased by the Foundation for the People of the South Pacific (FSP) and introduced to the island of 'Eua as part of the demonstration project. All of the existing fishing boats on the island were open 4-6 m locally-built dories with 15-25 horsepower outboard engines.

The fisheries extension officer on the island was responsible for overseeing the demonstration boat program. Participating fishermen were provided assistance in vessel management, fishing gear technology and finances (insurance payments, operating and maintenance costs). Emphasis was placed on developing improved fishing methods using appropriate technology.

Major Methods of Fishing

Trolling

Trolling was performed in 'Eua year-round with most of the effort occurring from September through February due to the increased occurrence of skipjack tuna (*Katsuwonus pelamis*) aggregations at this time of year.

Gear consisted of 135-180 kg test monofilament with a short length of steel trace wire at the terminal end which was attached to a double trolling hook. Lures were made of hard plastic tubing with synthetic rubber skirts at the end. Traditional lures using mother-of-pearl shell (*Trochus* shell) and bone were also used.

The demonstration program introduced deep trolling using 7-strand steel trolling cable that resulted in fishing depths between 10 and 12 m below the surface. Outriggers, made of bamboo, as well as tag lines were also incorporated into the training program and started to gain acceptance by other fishermen in the community. Major pelagic fishing grounds included the north and south ends of 'Eua along with the island of 'Euaiki (Fig. 1).

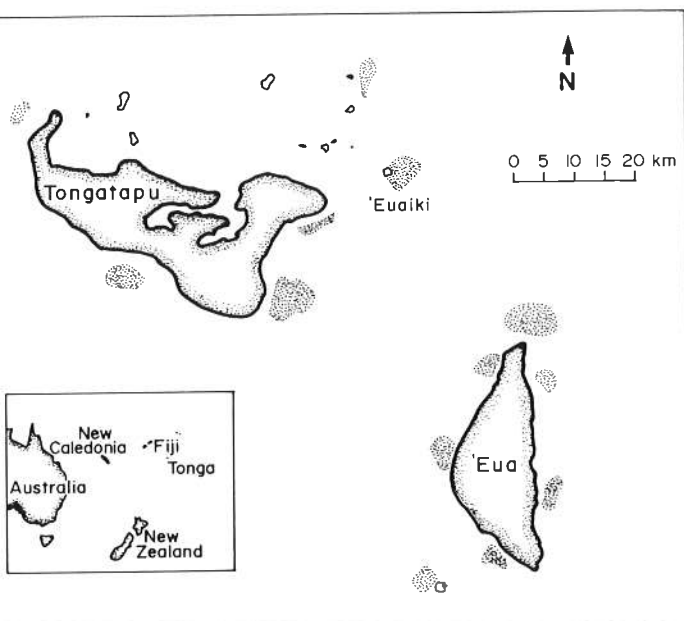


Fig. 1. The islands of Tongatapu and 'Eua, Kingdom of Tonga. Location of major fishing areas for 'Eua fishermen are dotted.

Bottom handlining

This method of fishing occurred in water depths ranging from 100 to 400 meters. Major reefs fished were those surrounding the island of 'Eua and along the eastern and southern edges of Tongatapu (Fig. 1).

Wooden hand reels similar to those developed in Western Samoa (Fusimalohi and Grandperrin 1979) were fitted on the demonstration vessel. These reels help improved fishing efficiency by eliminating tangles and decrease hauling time. Most bottom rigs employed 50-100 kg test monofilament line with a terminal rig consisting of two or three hooks and a one-kg weight.

Pelagic nightfishing

Pelagic nightfishing was conducted on anchored vessels during new moon phases using an artificial light source. Experimentation with sealed-beam halogen lights proved successful as well as cost effective and began to replace the commonly used pressure lanterns.

Fishing gear was constructed of a large tuna-circle hook (#4 or 5) attached to a steel leader. This arrangement was fastened to approximately 10 m of longline cord that was connected to a polyform float and secured to the vessel by an additional length of cord. The hook was normally baited with a fish head or viscera.

