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Blackfin tuna (*Thunnus atlanticus*) fishing around FADs in Martinique (French West Indies)

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Abstract – This paper examines the fishing of blackfin tuna (*Thunnus atlanticus*) around Fish Aggregating Devices (FADs) in Martinique (French West Indies). It is based on the compared analysis of catches from monthly experimental fishing surveys and sampling of commercial landings. The data collected in these two different ways allowed comparison of blackfin tuna length frequencies. A large part of the commercial landings were made up of young immature tuna with a fork length of less than 40 cm, whereas the experimental longline catches were mainly made up of fish with a fork length ranging between 55 and 75 cm. We give evidence that these discrepancies were mostly due to the fishing technique used. Indeed, contrarily to the experimental surveys, Martinican fishermen only fish during daytime and usually on the surface by trolling. This way, fishermen do not have access to the largest fish, which are found deeper. Our results suggested that a new fishing technique such as vertical longlining, could improve commercial catches of big blackfin tuna under FADs. © 2000 Ifremer/CNRS/INRA/IRD/Cemagref/Éditions scientifiques et médicales Elsevier SAS

blackfin tuna / *Thunnus atlanticus* / fish aggregating device / FAD / biology / experimental fishing survey / West Central Atlantic / Martinique

1. INTRODUCTION

The blackfin tuna (*Thunnus atlanticus*) is a small tuna (*figure 1*), its average weight ranging from 5 to 7 kg. The maximum weight reported for the species is 19 kg for a fish with a fork length of 100 cm. Its geographical distribution is limited to the West Central Atlantic, approximately between latitudes 40° N and 25° S. Its bathymetric distribution extends down to 400 m (Collette and Nauen, 1983). This fish is often called a coastal pelagic, for it is frequently found on the coastal shelf. It may approach the reefs and enter the bays, but is also caught offshore, on anchored FADs more than 10 nautical miles away from the coast (to depths of 2 500 m) and around natural drifting objects. It is very gregarious, and lives in schools, which are sometimes very large and are often associated with skipjacks (*Katsuwonus pelamis*). In the region different types of fishing gear are used to catch this species – trolling, drifting longline, and pole and line (live bait). It is one of the most common tuna species in the West Central Atlantic, being present all year round in the Lesser Antilles (Sacchi et al., 1981). In Martinique, blackfin tuna are usually caught by trolling around FADs, near seamounts or offshore (Laurans et al., 2000). The introduction of FADs has secured their on-going presence around Martinique (Taquet et al., 1998). The potential offered by this species for the small-scale Martinican fishing fleet requires further study of blackfin tuna biology and migration. In order to optimize catches, this preliminary study, based on both experimental fishing surveys and the sampling of commercial landings, attempts to improve knowledge of this species around Martinique.

2. MATERIALS AND METHODS

2.1. Experimental fishing surveys

Initially, a series of 24 experimental fishing surveys of seven days each was undertaken around the FADs

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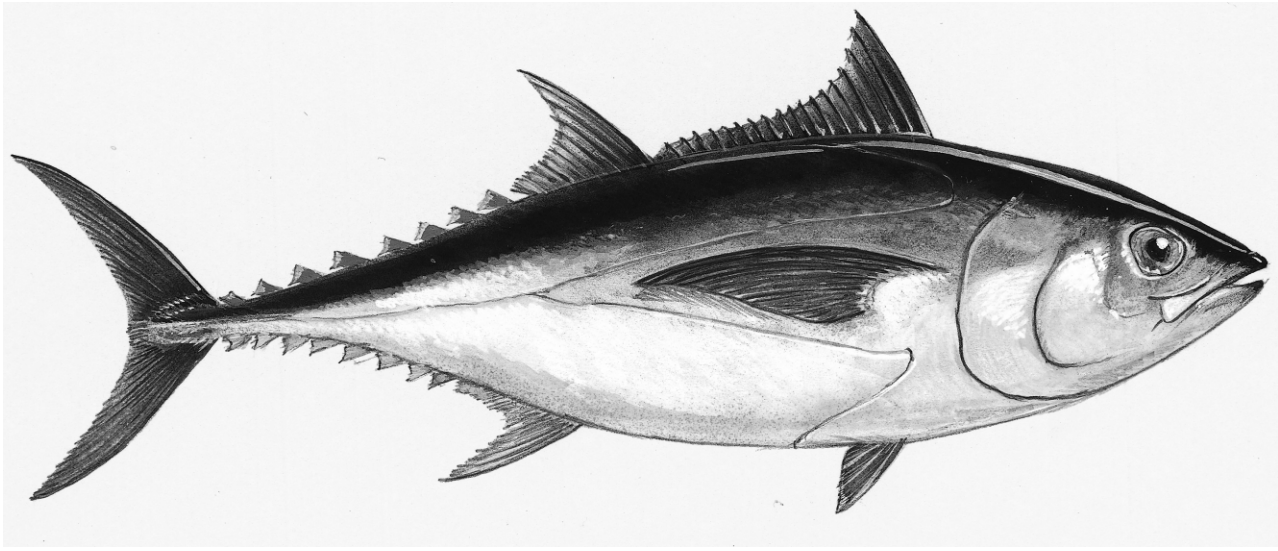

