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Sailfish movement in the Arabian Gulf: a summary of tagging efforts

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Abstract. In Arabian Gulf waters of the United Arab Emirates, sailfish (*Istiophorus platypterus*) are seasonally resident from October through April. Recreational anglers started occasional, self-initiated tagging in 1983. Tags originating from one local and five foreign agencies have been infixed. Early tagging and recovery data was often obscure or lost. In 1997, a concerted effort to understand migration cycles began by consolidating tagging practices and monitoring tag recoveries. Conventional dart tags were infixed on 1871 sailfish from 15 April 1996 to 21 April 2001. Recovered tags ($n = 92$), as of 16 July 2001, indicated a recapture rate of 4.91%. Of these, 90.21% ($n = 83$) were recovered during May/June in Iranian waters and represent springtime migratory movement leading northwest, further into the Gulf. Time-at-large for all recaptures ranged from 17 to 1148 days, while point-to-point travel extended from 2.5 to 697 km. Sailfish recaptured in the same year ($n = 59$) and exhibiting migratory movement travelled a mean distance of 474 km. Location of sailfish during late July through September is unknown, owing to deficiencies in tag recoveries, catch data and anecdotal information. The use of pop-up satellite tags is underway to address this question.

Extra keywords: *Istiophorus platypterus*, migration.

Introduction

Within the Arabian Gulf, sailfish (*Istiophorus platypterus* Shaw & Nodder, 1792) are reportedly widespread (White and Barwani 1971; Al-Baharna 1986; Kuronuma and Yoshitaka 1986; Assadi and Dehghani 1997). Other Istiophoridae members from the marlin genera *Makaira* and *Tetrapturus* are observed very rarely. Gulf sailfish are known to repeatedly aggregate in some locations. Being a highly migratory species, they frequently straddle the Gulf exclusive economic zones of the United Arab Emirates (UAE), Oman, Qatar, Saudi Arabia, Bahrain, Kuwait, Iraq and Iran. Geographically, the Gulf is a comparatively small and restricted basin. It has a nominal length of 1000 km, maximum width of 338 km and mean depth of 36 m; saltwater inflow and outflow is restricted to the narrow Strait of Hormuz, which is 56 km wide at the narrowest point (Reynolds 1993). The UAE is positioned at the southern end of the Gulf, where sailfish are recorded as seasonal residents in coastal areas. Their presence is marked by an appearance during October followed by departure in early April. During this period, aggregation is frequently observed and often produces observations by recreational fishing vessels of 100+ sailfish per day. Movement of sailfish and their geographical range in the UAE is not fully understood. A comprehensive survey of the area has not been undertaken and most available information is anecdotal. Well known aggregation sites are within 70 km of major cities and correspond to travel capabilities and limitations of single-day recreational fishing excursions.

Accurate landing data for commercial harvesting of sailfish in the UAE are deficient. The practice of trawling has been illegal for many years, and drift-netting was recently banned. Sailfish are not generally targeted as a commercial species in the UAE. Consequently, consumption is low and total harvest is thought to be insignificant. Economically, recreational fishing revenue potential is apparent and increasing rapidly in relation to coastal development and tourism demands. Recreational billfish fisheries are recognized as contributing substantial social and economic benefits to communities (Fisher and Ditton 1992; Ditton and Clark 1994). Accordingly, understanding sailfish population dynamics and ecology, leading to better management policies, directly benefits the UAE. Tag and release programmes promoting sustainable fishing and scientific research support this concept.

