

Movement behaviour of skipjack (*Katsuwonus pelamis*) and yellowfin (*Thunnus albacares*) tuna at anchored fish aggregating devices (FADs) in the Maldives, investigated by acoustic telemetry

Rodney GOVINDEN¹, Riyaz JAUHARY², John FILMALTER^{3,4}, Fabien FORGET^{3,4}, Marc SORIA⁵, Shiham ADAM² and Laurent DAGORN^{3,a,b}

¹ Seychelles Fishing Authority (SFA), PO Box 449, Victoria, Mahé, Seychelles

² Marine Research Centre, Ministry of Fisheries and Agriculture, Maldives

³ Institut de Recherche pour le Développement (IRD), UMR 212, PO Box 570, Victoria, Mahé, Seychelles

⁴ South African Institute for Aquatic Biodiversity (SAIAB), Private Bag 1015, 6140 Grahamstown, South Africa

⁵ Institut de Recherche pour le Développement (IRD), UMR 212, Parc Technologique Universitaire, PO Box 172, 97492 Sainte Clotilde Cedex, La Réunion, France

Received 12 March 2012; Accepted 14 June 2012

Abstract – The pole and line tuna fishery in the Maldives relies heavily on an array of 45 anchored fish aggregating devices (FADs), making it one of the largest anchored FAD-based tuna fisheries in the world. We examined the behaviour of skipjack (*Katsuwonus pelamis*) and yellowfin (*Thunnus albacares*) tuna around anchored FADs (1 000 to 2 000 m deep) in the Maldives using passive acoustic telemetry. Eight neighbouring FADs (distance range: 30 to 95 km, average: 50 km) were equipped with automated acoustic receivers in January 2009, for a period of 13 months. A total of 40 skipjack (37–54 cm *FL*) and 21 yellowfin (35–53 cm *FL*) tuna were tagged with Vemco V13 transmitters in January (start of the northeast monsoon, dry season) and November (end of the southwest monsoon, wet season) 2009 and released at the two central FADs within this instrumented array. No movement between FADs was observed for any acoustically-tagged tuna in the instrumented FAD array. These results suggest that FADs in the Maldives may act independently. The maximum time a tagged skipjack remained associated with a FAD was 12.8 days in January but only one day in November. In addition, residence times at FADs were found to differ with time (month) and space (FAD location) for skipjack tuna, suggesting that external biotic factors (e.g., prey, conspecifics or predators) might influence the time this species spends at FADs. In November, the residence times of yellowfin tuna (maximum observed time: 2.8 days) were three times greater than those of skipjack tuna at the same FADs. This specific difference could be explained either by the two species responding to different factors or by the species' responses being dependent on the same factor but with different thresholds. No particular preference for time of departure from the FADs was observed. Some monospecific and multispecific pairs of acoustically-tagged individuals were observed leaving the FADs simultaneously. Thus, this study indicates a high degree of complexity in the behavioural processes driving FAD associations.

Keywords: Behaviour / Fish Aggregating Devices / Passive acoustic telemetry / Skipjack tuna / Yellowfin tuna / Indian Ocean

1 Introduction

The association of tropical tunas (skipjack *Katsuwonus pelamis*, yellowfin *Thunnus albacares*, bigeye *T. obesus*) and several other pelagic fishes with floating objects has been well documented. The movement behaviour of tuna species around

anchored FADs has been investigated using conventional tagging methods (Kleiber and Hampton 1994; Itano and Holland 2000), active acoustic tracking (Holland et al. 1990; Cayré 1991; Cayré and Marsac 1993; Marsac and Cayré 1998; Brill et al. 1999; Dagorn et al. 2000a; Schaefer and Fuller 2005) and, more recently, by passive acoustic tracking (Klimley and Holloway 1999; Ohta and Kakuma 2005; Dagorn et al. 2007a; Mitsunaga et al. 2012; Robert et al. 2012). These studies have provided useful insights into the behaviour of tunas at anchored FADs. However, we still do not understand why tunas

^a Corresponding author: laurent.dagorn@ird.fr

^b Present address: Centre de Recherche halieutique méditerranéen et tropical, BP 171, 34203 Sète Cedex, France