Marine Policy 72 (2016) 1–10

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Towards sustainable fisheries management in emerging markets: An overview of properties, gaps and opportunities in Egypt

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ARTICLE INFO

Article history:
Received 30 November 2015
Received in revised form
27 May 2016
Accepted 27 May 2016

Keywords:
Fisheries management
Emerging markets
Mediterranean
Fishing technology
Egypt fisheries

ABSTRACT

The knowledge of fisheries features in emerging markets is an essential step to identify gaps in the management and opportunities for socio-economic development. Mediterranean coastal area of Egypt is subjected to a high level of anthropogenic pressure due to fishing activities and bottom trawling is considered as the most important as well as troubling fisheries, for the impact exerted on the bottom communities. In this context, the knowledge of fleet composition, technical properties of fishing gears and vessels, catch composition and distribution of vessels along the coast are considered as key factors for fisheries management and for the introduction-development of new technology and market opportunities. In this study, an overview of the fishing activities in Egypt, with a focus on the bottom trawling was carried out to provide fisheries managers with information suitable for the development of reliable technical measures. A SWOT analysis based on technical information gathered with direct measurement, interviews with net makers-fishermen and official data collected from the Egyptian General Authority for Fish Resources Development, enabled to explore current constraints and future possibilities for the fishing sector in Egypt. Technical information also allowed to develop a model which enabled to estimate the area swept by bottom trawling. The results obtained from the model show that potentially an area of more than 40 km2/h can be impacted by the Egyptian fleet in the Mediterranean. This model can be considered as a cheap tool to be used by fisheries managers for a rough estimation of bottom trawl impact and for a reasonable marine spatial planning.

1. Introduction

The Mediterranean Sea is one of the most important marine area in the world, where high biodiversity supports a variety of locally significant and diversified fisheries [1]. In the Mediterranean basin, fishing activities play an important social and economic role, especially in developing countries. Indeed, seafood is a staple in the diet of many Egyptians, accounting for almost 20% of their animal protein intake [2]. In the past 10 years, per capita fish consumption has doubled from 11.0 kg in 1998–20.55 kg in 2012. According to the annual statistical report published by the General Authority for Fish Resources Development (GAFRD) [3], in 2011 the fisheries industry accounted for 11.9% of the value of total agricultural production and for 42.9% of the value of total animal production.

Approximately 13,600 licensed [4] and more than 20,000 unlicensed fishermen [5] currently fish in Egyptian waters. The latter are mainly individuals who depend entirely on an informal market economy for their survival. With an estimated ~300,000 additional workers engaged in fish handling, transportation, processing, marketing, and related activities, the fishing industry in Egypt is clearly important both from the social and the economic viewpoint.

The Egyptian fishing industry is highly diversified, relying on a wide range of fishing gears and methods to target a large number of species that inhabit widely different environments at a wide range of depths. This variety is reflected in catch composition and fleet structure.

A thorough knowledge of fishing gears and technologies is crucial for fisheries management. Fishing gears, particularly towed gears, are responsible for ecosystem alterations in benthic habitats, since they may reduce the abundance and spawning potential of several species. Moreover, gear selectivity, i.e. the mesh used, affects fish age and size structure, sex ratio, species composition, and likely also population parameters (e.g. growth, maturation). Onboard technology may also affect the social organization of fishing communities, their economy, and fisheries management in several ways, for instance by inducing a workforce reduction.

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http://dx.doi.org/10.1016/j.marpol.2016.05.032
0308-597X/

Table 1.
Egyptian fleet and fishermen working in the Mediterranean Sea in 2012 (GAFRD, 2013).

Fishing port	Motorized boats				Non-motorized boats	Registered fishermen	Recreational licenses
	Trawls	Purseseines	Long lines	Nets			
Marsa Matrouh	–	–	3	8	56	120	–
Alexandria	32	6	192	36	198	424	2474
AbuQir	34	17	207	117	64	1877	–
Al Maadia	103	36	105	80	39	883	–
Rashid	90	16	68	60	138	2026	8
Motobas	–	12	11	2	41	291	–
Baltim (Burullus)	13	27	191	1	138	1850	–
Damietta	596	16	203	14	137	3021	1825
Port Said	230	55	242	2	601	1696	695
El-Arish	–	52	11	158	6	1408	347
Total	1098	237	1233	478	1418	13,596	5349

Over the past 10 years, fishing activities in Egypt have undergone a fast and remarkable technological development, resulting in increased fishing efficiency. However, information about the state of the art of fishing technologies is scarce and often unavailable in Egypt, hampering effective fisheries management and the development of new technologies. Knowledge of gear properties is clearly a key factor in view of the introduction of newer technologies that can provide greater social and ecological sustainability.

