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The Sultanate of Oman shark fishery: Species composition, seasonality and diversity

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Abstract

The Sultanate of Oman has a long established traditional shark fishery, which has experienced increased demand in recent years due to the shark fin trade. Despite the long history of the fishery in Oman and neighbouring countries, few studies have been undertaken to determine the biological characteristics of the fishery or its ability to withstand this increased exploitation. The present study was undertaken as a first step to remedying this situation. A total of 47 species was confirmed from Oman's coastal waters, of which 44 occurred in commercial landings. However, landings were dominated by eight species—*Rhizoprionodon acutus*, *Iago omanensis*, *Carcharhinus sorrah*, *Loxodon macrorhinus*, *C. macloti*, *C. limbatus*, *Sphyrna lewini* and *C. falciformis*. The species composition of landings varied along the coast and also with season. Brillouin Index values indicated that species diversity was greatest in the Muscat area, followed closely by Musandam. The Al-Wusta region displayed the lowest diversity. The occurrence of two uncommon shark species, *Chaenogaleus macrostoma* and *Echinorhinus brucus*, was of interest, as was the recording of a juvenile *Carcharhinus galapagensis*, extending its northern range in the Indian Ocean considerably.

Keywords: Oman; Shark fishery; Species diversity

1. Introduction

Global concern over the heightened level of commercial shark fishing has increased dramatically during the past decade. Already in several areas of the world, scientific evidence indicates that sharks are particularly vulnerable to overexploitation (Anon., 1999) with certain species having been fished almost to extinction. Global elasmobranch landings have risen dramatically since the 1960s, primarily as a direct result of the rising cost to the consumer and limited availability of more desirable groundfish species like the Atlantic cod, *Gadus morhua*. Further fuelling these increases in elasmobranch landings has been the unprecedented demand for shark fins to supply the expanding East Asian sharkfin soup market (Vannuccini, 1999). This demand has also seen increased landings in regions with long established traditional elasmobranch fisheries, such as Oman.

Presently, few countries regulate their shark fisheries and international management mechanisms that address these valuable renewable resources are almost non-existent. Nevertheless, consensus has started to emerge that there is a serious need to control the directed fishing for sharks and their relatives. This element represents a key article of the Code of Conduct for Responsible Fisheris (CCRF) adopted by the Food and Agricultural Organization in November 1995, to which the Sultanate of Oman is a signatory.

The capture of elasmobranchs in Omani waters is primarily by artisanal fishermen utilising wooden dhows and fiberglass skiffs, employing bottom-set longlines, bottom-set gillnets and driftnets. It is not uncommon for a combination of gears to be used, e.g. driftnets with snoods attached along the leadline. The majority of fishing takes place in water shallower than 100 m and is therefore confined to inshore areas. Prior to the export of fins to the Far East, elasmobranch landings were almost entirely for the purpose of local consumption.

Unfortunately, little biological information exists to allow Oman and similar countries to effectively manage their elasmobranch stocks. In many cases, the species involved in the fishery are not even known. Within the northern Indian Ocean, elasmobranch research has been very limited. Thus, species occurrence, movements and general biology remain neglected. The present study was therefore undertaken to determine what species occur

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in Omani waters and to assess the diversity of the local elasmobranch fauna.

2. Materials and methods

Exploratory visits to traditional fishing areas along the Omani coast revealed that shark landings were concentrated at nine primary locations: Diba (Musandam), Barka (Al Batinah), Seeb/Muttrah (Muscat), Sur (Sharquiyah), Khalouf/Duqm (Al Wusta), and Raysut/Mirbat (Dhofar) (Fig. 1). The sampling effort therefore focused on these sites.

Data collection commenced in January 2002 and ran until December 2003. Landing sites outside the capital area were visited on a rotating basis, each visit being 3 days in duration, with two sites visited per month. Landing sites within the capital area, i.e. Muscat and Seeb, were visited on a weekly basis, each visit being of 1–2 h, depending on the amount of sharks landed. All sharks landed during this time were identified to species, sexed, measured to the nearest centimetre with the caudal fin straightened along the axis of the body (pre-caudal PCL, fork FL and total TL lengths) and weighed on a spring balance. In the case of large specimens (i.e. exceeding 30 kg), weight measurements could not be taken.

Although all data analyses were conducted solely on commercial landings data, a dedicated longline sampling programme was initiated at the same time in order to prospect for additional species which might be found beyond the range of the commercial fishery. Longlines, 300 m long with 60 snoods, were typically bottom-set between 100 and 250 m depth just off the Muscat coast and baited with fresh Indian oil sardine *Sardinella longiceps*. The longline trips were undertaken on a monthly basis with each trip lasting between 2 and 3 days. Lines were soaked for approximately 6 h before being hauled, re-baited and re-set.

