

ASSOCIATION OF YELLOWFIN TUNA AND DOLPHINS IN MALDIVIAN WATERS

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Abstract

Large yellowfin tuna (*Thunnus albacares*) are regularly found in association with dolphins in Maldivian waters. The species involved are the spotted dolphin (*Stenella attenuata*) and the spinner dolphin (*Stenella longirostris*). Maldivian fishermen targeting large yellowfin use the presence of dolphin schools to locate the tunas. The yellowfin are caught using simple handlines, and are mostly within the length range 70-160 cm FL. No dolphins are caught.

Introduction

Yellowfin tuna (*Thunnus albacares*) is a major target of tropical pelagic fisheries around the world. Total world catch in 1993 amounted to some 1.2 million metric tonnes (t). In some areas of their range, most notably in the eastern tropical Pacific (ETP), large yellowfin tunas frequently associate with dolphins. The main dolphin species involved are the pantropical spotted dolphin *Stenella attenuata*, the spinner dolphin *Stenella longirostris*, and common dolphins *Delphinus* spp. (Evans, 1994; Norris et al., 1994; Perrin and Gilpatrick, 1994; Perrin and Hohn, 1994), although other species are also involved. The targeting of dolphin-associated yellowfin tuna schools by tuna purse seiners in the ETP and consequent mortality of the dolphins has been a major issue since the early 1970s (Joseph and Greenough, 1979; Joseph, 1994; Hall, 1998).

In the Maldives, fishermen have traditionally used livebait pole and line, and targeted small surface-swimming tunas including skipjack and juvenile yellowfin tuna (Anderson, 1985; Adam and Anderson, 1996). Schools of these small tunas are located mainly by the presence of sea birds. Although large yellowfin are present in Maldivian waters, most fishermen did not traditionally target them. This was because the fishermen could achieve higher catch rates using pole and line and because there was no specific market for such large fish. Within the last few years, however, markets (both domestic and export) have developed for large yellowfin. As a result, some Maldivian tuna fishermen are now targeting these fish, and it has become apparent that large yellowfin do associate with dolphins in Maldivian waters. The aim of this report is to document this association and the Maldivian fishery.

Materials and Methods

A questionnaire on the yellowfin tuna fishery was sent by the Marine Research Centre (MRC, formerly the Marine Research Section) to all inhabited islands in the Maldives in September 1995. A reminder was sent in April 1996 to islands that had not responded. Responses were received from 188 out of the 200 islands (94%). As part of this questionnaire, information was requested on the extent and seasonality of large yellowfin fishing and the association of dolphins and yellowfin.

Length frequency data were obtained from Malé fish market, during the regular sampling programme of MRC/MRS. During the period April to December 1997, samplers (including both authors) specifically asked fishermen from what type of school their large yellowfin catches were made. Yellowfin caught in association with dolphins were recorded separately from all other yellowfin. Sampling was not continued in 1998 due to shortage of staff. Fork lengths (FL) were measured with tapes. Tape lengths were converted to board lengths using the formula of Anderson, Adam and Nadheeh (1996).

The authors have participated in many tuna fishing trips and some cetacean survey trips in Maldivian waters. Field notes have been kept by the senior author of all dolphin sightings since 1990. Details of sightings involving dolphins associated with tunas are listed in Table 2.

Results

Relevant results of the yellowfin fishery questionnaire sent to every inhabited island are summarized in Table 1. A total of 57 islands (30%) reported fishing for large yellowfin. Fishermen on 94 islands commented on the association of yellowfin and dolphins: 88 (94%) reported that yellowfin did associate with dolphins, and 6 (6%) reported that they did not. Large yellowfin fishing, and the observation of yellowfin associating with dolphins were reported from all regions of the Maldives. Comments were received on the seasonality of the fishery, but consistent results were only obtained from the far north and far south of the country. Fishermen in the three northernmost atolls reported that large yellowfin are fished during the northeast monsoon season. Fishermen in the two southernmost atolls reported that large yellowfin are fished in November-December and, to a lesser extent, in May-June.