Figure 1. Drawing of a blackfin tuna (*Thunnus atlanticus*) by Alain Diringer.

off Martinique between October 1995 and October 1997. Three different types of fishing gear were used. Trolling lines with small artificial lures were used by day. An experimental drifting longline with an average of 140 hooks was used by day and by night. For 89 sets, this longline was placed horizontally in the upper water layer during the night. During these night-time sets, one 3-m buoy rope was used for each five branchlines. This gear configuration ensures that all the fish were caught at depths between 8 and 55 m. During the day, the longline was placed diagonally to explore the region between the surface and a depth of 600 m (115 sets). Different sizes of buoy ropes were used to maintain the mainline in the right position. In this way, we could deduce the approximate depth for each catch by the position of the hook on the mainline. Several baits were tested, including flying fish, 'balaous' (Hemiramphidae) and small Carangidae but, for reasons of availability, most often frozen squid was used. During the same surveys, a few underwater observations were done under the FADs, down to a depth of 60 m, either by two divers or by using a video camera connected to the fishing boat.

2.2. Monitoring commercial landings

The statistical sampling of catches by fishermen working on and off FADs was started in May 1998. The sampling was carried out twice a week at two of the most important landing sites of the Caribbean and Atlantic coasts. Fishermen at the Caribbean coast fish in the leeward area whereas those at the Atlantic coast fish in the windward area. The sampling was timed at each site to maximize the number of fishermen coming back from sea. All pelagic fishing trips were monitored for fishing zones, FADs visited, number of lines, techniques used, time of departure and time of return. All pelagic fish were identified, sized and weighed.

3. RESULTS

In terms of the number of fish, blackfin tuna was one of the main species caught during the experimental surveys (219 individuals). It was also the main species in commercial landings (55 % in number and 29 % in weight). The comparison of blackfin tuna mean weight and mean length shows a significant difference depending on the gear used (*table I*). A Kolmogorov-Smirnov non-parametric comparison test confirms the length-frequency difference ($\alpha = 0.01$) of blackfin tuna caught with trolling line and longline.

Measurements taken during the samplings done at the landing sites allowed a comparison between the size frequency of the blackfin tuna caught by the fishermen around FADs (1 777 fish sized) and that

Table I. Comparison of blackfin tuna mean weight and mean length caught with different types of gear during experimental surveys.

Gear	Number of fish	Mean Weight (kg)	Std. deviation	Mean Length (cm)	Std. deviation	Period	Depth range (m)
Trolling line	90	0.65	0.97	29	8.1	day	0 to 5
Horizontal longline	126	4.75	1.8	61	6.9	night	8 to 55
Oblique longline	3	5.82	1.98	64	4.5	day	40 to 130

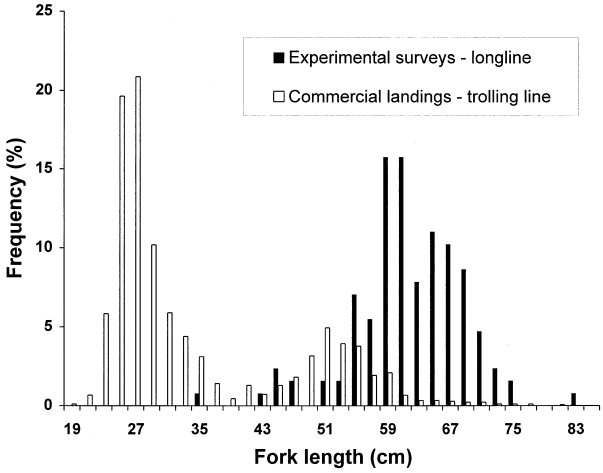

Figure 2. Comparison of the size frequency of the blackfin tuna landed by the fishermen and those observed during the experimental fishing surveys.

observed during the experimental fishing surveys using the longline (*figure 2*). The commercial catches were done with different surface trolling lines using small artificial lures. A large part of these commercial catches was made up of young immature tuna with a fork length of less than 40 cm, whereas the experimental longline catches were made up mainly of fish with a fork length between 50 and 75 cm.

Diving observations under FADs indicated the presence of considerable concentrations of blackfin tuna. The schools observed were not homogeneous regarding to size. Small fish generally seemed to be closer to the surface, the larger ones often being found at depths between 30 and 50 m.

