



STUDY ON

**STOCK ASSESSMENT AND FISHERIES MANAGEMENT OF
INVERTEBRATES WITH SPECIAL REFERENCE TO SHRIMP AND THE
DESTRUCTIVE IMPACTS OF TRAWL FISHING
in the Saudi Arabian Red Sea Coast**

Progress Report

Prepared by

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Introduction

This technical progress report presents the sampling design, collected data, analysis methods and preliminary results from the study carried out in the Saudi Red Sea coast. This was implemented to provide information on invertebrates' stocks with special reference to shrimps, cattle fish, crabs as well as impacts of trawl fishing.

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) is executing the Strategic Action Programme (SAP) funded by the World Bank, United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and other donor organisations.

The SAP was prepared following an extensive analysis of regional environmental issues and has been endorsed by the PERSGA Council of Ministers. The SAP provides a cooperatively developed framework for the long-term conservation and management of the coastal and marine resources of the Region. A programme of activities is being carried out through six complementary components: reduction of navigation risks and maritime pollution, the promotion of integrated coastal zone management, sustainable use of living marine resources, conservation of habitats and biodiversity, the establishment of marine protected areas, and the enhancement of public awareness and participation.

As part of the activities to promote sustainable use of living marine resources in the region, PERSGA/SAP Living Marine Resources (LMR) component decided to conduct a study to assess the stock of invertebrates particularly shrimp, its current and maximum sustainable exploitation rate, & the impacts of trawl fishing and propose a management plan for its fisheries in the Saudi Arabian Red Sea Coast. Similar studies are being conducted in both Egyptian and Yemeni Red Sea Coasts.

The present study *for Assessing the Status and Potential for invertebrates' Fisheries and the Environmental Impact of trawl fishing* was conducted in by Mr. Talal Abu Shoushah and Dr. Mohamed Abdallah on Jan-Dec. 2002 with the following specific objectives:

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1. To identify, inventorize and prepare a list of species with quantities, size ranges and exploitation rate of the stocks.
2. Inspect the fishing gears currently exploiting the shrimp fisheries and prepare standardized fishing effort units to be used in regional analysis.
3. Review, collect and standardized the available statistical catch/effort data.
4. Conduct at least a monthly sampling survey at the relevant landing sites.
5. Interviewing the trawlers skippers of currently existence in the relevant landing sites.
6. Prepare guidelines for the assessment of the stocks of the main commercial shrimp species.
7. Assess the impact of the present shrimp trawl fishing including discards and bycatch.
8. Prepare a draft plan for sustainable management of shrimp fisheries including legal, institutional and capacity building needs.
9. Train two counterparts on the above tasks including species identification, sampling, data collection, stock assessment and fisheries management.
10. Propose a sustainable plan of monitoring, control and surveillance of the exploitation of invertebrates' fisheries, with focusing on shrimp.

Study Area

This study covered two areas where the bottom trawlers are operational in the Saudi Red Sea coast. The first area of study extends from Lat 17° 40' N southwards to the Yemeni border (Figure 1) covering an estimated total area of about 10,000 square kilometers. With the Farasan Islands, this area supports the activity of more than 90% of the industrial fishing fleet operated in the Red Sea. Shrimp trawling practices is concentrated in the coastal waters from 9 to 35 m depth. In the early months of the fishing season, the fishing fleet usually operates in the northern grounds and moves later to the southern grounds near the Yemeni border.

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The second study area (Al-Qunfthah) Extends from to .It contributes the fishery by It is exploited by some 5 to 14 trawlers.

Two different trawl fleets were exploiting the Red Sea shrimp fishery, since 1995, the Saudi Fisheries Company fishing fleet (SFC) and the traditional Saudi industrial fleet. Currently, the Red Sea shrimp fishery is exploited by only the second mentioned fleet.

Study Design

To gather baseline data on length frequency, abundance, diversity and distribution of resident fauna, monthly sampling survey was conducted during the period Jan-Dec. 2002. Table (1) summarizes the sampling effort within the study areas. A national team of 10 technicians from the Ministry of Agriculture were involved I all stages of the study including field surveys and laboratory duties.

Methodology

Data sources

Survey landing sites

Starting in Jan 2002, Shrimp, cuttlefish and crabs samples were collected every month from landing at the Jizan and Al-Qounfthah.

Supplementary information on the amount and composition of commercial shrimp, cuttlefish and crabs landed from the study areas was also collected at the landing sites.