Table. 1. Summary results from questionnaire on yellowfin fishing sent to every fishing island

Atoll	No. respondents	No. fishing for large yellowfin	No. reporting dolphin association	No. reporting no association
Haa Alifu	16	8	10	1
Haa Dhaalu	16	5	10	0
Shaviyani	14	2	7	0
Noonu	13	3	5	1
Raa	13	7	8	0
Baa	13	6	6	0
Lhaviyani	4	2	4	0
Kaafu	7	5	6	0
Alifu	15	3	4	0
Vaavu	5	1	1	1
Meemu	8	1	2	0
Faafu	4	0	0	0
Dhaalu	8	0	4	1
Thaa	13	3	7	0
Laamu	8	1	2	1
Gaafu Alifu	8	4	4	1
Gaafu Dhaalu	10	2	4	0
Gnaviyani	1	1	1	0
Seenu	5	3	3	0
Total	188	57	88	6

The length frequency distributions of yellowfin landings at Malé market during 1997 are presented, by quarter, in Fig. 1. Note that these data are unraised: they do not accurately reflect the differences in total landings between quarters, nor the relative abundance of large and small yellowfin. In particular, it is stressed that large yellowfin are grossly over-represented in length frequency samples. The unraised data are presented here in order to emphasize the large yellowfin landings. Three main categories of yellowfin tuna were sampled at Malé market:

1. Small (juvenile) yellowfin tuna caught almost entirely by livebait pole and line. 95% of these fish were within the length range 27-55 cm FL.
2. Large (subadult and adult) yellowfin caught mainly by handline or troll, but not associated with dolphins. 95% of these fish were within the length range 66-150 cm FL. The largest yellowfin of this type measured was 171 cm FL.
3. Large (subadult and adult) yellowfin caught by handline and associated with

dolphins. 95% of these fish were within the length range 72-144 cm FL. The largest yellowfin of this type measured was 165 cm FL.

Of 640 large yellowfin measured between April and December 1997, 504 (79%) were reported by fishermen to have been caught from schools that were associated with dolphin. 136 (21%) were reported to have been caught in schools not associated with dolphins.

Sightings of dolphins associated with yellowfin tuna in the Maldives made by the authors are summarized in Table 2.

Table 2. Sightings of dolphins associated with yellowfin tuna in the Maldives (YFT = yellowfin tuna)

Species	Date	Position	Lat / Long	Remarks
1 Bottlenose	25.8.90	Laamu Atoll (mooring)	01°49'N 73°23'E	With large YFT
2 Spinner	14.9.93	E of K. Maafushi	03°56'N 73°32'E	With tuna school
3 ?Spotted	18.8.94	11/2° Channel	01°15'N 73°18'E	With tuna school
4 Spotted	16.8.95	W of Baa Atoll	05°04'N 72°35'E	With tuna school
5 Unid dolphin	19.8.95	W of B.Thulaadhoo	05°01'N 72°35'E	With large YFT
6 Spotted	19.8.95	SW of B.Thulaadhoo	04°58'N 72°40'E	With large YFT
7 Bottlenose & rough- toothed	20.8.95	Baa Atoll FAD	04°57'N 72°45'E	With small yellow fin and skipjack
8 Unid dolphin	20.8.95	SW of Baa Atoll	04°55'N 72°43'E	With large YFT
9 Spotted	2.5.97	NE of V. Keyodhoo	03°29'N 73°36'E	Probably with tuna
10 Spotted	5.3.97	NE of K.Dhiffushi	04°40'N 73°50'E	With large YFT
11 Spinner	5.3.97	NE of K.Dhiffushi	04°50'N 73°55'E	With large YFT
12 Spotted	10.4.98	N of H.A.Atoll	07°10'N 73°01'E	With large YFT
13 Spotted	13.4.98	NE of R.Inguraidhoo	05°30'N 73°08'E	With large YFT
14 Spinner	16.4.98	S of Lhaviyani Atoll	05°14'N 73°33'E	Possibly with YFT
15 Spinn. & spot.	17.4.98	S of Lhaviyani Atoll	05°06'N 73°35'E	With large YFT
16 Spotted	18.4.98	SE of V. Dhiggiri	03°38'N 73°31'E	With large YFT
17 Spinn. & spot.	29.4.98	E of V.Alimatha	03°34'N 73°34'E	With large YFT

Discussion

The results of the national yellowfin fishery questionnaire suggest that the association of yellowfin tuna with dolphins is well known to local fishermen, and is wide-

spread in Maldivian waters. Our observations (Table 2) confirm this second point. The reporting in the questionnaire replies of a northeast monsoon fishery for large yellowfin off the northern Maldives, and a separate November-December fishery off the southern Maldives confirms previous reports (Anderson, 1985; Anderson, Adam and Waheed, 1993; Adam and Anderson, 1996).

