The Lagoon Fisheries of French Polynesia

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Abstract

A brief review is presented of the lagoon fisheries of the Tuamotu (especially Rangiroa) and Society Archipelagos, French Polynesia, with some emphasis on the role of traps and of social and economic factors affecting the distribution of fishing effort.

Introduction

French Polynesia consists of 118 islands with a human population of about 200 000. The oceanic Exclusive Economic Zone (5 500 000 km^2) is larger than Europe and the total lagoon area is 12 000 km^2 (Fig. 1).

At the end of 1990, the annual artisanal fisheries catch from lagoons in French Polynesia was about 5 500 t, twice above the open sea production of 2 100 t.

Before 1962, less than 30% of the Tuamotu atolls catch was sold in Papeete, the main fish market in Polynesia. This has increased and now about 64% of the fish sold in Papeete come from Tuamotu, 23% from the Society Islands and 13% from other archipelagos.

Fisheries from the Tuamotu Atolls

General observations

The catch landed on the atolls of Tikehau and Kaukura was regularly sampled and studied over a period of three years, from 1986 to 1988 (Caillart 1988; Caillart and Morize 1986; Morize 1991). Of the lagoon fishing gear, traps weirs (in French "parcs à poissons") were responsible for 90% of the catch, hook and lines for 7%, spearfishing for 2%, and various nets for 1% (Blanchet et al. 1985). The key contrast visible here is that between the relative stability of total production and the high fluctuations for particular species.

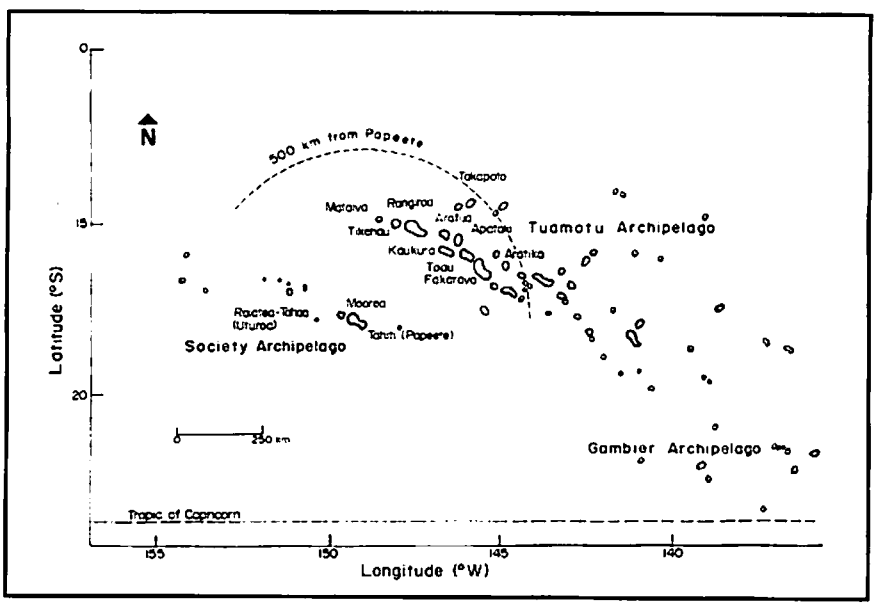

Fig. 1. Map of French Polynesia, showing sites mentioned in text.

A quantitative study of the fish lagoon communities was carried out annually on sites on Tikehau and Mataiva Islands between 1976 and 1986 (Bell and Galzin 1988; Galzin et al. 1990; Caillart et al. 1994). Three strong "cyclones" (i.e., hurricanes) occurred in the period from December 1982 and February 1983, which also saw dystrophic crises in several lagoons and an increase in human activity. The fish community of the outer slopes showed no outward signs of progressive reef degradation, but the lagoon community was reduced both in number of species and abundances per species. There was also a shift in trophic structure: a large decrease in carnivores (notably the corallivorous and the planktivorous species) and a small increase in herbivores.

The Tuamotu Lagoon Fisheries

From 1965 to 1987, statistical studies were carried out by different territorial agencies. Although these statistics were heterogenous and distorted by factors such as discarded bycatch (2%), consumption by the fishers themselves (6%), and unauthorized selling (15%), we have been able to document the exports by boat from nine atolls within 500 km of Papeete (see Table 1 for details on five of those) and to identify the following patterns:

- the five most productive atolls are those closest to Tahiti and all possess an airport;
- the atolls of Aratua, Kaukura and Tikehau all have annual catches higher than 300 t. These high values can be explained by the absence of ciguatoxic fishes, a regular price for the landed fish and a high number of active fishers with traditional fishing gear during the low season;
- yields decreased, during the 1980s at the atolls of Rangiroa and Apataki, due to a diversification of the activities of the fishers (into tourism, administration, ...), and negative experiences with private cooperatives;
- the atolls of Aratika, Fakarava, Mataiva and Toau had yields always below 100 t.