Sailfish tagging in the UAE has occurred sporadically since 1982 (B. Panzer, personal communication), with expatriate recreational fishermen using tags imported from foreign agencies. J. Pepperell (personal communication) reported 406 sailfish tagged off Dubai, UAE, during the period 1982–1992, with tags issued from New South Wales, Australia. Three local recaptures of these tags, recorded during 1985–1987, provide inconclusive evidence of migration. A fourth Australian tag was recently reported as recovered off Iran in 1993 (N. Niamaimandi, personal communication). Unfortunately, recapture data for this tag are unavailable. Endeavouring to understand sailfish migration patterns, UAE

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recreational fishermen renewed tagging in 1996. Tags originating from four foreign agencies were infixed. They include the National Marine Fisheries Service, USA, The Billfish Foundation, USA, African Billfish Foundation, Kenya, and the Oceanographic Research Institute, Republic of South Africa. In order to consolidate effort and retain data locally for management purposes, the Environmental Research and Wildlife Development Agency of Abu Dhabi introduced a cooperative tagging programme with recreational fishermen in November 1998, encouraging private anglers and charter captains to voluntarily tag and release. This paper serves to combine data and present an overall view and summary of tagging activity in the Gulf.

Materials and methods

Sailfish were captured by recreational fishing techniques with trolled natural and artificial baits, as well as live baiting. In the case of live baiting, circle hooks are used extensively. Conventional plastic number tags attached to stainless steel or plastic darts were implanted into epaxial muscle with standard applicator sticks. Data cards containing release information were returned to the agencies involved. The Environmental Research and Wildlife Development Agency administers a reward incentive honouring all tag returns from the Gulf region. During the period 15 April 1996 to 21 April 2001, a total of 1871 tags originating from five tagging agencies was infixed.

Results

Of the 1871 tags infixed, 92 recaptures occurred before 16 July 2001, representing a recovery rate of 4.91% (Table 1). Nine of the 92 tag recoveries were local recaptures, while the remaining 83 exhibited travel north-west, leading further into the Gulf (Fig. 1). Some of these recoveries were previously reported (Holts and Prescott 1999, 2000, 2001; Kenya Association of Sea Angling Clubs 1999; Hoolihan 2001). For simplification, generalized groups depicting spatio-temporal variation of tag recoveries have been created (Table 2).

Group A ($n = 9$) denotes local recoveries occurring in the original tagging area. The members of Group B ($n = 59$) were recovered at distance in northern Iranian waters during the same year (season) as release, portraying direct springtime migratory movement. Group C sailfish also exhibit migratory movement into northern Gulf waters, but were recovered after more than 1 year. The remaining two sailfish of Group D showed migratory movement but release date and location data are unavailable. Time-at-large between

Table 1. Tag deployment and recovery

Agency	Number tagged	Number recovered	Percentage recovery
Environmental Research and Wildlife Development Agency (UAE)	928	53	5.71
National Marine Fisheries Service (USA)	155	15	9.68
The Billfish Foundation (USA)	776	17	2.19
African Billfish Foundation (Kenya)	50	2	4.00
Oceanographic Research Institute (Republic of South Africa)	102	5	4.90
Total	1871	92	4.91

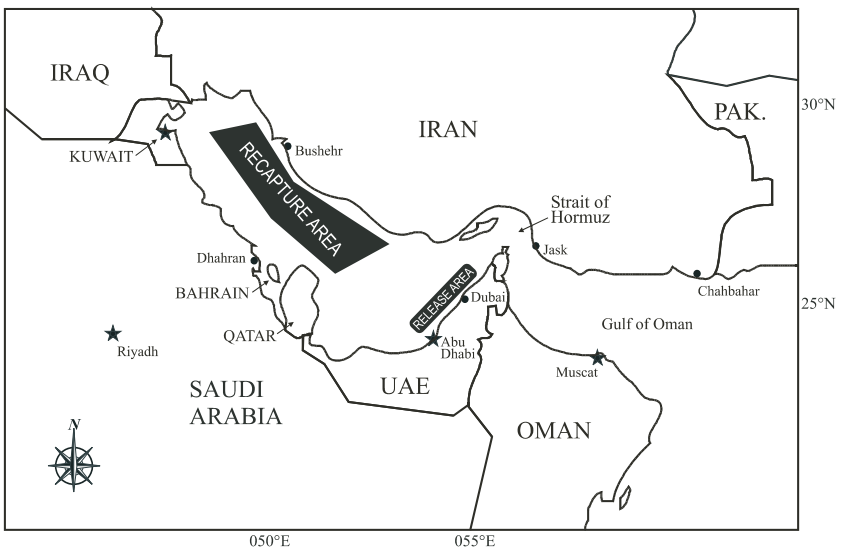

Fig. 1. Tag, release and recovery areas.