The main purpose of this paper is to review the fishing technologies employed in Egypt, to provide fisheries managers with information that can guide them in developing reliable technical measures. Bottom trawling is the foremost fishing activity in Egypt, in terms of number of vessels, engine power, number of fishermen per vessel, and revenue (Tables 1and 2). Since it is also the one with the heaviest impact on bottom communities [6], the present review focuses on bottom trawling.

Technical information was collected by making direct measurements and by interviewing net makers and fishermen. These data were used to develop a model to estimate the area impacted by bottom trawling, which may have a broad application. The information obtained through interviews and the official GAFRD data was then used in a SWOT (strengths, weaknesses, opportunities, threats; [7,8]) analysis based on three main themes (fishing technology, socio-economics, and environmental impacts). Through a systematic approach of introspection into both positive and negative concerns, SWOT analysis highlighted current constraints and future prospects for the fishing sector in Egypt.

2. Egyptian fisheries

A survey of the main fishing methods, gear types, and technical features was carried out in 2011 and 2012 in the main Egyptian fishing harbours. Data were collected by direct measurements taken on deck and in the main Mediterranean landing areas of Damietta, El-Burullus, El-Maadia and Alexandria's Eastern harbour, where most of the fleet is based (Fig. 1), including fleet composition in each fishing harbour, and through interviews with fishermen, stakeholders, and net makers. The survey thus reports the following information:

-The main fishing gears used in Egypt;.

-The main technical features of the different types of gear used;.

-The characteristics of the fishing fleet;.

-The characteristics of the fisheries;.

-The fishing areas.

Four fishing methods were selected to review the technical information, trawling, purse seining, longlining, and passive nets, because they are the chief commercial gear types in Egypt's Mediterranean waters. This information was incorporated with official GAFRD data [3,4], to conduct SWOT analysis based on three main themes: fishing technology, socio-economics, and environmental impacts. SWOT analysis is a strategy commonly used to analyze the internal (strengths, weaknesses) and external (opportunities, threats) components of an industry and provides a matrix of positive and negative factors for policy decision-makers to address.

2.1. General characteristics of the Mediterranean fleet

The characteristics of the Egyptian fleet operating in the Mediterranean Sea in 2012 are reported in Table 1. The fishing fleet was comprised of 1098 trawlers operating on the Egyptian Mediterranean coast (GFCM-GSA 26), 1233 longline vessels, 478 vessels using passive nets, and 237 purse seiners. Most purse seiners (68%) were motorized with 20 to 1000 hp inboard diesel engines (Table 1; [4]). Several vessels use a Global Positioning System (GPS) and small electronic fish finders; the other vessels have very limited navigational or safety equipment.

The Egyptian Mediterranean coast (GFCM-GSA 2 6) is nearly 1100 km long and extends from W to E from the Libyan border to the Gaza Strip. The catch landed from this area accounts for about 60% of total marine catch in the country [4].

The Nile River is a large source of freshwater and nutrients that strongly affects productivity, fish biomass and catches. The fishing grounds along the Egyptian Mediterranean coast can be divided into three main regions: a western area (from Alexandria to El-Salloum), a middle area (off the Nile Delta) and an eastern area (from Port Said to El-Arish). The fishing gear should be assessed in its geographical context, especially bathymetry and seabed morphology. The flat and smooth seabed of the middle and eastern area, which is mostly composed of muddy and sandy sediment, is ideally suited for bottom trawling. In contrast, the western area is characterized by rocky patches and a narrow continental shelf, making these fishing grounds harder to access for trawling gear. Therefore, most fishing grounds explored by Egyptian vessels are located on the wide continental shelf in front of the Nile Delta and may extend to the eastern side of Port Said, where the bottom is suitable for trawling. There are nine officially recognized landing harbours - most of them located in the area of the Nile Delta - of which Damietta, El-Burullus, El-Maadia, Rashid, and Alexandria's Eastern harbour are considered as most important (Fig. 1).

The fishing fleet, subdivided into harbour and main fishing technique/ gear, is described in Table 2. Bottom trawl, purse seine, longline and passive nets are the main gear types used by professional fishermen. The fishing fleet of the four main harbours included 746 trawlers, 87 purse seiners, 709 boats using longlines,