Analysis of the Rangiroa Fishery

Based on published data (Anon. 1987, 1988; Brosse 1974; Caillart and Morize 1986; Grand 1983, 1985; and Stein 1988a), we have been able to reconstruct a time series of total catches from Rangiroa lagoon, taking into account local consumption, the fish transported by air among atolls and the historic fluctuation of the fishing effort exerted by a number of traps (Table 2), contributing 80% of the local catches.

One underlying characteristic of these data is their stability, due to species replacements. Fig. 2 shows that this results in a strong inverse relationship between ln (catch/effort) and effort, and hence in a Fox-type surplus - production model (Fox 1970). Fig. 2 suggests a maximum sustainable yield (MSY) is 380 t, corresponding to 53 traps.

Table 1. Reconstructed exports by boat of fish caught (t) at five French Polynesian atolls, 1965-1988 (lagoon areas in km²) (various sources).

Year	Area (km²)				
	Tikehau (400)	Aratua (484)	Kaukura (434)	Apataki (706)	Rangiroa (1 610)
1965	45	-	-	-	20
1966	170	-	-	-	130
1967	150	60	90	5	30
1968	175	160	165	35	40
1969	172	40	90	30	60
1970	175	50	155	40	50
1971	330	55	150	170	160
1972	400	65	150	40	210
1973	470	250	210	35	250
1974	360	275	160	20	220
1975	340	260	160	100	210
1976	400	260	180	150	210
1977	260	180	100	-	220
1978	295	210	220	120	200
1979	200	255	260	120	180
1980	190	180	420	50	175
1981	305	160	300	90	170
1982	155	200	380	125	120
1983	210	340	385	90	120
1984	185	285	350	40	120
1985	188	200	355	35	130
1986	165	310	385	105	80
1987	165	-	-	-	-
1988	140	-	-	-	-

However, when the cost of maintenance of the gear and an average price for the fish (100 CFP in 1988) are taken into account, it can be estimated that maximum benefits, (CFP 1 000 000·year^{-1}, i.e., about US$ 10 000) will be obtained when as few as about 10 traps are operating.

The Fisheries of Society Islands

Although they represent 23% of lagoon fisheries yields, the catch of only three Society Islands were studied: Raiatea-Tahaa and Moorea.

The study of the Raiatea-Tahaa lagoon fishery began in 1989 and consisted of random samples taken three times a week. The first results are (François 1992):

- total production is 25 t·year^{-1} (or 9 kg·ha^{-1}·year^{1}) for these two islands, which share the same 23 000 ha lagoon. 50% of the catch is taken by traps, 21% by divers with cross bows, 19% by hooks and lines, and 10% by gillnets;
- assuming fish theft can be ignored, then the trap is appropriate for several reasons, including the fact that the caught fish stay alive for several days, and that the fish actually catch themselves, thus freeing the fishers for agriculture or other activities. It is interesting to note that traps catch an average 25.4 kg·fisher hour^{-1}, i.e., approximately 40 kg·day^{-1} in this lagoon (Francois 1992);