Demersal nightfishing

Night bottomfishing took place near shore in waters of about 100 m and was conducted concurrently with pelagic fishing. Gear was similar to that used during daytime bottomfishing with lighter test line (20-35 kg) and smaller hooks.

Results

Harvest data

Mean catch per unit effort for the demonstration vessel "Lokua" was 4.79 (+/- 0.63) kg per boat hour (range 3.01 to 6.90). From January to November 1984, 39,021 kg of fish were landed on 'Eua. These landings were higher than those reported by Schuh (1982) on 'Eua for 1980 and 1981 (27.8 mt and 32.7 mt, respectively). The demonstration vessel "Lokua" fished during this period excluding April and October when it was hauled and refitted. The demonstration vessel accounted for more than 21% of the island total landings during the months that it fished (Fig. 2).

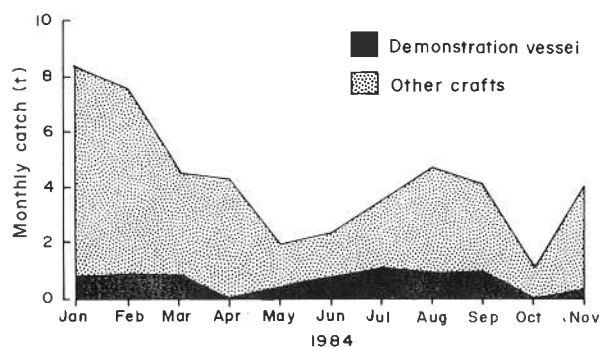


Fig. 2. Fish landings of 'Eau Island, Tonga, in 1984 demonstration vessel and island total.

Major species taken while trolling include skipjack tuna and yellowfin tuna (*Thunnus albacares*) (37.3% and 13.2% of total catch, respectively). Other important pelagic species include wahoo (*Acanthocybium solandri*), dolphin (*Coryphaena hippurus*) and dogtooth tuna (*Gymnosarda unicolor*). Pelagic fish accounted for approximately 57% of the total catch. Rosy jobfish (*Pristopomoides* sp.) was the most common demersal species caught, accounting for 22.2% of the total catch.

The winter months from June to September historically had the lowest fish landings on 'Eua (Schuh 1982). Poor weather during this time of year prevents many fishermen from operating their small open boats. Total landings in 1980 and 1981 for these months averaged 1.05 t/month. Landings for June to September in 1984 with 2 diesel vessels fishing averaged 2.75 t/month. These vessels landed 7,330.75 t of fish composing 66.6% of the total island catch for that period (Fig. 2).

The pelagic night handline fishery was effective in catching big-eye tuna (*Thunnus obesus*) and yellowfin

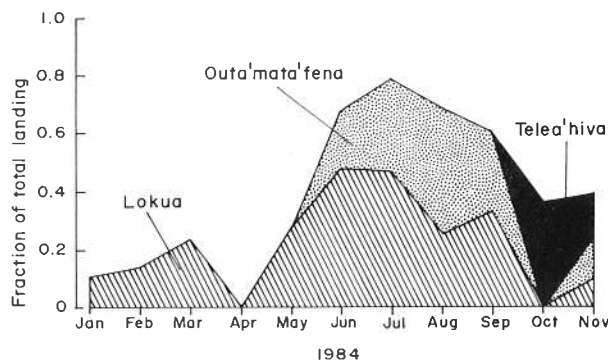


Fig. 3. Contribution of diesel vessels to total landings of 'Eua Island, Tonga, in 1984.

tuna. This simple and low-cost fishing method supplemented bottom fishing activities with little additional effort.

Economic results

Economic results for the demonstration program appear in Table 2 and 3. Fuel usage for a 6-m diesel fishing boat operating during the program averaged about 20 l per trip (\$8.42) while a similar 6-m boat with 20 hp outboard consumed approximately 35 l (\$18). Including two-stroke oil and spark plug replacement, the cost for operating the diesel vessel was less than half that of a fishing boat with outboard engine.

In the past, the majority of the fish caught by 'Eua fishermen were sold directly from fishing boats to the consumers on shore. Larger catches and large individual fish were unwanted by buyers who could not preserve them for extended periods of time.