Most Maldivian tuna fishermen use livebait pole and line fishing methods to catch small surface-swimming tunas. In contrast, large yellowfin are taken normally by handline, using nylon monofilament line of 60-80 lb (25-35 kg) breaking strain, and number 8-9 hooks (Waheed and Zahir, 1990). Such relatively light line is used because the yellowfin are apparently more likely to see and avoid thick fishing lines. The monofilament line may be tied to a thicker monofilament line, and then to a rope, to facilitate fighting the fish. A few fishermen in the northern Maldives (Raa, Baa and Lhaviyani Atolls) sometimes use double poles, or single poles with pulley assist, to catch large yellowfin tuna.

Live bait is preferred for catching large yellowfin, with medium-sized fusiliers (Caesionidae) being particularly favoured. Cut pieces of tuna are often used by fishermen at Fuvah Mulaku, where livebait is particularly scarce, but they are not regularly used as bait for large yellowfin by other fishermen. Therefore the ability of pole and line fishermen to make opportunistic catches of dolphin-associated large yellowfin is often limited by the bait that they carry. The livebait carried by pole and line fishermen is usually too small to be used for large yellowfin. Fusiliers are only carried in certain seasons (Anderson and Saleem, 1994). For this reason pole and line fishermen will often ignore dolphin-associated tuna schools (as was observed by the authors in the cases of sightings 4, 5, 6, 8 and 17 as listed in Table 2).

Only large yellowfin (i.e. FL > c70 cm) are associated with dolphins. With the limited data available from Malé market, there is no obvious difference in size between large yellowfin caught in association with dolphins and those caught from non-associated schools. Few yellowfin longer than 145 cm FL are caught from schools associated with dolphins. This is probably as much a reflection of the difficulties of landing such large fish by handline as it is of their true abundance. Dolphins are not caught by Maldivian tuna fishermen.

79% of large yellowfin landings at Malé during the period April to December 1997 were reported to have been caught from schools that were associated with dolphins. It is not known how representative this is of the whole country. While fishermen from many islands report that they do see yellowfin associated with dolphins, we have no data on national catches of dolphin-associated yellowfin. A seasonal fishery in the south of Maldives that occurs every November-December (Anderson, 1985; Anderson, Adam and Waheed, 1993) catches large yellowfin that are not associated with dolphins (even though fishermen there report seeing an associa-

tion: Table 1).

Our field observations (Table 2) suggest that two species of dolphin regularly associate with large yellowfin tuna schools in the Maldives: spotted and spinner dolphins. These are the same species that most commonly associate with yellowfin tuna in other areas (Norris et al., 1994; Perrin and Hohn, 1994; Perrin and Gilpatrick, 1994; Hall, 1998). The number of sightings with positive identifications of these species were:

Spotted dolphins only: N=7

Spinner dolphins only: N=3

Spotted and spinners: N=2

Spinner dolphins are very common in Maldivian waters (pers. obs.). In only a small proportion of all spinner dolphin sightings were the dolphins associated with yellowfin tuna. In contrast, spotted dolphins are much less common in Maldivian waters and a high proportion of sightings of this species involved an association with yellowfin. Thus, spotted dolphins 'carry tuna' more reliably than do spinner dolphins, just as they do in the eastern tropical Pacific (Norris et al., 1994: 224).

A third dolphin species (or species group) that often associates with yellowfin in other areas is the common dolphin (Evans, 1994). Common dolphins are not known from Maldives (pers. obs). Elsewhere in tropical waters they appear to be confined to areas of strong upwelling (Balance and Pitman, 1998).

There are two sightings of other dolphin species with yellowfin tuna (Table 2). In both cases the dolphins appeared to be feeding on the same prey as the yellowfin. In the first case (sighting 1, bottlenose dolphins, *Tursiops* sp) were feeding on fish aggregated under a moored vessel; large yellowfin were also present under the vessel. In the second case (sighting 7), bottlenose dolphins and rough-toothed dolphins (*Steno bredanensis*) were seen in the immediate vicinity of a fish aggregating device (FAD). Yellowfin tuna were associated with the same FAD. In both these cases it is believed that the dolphins and yellowfin were associating with the same prey and/or aggregating device rather than directly with each other.

Most Maldivian fishermen report that when schools of yellowfin and dolphins are associated, the dolphins follow the yellowfin, and not vice versa. Indeed, they refer to dolphin-associated yellowfin schools as *koamas kuri ainu*, i.e. schools in front of the dolphins. This agrees with a report from Sri Lanka (De Silva and Boniface, 1991). However, this is contrary to the commonly reported situation in the eastern tropical Pacific, where dolphins are usually thought to lead the tuna (Norris et al., 1994; Hall, 1998). The reason(s) for this difference, if real, are unknown but may relate, in part at

least, to the different ways in which the fisheries operate.