Table 2. Recovery group descriptions

Group	Recovery description	Number recovered	Percentage recovery
A	Local: UAE recoveries in original tagging area. Includes same season and 1+ season recaptures. Second year recaptures assume probability of seasonal migrations between UAE and Iran	9	9.78
B	Migratory: Iranian recoveries during season of deployment. Indicative of springtime migration leading north-west, further into the Gulf	59	64.13
C	Migratory: Iranian recoveries 1+ season after deployment. Assumes probability of seasonal migrations between UAE and Iran	22	23.91
D	Migratory: Iranian recoveries of UAE tag deployment lacking release dates	2	2.17
	Total recoveries	92	

Table 3. Spatio-temporal attributes of tag recoveries (±0.5)

	Tag recoveries			Distance range (km)	Distance mean (km)	Time range (days)	Time mean (days)
	Year 1	Year 2	Year 3				
Group A ($n = 9$)	4	5	–	4–78	19	17–818	326
Group B ($n = 58$)	58	–	–	284–697	474	19–193	105
Group C ($n = 22$)	–	21	1	337–585	469	391–1148	538
Group D ($n = 2$)[a]	–	–	–	–	–	–	–

[a]Release date and location unavailable.

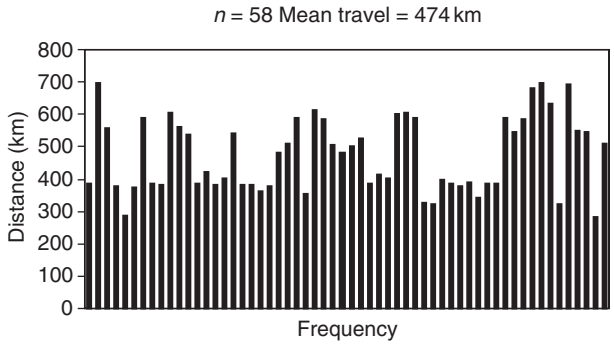

Fig. 2. Migratory distance of group B.

tagging and recapture of all groups ranged from 17 to 1148 days, and direct point-to-point travel ranged from 2.5 to 697 km. In some instances, straight-line travel was measured in multiple segments to avoid intersecting landmass. Spatio-temporal attributes of tag recoveries are depicted by designated groupings in Table 3.

Local UAE recoveries in Group A are separated into four for the first year (same season) and five in the following year. For Group B, only 58 of 59 recoveries are used for time and distance calculations, one being discarded as it lacked release date and location details. From Group B, 58 of 59 tag recoveries ranged in migratory travel from 284 to 697 km (mean 474 km) as shown in Fig. 2.

Practically speaking, the distance of 697 km is the maximum northern end of the Gulf for sailfish habitation. This area along the Nowrouz Oilfield represents the 18-m depth contour, the remaining water, extending 50–75 km to the Gulf's northern shore, being extremely shallow. Group B exhibited a mean travel speed of 5.3 km day^{-1} and range of 2–20 km day^{-1}. No tag recoveries were made after mid-July. Moreover, no tag recoveries have come from outside the Gulf.

Group C is separated into 21 recoveries for the second year and a single recovery the third year. The third year recovery (time-at-large 1148 days) is the oldest tag recovered so far.

Discussion

Although capture of sailfish by UAE recreational fishermen begins around October, the majority of tagging takes place during the period January through March. Generally, during the first 10 days of April, a sudden emigration takes place involving the population majority. This is followed within weeks by tag–recaptures in the northern Gulf (Fig. 1). Iranian vessels employing driftnet gear are responsible for these catches, which are reportedly a bycatch of the kawakawa (*Euthynnus affinus*), longtail tuna (*Thunnus tonggol*) and narrow-barred mackerel (*Scomberomorus commerson*) fishing harvest. All tag–recaptures in this area are concentrated during the period from late April to mid-July.