Landing data allow us to compare the length distribution of blackfin tuna catches in different areas. The sizes of individuals caught under and off FADs were very different (*figure 3*). The first peak centered at 25 cm fork length only appeared in sets associated with FADs. This confirms the FAD-effect on juvenile blackfin tuna. These young tuna could be three- or four-month old recruits born in the area. The second peak, centered at 53 cm, corresponds to two-year old fish or to four year-old fish according to Carles (1974) growth data or according to Neilson et al. (1994), respectively. In spite of the uncertainty about the age of the fish, they had reached initial sexual maturity (Baez-Hidalgo and Bécquer, 1994) and may be in the area for breeding. The relatively small number of fish of between 35 and 48 cm fork length already observed by Gobert (1989) may be the result of a trophic migration. In addition to the lack of certainty about growth velocities, the migration period outside Martinican waters may be longer or shorter. The narrowness of the first size-frequency peak observed in Martinique, despite a spawning period spread over several months, suggests the systematic movement of

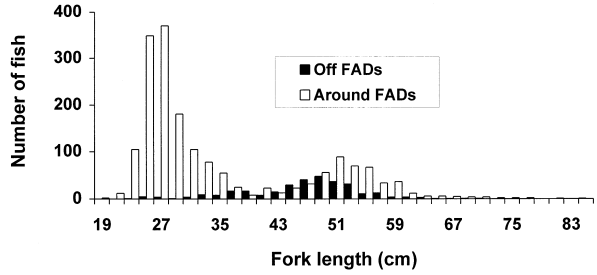

Figure 3. Comparison of the size frequency of blackfin tuna caught under and off Martinican FADs.

very young individuals, probably to a feeding area. The rarity of big fish (fork length > 60 cm) in commercial landings is explained by the type of gear used (size and depth), because their presence in Martinican waters was confirmed through underwater observations and experimental longline fishing results around FADs.

A comparison of the catches made by fishermen around FADs on each coast (leeward and windward) shows a significant difference (Kolmogorov-Smirnov, $\alpha = 0.01$) in size frequencies (*figure 4*). The mean number of blackfin tuna caught per trip was respectively 8.1 and 5.8 at the leeward and windward coasts in spite of a shorter duration of the trip at the leeward coast (mean of 4 h) than at the windward coast (mean of 10 h). With our present knowledge of this specific fishery, it is difficult to say if this difference in yield resulted from fish abundance or fishermen's performance. At the Caribbean coast (leeward), the fishermen adopted FADs a long time ago and use them all-year round. Another factor is that the travel time to reach the FADs is longer at the windward coast because the FADs are farther out at sea.

As in most areas where blackfin tuna were fished (Suarez Caabro and Duarte Bello, 1961; Idyll and De Sylva, 1963; Garcia, 1987), a predominance of males has been observed in Martinican catches. During the

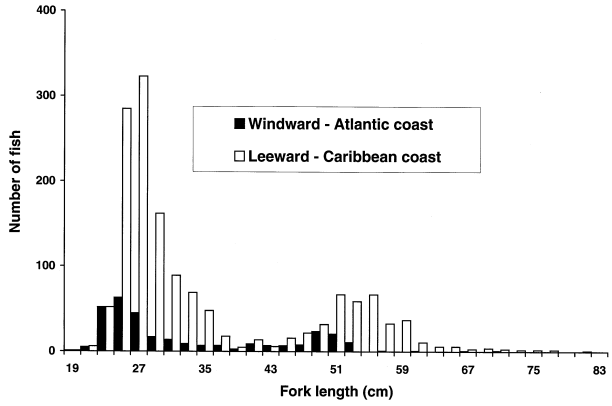

Figure 4. Comparison of the size frequency of blackfin tuna caught around FADs at each coast (leeward and windward).

experimental fishing surveys, 80 % of blackfin tuna were males (30 to 82 cm fork length). Observations during May and June of numerous mature males and females around FADs show that there is very probably a blackfin tuna breeding ground in the Lesser Antilles, as was reported by Morice and Cadenat (1952).

4. CONCLUSION

The Martinican fishermen fish by day, mainly on the surface by trolling, and therefore do not have access to the largest fish, that swim deeper. The use of small lures explains the juvenile catches but should not prevent the big ones from being caught if they are at the surface. This is an important consideration because the result of this study shows that fishermen might improve their catches of bigger blackfin tuna under FADs by using a different fishing technique, vertical longlining for example (Preston et al., 1998). The drifting vertical lines used at present by fishermen target yellowfin tuna and billfish. They are too big for blackfin tuna. Considering the large aggregations, particularly of big individuals, observed around FADs, production of this species can probably be improved around Martinique. However, the lack of statistical and biological data does not allow accurate assessments of the stocks of blackfin tuna.

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