Shipments of fish on ice were established with the assistance of the Tonga Cooperative Federation in

Table 2. Landings and economic data of the demonstration boat program. First session of program (November 1983 - March 1984).

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Days fishing	7	17	20	20	20	15	99
Total catch	215.00	623.00	775.50	918.00	871.50	587.00	3,990.00
Fishing gear	0.00	7.95	37.19	4.25	16.50	3.00	68.89
Oil	8.75	0.00	8.75	3.50	8.75	3.50	33.25
Ice	1.20	3.00	0.00	4.00	4.00	0.00	12.20
Insurance	20.00	80.00	80.00	80.00	80.00	60.00	400.00
Fuel*	45.30	*	*	*	188.60	98.50	332.40
Crew wages**	**	**	**	**	**	**	**
Miscellaneous	0.00	6.00	8.70	5.47	17.50	6.00	43.67
Total expenses	75.25	96.95	134.64	97.22	315.35	171.00	890.41
Gross earnings	152.00	396.50	428.60	544.50	464.50	415.00	2,401.10
Net earnings	76.75	299.55	293.96	447.28	159.15	244.00	1,529.69

* Fuel - fuel was exchanged for landed fish during the months of December, January and February. Approximate costs were: December = \$147; January = \$177; and February = \$201

**Crew wages - wages were paid in landed fish. Approximately 10 kg were allotted for the crew per trip, amount to 990 kg of fish.

Table 3. Landings and economic data for demonstration boat program. Second session of program (May - August 1984).

	May	June	July	August	Total
No. of days fishing	19	20	21	26	86
Total catch (kg)	413.00	750.00	1115.00	948.50	3,226.50
Fishing gear	10.60	10.70	10.00	4.00	35.30
Oil	8.90	1.75	8.75	0.00	19.40
Ice	0.00	3.50	0.00	0.00	3.50
Insurance	60.00	80.00	80.00	80.00	300.00
Fuel	144.00	186.24	222.10	244.80	797.14
Crew wages A (\$)	10.00	6.00	53.50	28.70	98.20
Crew wages B (kg)	48	131	135	147	461
Miscellaneous	7.20	30.50	19.50	15.90	73.10
Total expenses	240.70	318.69	393.85	373.40	1,326.64
Gross earnings	393.00	629.00	934.75	824.50	2,781.25
Net earnings	152.30	310.31	540.90	451.10	1,454.61

Crew wages A = wages paid in cash.

Crew wages B = wages paid in landed fish (price was approximately \$1 per kg.)

the fall of 1983 to improve the quantity and quality of fresh fish available to consumer in Tongatapu. Insulated ice boxes were shipped to 'Eua on a periodic basis aboard the daily ferry service. With the supervision of the fisheries extension staff, a local fisherman was trained to inspect, weigh and ship fish from 'Eua to Tongatapu. This fish marketing arrangement helped stabilize the price of fish which resulted in an increased awareness of fish handling and care by the local fishermen.

More than eight tons of high quality iced fish were shipped to Vuna market in Nuku'alofa during the period between November 1983 and August 1984. This fish was in great demand and frequently sold for \$0.50 to \$1.00 more in the market than local fish.

Conclusions

The introduction of semi-enclosed diesel-powered fishing vessels greatly improved fishing yield and subsequent marketing in 'Eua. Catch returns were higher in 1984 than in previous reporting years. The diesel engines proved to be simple and economical to operate and maintain. These semi-enclosed boats were more seaworthy than the traditional boats and provided more comfort and safety in poor sea conditions. As a result, fishing could be performed on a year-round basis and a more stable supply of fish was established.

Ice boxes on the training vessels allowed for extended time at sea, rather than returning to port at the completion of a fishing day with a catch that might have been unprofitable. Ice boxes also vastly improved the quality of the catch.

Many of the fishing techniques incorporated in the demonstration program increased fishing success and utilized technology consistent with existing fishing methods on the island. The use of outriggers with tag lines and wooden hand reels improved fishing efficiency and increased landings. They were of appropriate design and construction so that they could be easily adapted for use by other members of the fishing community.

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