The most commonly employed measure of α-diversity in ecological studies is Shannon's H'. However, this diversity index relies on the underlying assumption that all species in the community are accounted for—i.e. every species occurring in the study area is recorded (Magurran, 1988). As this assumption is rarely met, the Brillouin Index (HB) was employed to explore α-diversity during the present study.

Most measures of β-diversity are designed for qualitative data along an ecological gradient. However, the Bray–Curtis distance coefficient (B) takes account of species abundance and can be used to determine the similarity in species diversity between discreet locations, hence this approach was chosen. The degree of similarity in the species composition of the various regions was explored with the Jaccard Index (Southwood, 1978) and species dominance was assessed with the Berger–Parker Index (Berger and Parker, 1970).

3. Results

3.1. Species richness

Commercial landings yielded 44 elasmobranch species—29 sharks, 9 rays, and 6 guitarfish (Table 1). Among these 44 species were 2 previously undescribed guitarfish species which are referred to as RHY and RHX throughout this paper (Fig. 2). The longline programme captured one additional species, *Echinorhinus brucus*, four specimens of which were taken between 220 and 250 m depth. In addition to these 45 species, which were recorded first-hand by project personnel, the occurrence of one additional shark species (*Rhincodon typus*) and one ray species (*Torpedo sinuspersici*) in Omani waters was confirmed through photographic evidence. While the total number of species recorded was quite high, many species were recorded

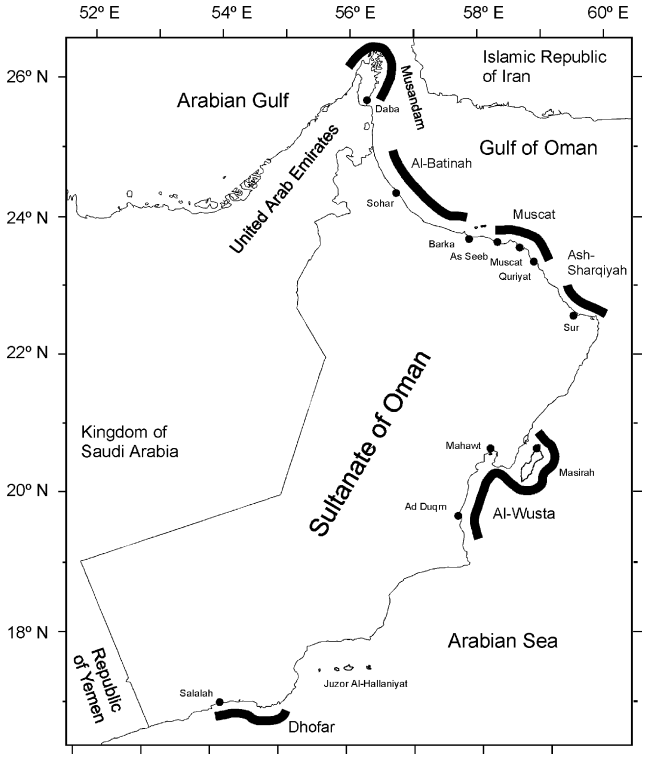

Fig. 1. Primary sites of data collection during the present study.

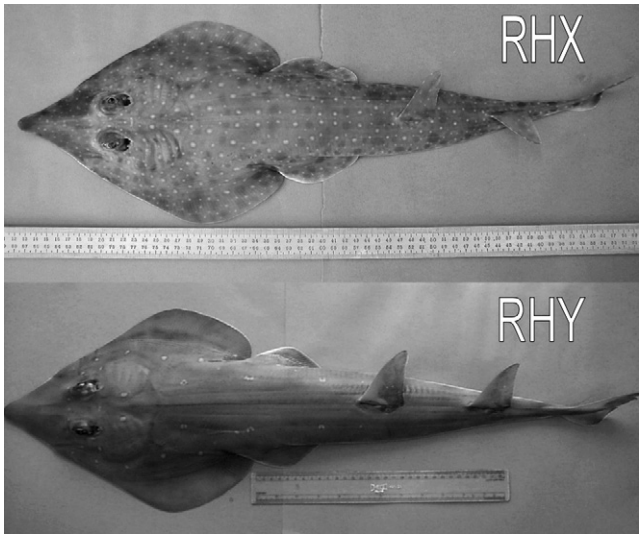

Fig. 2. Two undescribed guitarfish species recorded during the present study, coded RHX (top) and RHY (bottom).