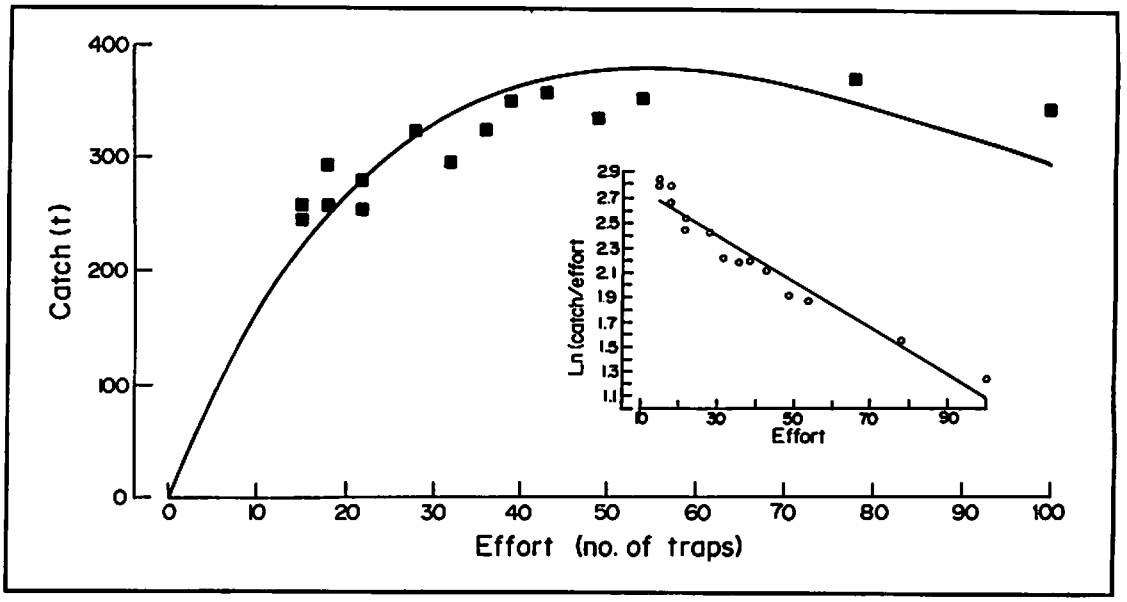

Fig. 2. Relationship between catch and effort in the trap fishery of Rangiroa lagoon. Inset: plot of (catch/effort) vs. effort, same data.

Table 2. Historical reconstruction of trap catches (t) in the Rangiroa lagoon fishery (see also Fig. 2).

Year	No. of traps	Catch disposition		
		local cons.	by air	by boat
1972	100	63	50	225
1973	78	65	51	250
1974	54	68	52	230
1975	49	70	53	210
1976	43	72	53	230
1977	39	75	54	220
1978	36	77	56	190
1979	32	79	58	158
1980	28	81	61	180
1981	22	83	66	130
1982	15	85	73	100
1983	18	88	81	88
1984	22	90	90	75
1985	18	93	100	100
1986	15	95	110	40

- the amount of fish transported from Raiatea-Tahaa to Papeete decreased from 40 t to 4 t between 1987 and 1991. However, at the same time, yield of fish for local consumption increased, 47% being sold at Uturoa market on Raiatea and 42% in Tahaa. A further 11% were consumed by the fishers themselves and their families or by other local consumers.

A study of the Moorea lagoon fishery was carried out in 1988 over a two-month period from 15 October to 15 December. Yields for the month of November was estimated at 7 t (Galzin et al. 1990). Extrapolating this to a whole year, using the seasonal data in Stein (1988b), we can estimate the Moorea lagoon fishery yields at between 50 and 60 t (12-14 kg·ha^{-1}·year^{-1}). Recently, another estimate obtained using a different procedure resulted in nearly the same figures: 53 ± 15 t·year^{-1} (Aubanel 1993). These figures suggest that only a small part of biological production is actually harvested (Arias-González 1993).

There are no fixed traps in Moorea - the vast part of the production is caught by hook and line and diving with cross bows. In an attempt to reduce theft, about 20% of the catch is taken by light, moveable traps made of netting material. Most of the catch is consumed by the fishers, or at least locally. However, in the early 1990s, some of the catch has been sold at Papeete but not at the market (Aubanel 1993).

Conclusion

During the 1980s, the catch from lagoon fishing in French Polynesia was 2.5 times that from offshore fishing, although it is still quite low when compared to other areas (Arias-Gonzalez 1993, and see Table 3). Much of the catch came from the Tuamotu atolls but, because of a demographic increase, local production in the Society Islands is gradually becoming important.

Papeete absorbs almost all the fish exported from the Tuamotu Archipelago and less and less from other Society Islands. By far the largest part of the Tuamotu catch is obtained from traps even though this gear is responsible for only half the production of Raiatea-Tahaa and does not occur in Moorea. It has been noted that, in the heavily

Table 3. Comparisons of catches from aquatic systems (various sources).

System type	No. of cases	Yield (kg·ha^{-1}·year^{-1})	C.V. (%)
Continental shelf	20	59	50
Coastal lagoons	107	113	179
Coral reefs (lagoons)			
· Great Barrier Reef	10	49	26
· Tuamotu Archipelago	13	4	252
· Moorea	-	13	-
· Raiatea-Tahaa	-	9	-

populated islands, some scattered sport fishing and/or fishing for personal consumption occurs and this seems to gradually exert locally a larger fishing pressure than the more traditional methods used on other islands.

This, and the other trends reviewed here, and the fact that overall lagoon area is very limited imply that we will have to be extremely careful regarding development of the lagoon fisheries of French Polynesia.

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