Elsewhere in the Indian Ocean there are several reports of yellowfin-dolphin associations. Off the west coast of Sri Lanka, fishermen use the presence of dolphins to locate large yellowfin schools (De Silva and Boniface, 1991). The yellowfin there are caught by handline and are greater than 100cm FL. The main species of dolphin involved were reported by fishermen to be spinner and spotted dolphins. Leatherwood and Reeves (1989: 31) also mention that Sri Lankan fishermen use dolphins to locate tuna schools.

In Indonesia, spotted dolphins associated with tunas have been reported from the Savu Sea between Flores and Timor (Rudolph, Smeenk and Leatherwood, 1997:15). Severns (1998) described artisanal fishermen from Alor, in the same region, fishing for yellowfin tuna in association with dolphins.

Within the western Indian Ocean purse seine fishery, the association of tunas with dolphins has been reported, but is said to be rare (Hallier and Marsac, 1985; Stéquent and Marsac, 1986: section 6.2.8; Montaudouin and Lablanche, 1991). Several authors have reported the association of tuna schools with whales on the purse seine grounds (Hallier and Marsac, 1985; Stéquent and Marsac, 1986; Lablanche and Karpinski, 1988; Montaudouin and Lablanche, 1991; Robineau, 1991).

Balance and Pitman (1998) reported the findings of a western Indian Ocean cetacean survey. They noted several sightings of tunas associated with dolphins, including spotted dolphins, spinner dolphins and 'common dolphins' (*Delphinus* sp.), the latter only off the coast of Oman. They also noted that spotted dolphins were much less common in the western Indian Ocean than in the eastern tropical Pacific.

In conclusion, yellowfin tuna are regularly associated with spotted dolphins and sometimes associated with spinner dolphins in Maldivian waters. Local fishermen make use of these associations to locate schools of yellowfin. The association of dolphins and yellowfin tuna appears to be more widespread and frequent in the Indian Ocean than was previously realised, although it appears to be less common than in the eastern tropical Pacific. Further studies will be required to reveal the full extent and nature of the association in the Indian Ocean, and the reasons for differences between oceans.

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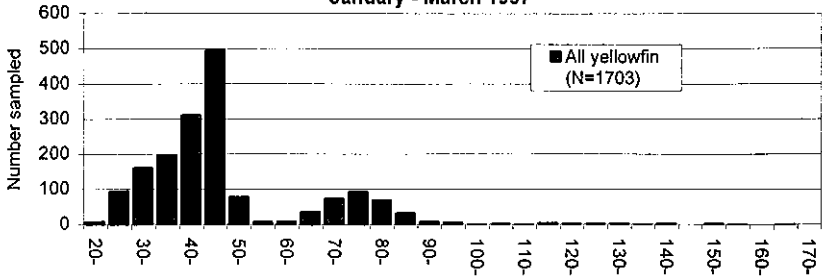
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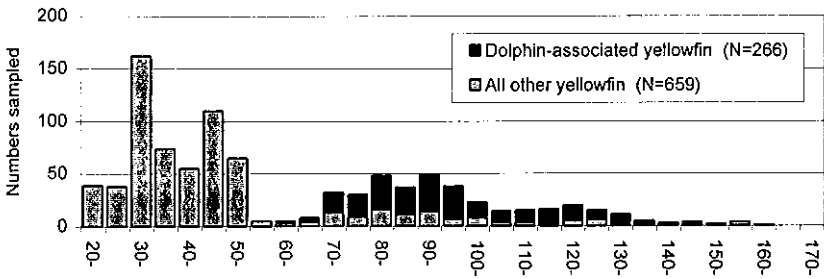
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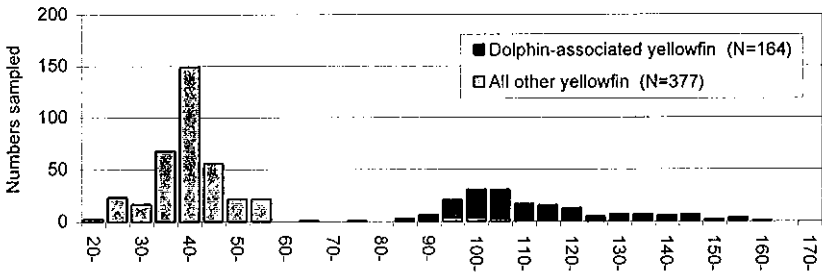
Fig. 1a. Yellowfin tuna - length frequency distribution of landings at Malé market, January - March 1997



b. April - June 1997



c. July - September 1997



d. October - December 1997