Bottom trawling

Three bottom trawls were conducted each month on the Jizan area. The bottom trawling survey was conducted in Al-Qounfthah area only during the first four months of the study period due to constrains of trawlers availability. From each trawl, all catch was quantified and a sample randomly selected was retained, stored iced in buckets and returned to the laboratory for processing.

Catch and fishing effort statistics

The skippers of trawling fleet were requested to fill down information forms including areas fished, fishing gear specification, duration of fishing, catch composition, etc. Collected data was verified at landing sites. These data was used to estimate total catch and species composition of the commercial landing, fishing effort and catch per

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unit fishing effort. Historical data on catch and fishing effort were compiled from the ministry of agriculture.

Data Analysis

Catch composition and discards

Historical data on the commercial landed bycatch and shrimp of the fishing fleet operating in the Jizan fishing ground were available since 1995 but data on the discarded portion were unfortunately absent. To estimate the ratio and species composition of the discards, all catches of the previously mentioned (36) hauls, were sorted out, weighed and analyzed. The operation time, duration of towing, depth of trawl, and location (longitude and latitude) of the each haul were recorded on board the trawler. The catch was grouped according to the following criteria:

- a. Main target species i.e. shrimps.
- b. Bycatch species; the incidentally caught commercial fish, crab, and molluscs suitable for human consumption.
- c. Discards; young and juveniles of commercially important fish (>10–15cm TL), and noncommercial species consisting of a variety of species including fish, crustaceans, echinoderms, molluscs, etc.

The average estimator that has been described by many authors (e.g. Andrew et al., 1995) was adopted to estimate the total discards. This method first estimated the monthly average discards per haul, μ_b , from survey data, and take the product, $N\mu_b$ as the monthly total discards estimate, with N being the monthly total fishing hauls of the shrimp fleet which have been derived from the logbooks of the fishing fleet at Jizan fishing port during September 2002–April 2002. These estimated discards then were used to feed the neural network modeling process.

A simple discards per towing hour prediction neural network model was set up using six predictive variables that were available from the survey data: total landed catch/towing hour, shrimp catch/towing hour, bycatch/towing hour, towing period, water depth and latitude. The model structure was 6-5-1 NN, where the number of hidden nodes (5) considered as $2 \times \sqrt{(Number\ of\ Inputs + 1)}$. This model was used to predict discards portion in different water depths as well as different towing periods,

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with 0.1 learning rate, 0.1 momentum term and 5 verify rate. All data set was used for both training and test process.

Both survey and landings data sets were combined together to set up another neural network model to predict the discards portions using four predictive variable, total landed catch, shrimp catch, bycatch and towing period. The model structure was 4-6-1 NN using the default hidden nodes number as previously indicated. A range (1-10 rows) from the survey data set was used to train the neural network model with 0.5 learning rate, 0.5 momentum term and 5 verify rate while the whole data set (1-25 rows) were used for testing process.

Species Diversity Indices

To take into account the number of taxa (species richness) and the distribution of individuals among the species (species evenness), the following indices were calculated as follows:

Total species (S) – The number of species in each sample.

Total individuals (N) – The number of individuals in each sample.

Margalef's species richness (d) - It measures the number of present species making some allowance for the number of individuals.

$$D = (S-1)/\text{Log}(N)$$

Pielous evenness (H) – It is measure of how evenly the individuals are distributed among the different species.

$$H = \text{Log}(Ni/\text{PROD}(Ni))/N$$

Shannon-Wiener diversity index (H')

$$H' = - \text{SUM}(Pi*\text{Log}(Pi))$$

where e was the used Log base.

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Species Identification

Recorded species were identified according to FAO species identification sheets, (Fischer and Blanchiceds, 1984) and FishBase (2000).

Results

Catch

The monthly Shrimp, bycatch and total landed catch taken by the bottom trawlers (shrimp trawlers) during the fishing seasons from 1995 to 2001 are given in tables..... and graphically represented in figures,.....

Catch composition

The shrimp catch exceeded the bycatch only during the fishing season 1995/1996. It was fluctuated from its maximum (1236.5 tonne) during 95/96 to its minimum (894.9 tonne) during the season 2002/2003.

Fishing Effort

Bottom Trawling Fleet Description

Some of 84 bottom trawlers are exploiting the Jizan fishing area. Their length ranges from 9 to 20 meter. They are powered by engines of --- to--- hp. Most of them are equipped with eco-sounders. The crew number ranges from – to—person. The trawl net ranges from – to ---m body length and from length with an average of 3.8 code end mesh size.

Catch per Unit Fishing Effort

Analytical Models Analysis

Discards

Species Assemblage

Species Biodiversity

Annexes

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