Sailfish tagged in the UAE and recovered in Iran during the same year (Group B) validate the existence of a springtime migratory movement leading north-west, further into the Gulf. Sailfish recovered in subsequent years (Group C) are presently assumed to be making migratory round trips each year between the UAE and Iran. Accordingly, the

same would be true of Group A local recoveries that were recaptured following the first year.

Lack of tag recoveries leaves the summertime sailfish location in question. However, a lack of summer tag recoveries from the northern Gulf is not necessarily owing to an insufficiency of sailfish. Iranian shrimp trawling season begins around the end of July. Driftnet use is suspended at this time to prevent net damage from trawlers. Also, most vessels cease using driftnets and change gears for shrimp trawling (N. Niamaimandi, personal communication).

The 4.91% tag recovery rate is notably high. Other programmes, tagging substantial numbers of sailfish, report lower rates. The Billfish Foundation programme recovery rate of 1.97% ($n = 14\,746$) for sailfish tagged between 1990 and 1996 includes efforts in the Atlantic, Pacific and Indian Oceans (Peel *et al*. 1996). Also from the Atlantic, Jones and Prince (1996) reported a recovery rate of 1.7% ($n = 61\,428$) for the period 1954–1995. Holts and Prescott (2001) reported a recovery rate of 0.58% ($n = 7749$) for the period 1963–1998 for sailfish from the Pacific and Indian Oceans. The Oceanographic Research Institute showed a recovery rate of 1.24% ($n = 2020$) as reported by Bullen *et al*. (2000). The high recovery rate within the Gulf is probably attributed to the comparatively small geographic area, coupled with high exploitation from driftnet fishing.

The emerging question surrounding the summer location of this population seeks to establish whether sailfish are exiting the Gulf or remain year-round residents. The possibility that this relatively small geographic region supports a year-round resident population emphasizes the importance of further understanding and proper management. The northern area of tag recoveries is not an isolated fishing area. Iranian fishing activities continue southward along their coastal border, through the Strait of Hormuz and into the Gulf of Oman. The Iranian Fisheries Research and Training Organization have informed their offices in the districts of Hormozgan and Chahbahar about the tagging programme, both verbally and through agency publications. Hormozgan district contains the port city of Jask, situated just outside the Gulf; Chahbahar is further south-east near the Pakistan border. Both of these areas report bycatch landings of sailfish each year. Few sailfish are landed along the western (or Arabian) side of the Gulf of Oman, even though an extensive netting activity for Scomberomorus species takes place. Despite the fishing community's awareness of the cooperative tagging programme, no tag–recaptures have come from these areas. This may indicate a greater possibility of population confinement, whole or partial, to the tagging and recovery areas within the Gulf.

Reproduction in the Gulf would be required for year-round residency. Limited information is available on the spawning activities of Gulf sailfish. However, I have observed ripe oviducts and testes at Iranian landings during the month of June, indicating that the springtime migration from the UAE is most likely a spawning migration. No reports of similar gonadal development are available for the sailfish season in the UAE. On one isolated occasion, juvenile sailfish were observed in the mid-1980s schooling around a wreck site 3.2 km off the coast of Dubai (P. C. DeMaré, personal communication). This consisted of several hundred juvenile sailfish, each around 30 cm total length. Further research to establish the spatio-temporal characteristics of spawning and larval distribution is warranted.

The establishment of a springtime migration to northern waters countered with no evidence of sailfish exiting the Gulf indicates the need for further investigation. In order to sustain this recreational fishery in the UAE, research and management decisions must encompass the total habitat range and political boundaries therein. Verification of spawning habitat and periods is considered mandatory in this respect. Plans are under development to investigate the incidence of larval fish. Additionally, the use of pop-up satellite tags was scheduled for spring 2002 to determine the summer range of the population.

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