Food and Agriculture Organization of the United Nations

FAO FISHERIES AND AQUACULTURE TECHNICAL PAPER

656

ISSN 2070-7010

Implementation of the ecosystem approach to fisheries for the purse seine fisheries in Lebanon

Baseline report

COVER PHOTOGRAPH: ©FAO/CLAUDIA AMICO

Implementation of the ecosystem approach to fisheries for the purse seine fisheries in Lebanon

FAO
FISHERIES AND
AQUACULTURE
TECHNICAL
PAPER

656

Baseline report

Manal R. Nader
Director - Institute of the Environment
Associate Professor - Faculty of Arts and Sciences
University of Balamand
Lebanon

Shadi El Indary
Instructor
Marine and Coastal Resources Program
Institute of the Environment
University of Balamand
Lebanon

Manale Abou Dagher
Fishery Resources Officer
Marine and Coastal Resources Program
Institute of the Environment
University of Balamand
Lebanon

Marcelo Vasconcellos
Fishery Resources Officer
Marine and Inland Fisheries Branch (FIAF)
FAO
Rome, Italy

Samir Majdalani
Former Head of Department of Fisheries & Wildlife
Directorate of Rural Development & Natural Resources
Ministry of Agriculture
Lebanon

Mark Dimech
Senior Fishery and Aquaculture Officer
FAO
Abu Dhabi

Imad Lahoud
Agricultural Engineer - Head of Department
Department of Fisheries & Wildlife
Ministry of Agriculture
Lebanon

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2020

Nader, M.R., El Indary, S., Dagher, M.A., Vasconcellos, M., Majdalani, S., Dimech, M. & Lahoud, I. 2020.
Implementation of the ecosystem approach to fisheries for the purse seine fisheries in Lebanon – Baseline report.
FAO Fisheries and Aquaculture Technical Paper No. 656. Rome, FAO.
https://doi.org/10.4060/ca7533en

ISBN 978-92-5-132125-6

Preparation of this document

The Food and Agriculture Organization of the United Nations (FAO) and the University of Balamand (UOB), Institute of Environment (IOE), with the agreement of the Ministry of Agriculture (MOA), started the implementation of a pilot case study on the ecosystem approach to fisheries (EAF) in Lebanon in 2016, within the framework of the FAO Mediterranean Project EastMed ("Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean"). The pilot case study focuses on the purse seine sardine fishery (PSSF) in Lebanon that harvests small pelagic fish, specifically sardines which are assumed to be the main target species. The case study was funded by the FAO–EastMed project and implemented in collaboration with the MOA and FAO Lebanon.

One of the first steps in the pilot case study was the elaboration of an EAF-Baseline Report (EAF-BL), which is presented in this publication. The objective of the EAF-BL is to complete the EAF planning phase by defining the scope of the case study. The EAF-BL is a document that outlines the available information on the PSSF that can assist with the rest of the EAF management planning process. It documents all relevant information about the fishery, the species and geographical areas covered in the case study, the socio-economic profile of the fishery and the institutional arrangements for its management.

Abstract

The objective of the EAF baseline report was to provide the necessary baseline information to pilot an EAF on the PSSF in Lebanon. This decision was based on the advances that the country has made in the fisheries sector in the past decade which paved the way for the introduction of the latest management approaches in fisheries. In-depth background research on the PSSF was undertaken by the Marine and Coastal Resources Program at the Institute of Environment, University of Balamand (MCR-IOE-UOB) which covered national and regional documents deemed beneficial for the project objectives. Additional documents and information were provided by the EastMed Project and, at national level, by the Directorate of Fisheries and Wildlife (DFW) within the MOA. These documents included material relating to the laws regulating the PSSF, the number of fishers and vessels, the size of the catch and the species caught, etc. Through regular meetings and constant exchange of information between project partners, this report documents all the available and relevant material on the PSSF in Lebanon, including the species caught, the geographical areas covered by the case study, the socio-economic profile of the fishery and the current institutional arrangements for its management.

Contents

FIGURES

PLATES

TABLES

Abbreviations and acronyms

AUB	American University of Beirut
ARDP	Agriculture and Rural Development Programme
CPUE	Catch per unit effort
CNRS–NCMS	National Council for Scientific Research – National Centre for Marine Sciences
DCRF	Data Collection Reference Framework
DFW–MOA	Department of Fisheries and Wildlife – Ministry of Agriculture
EAF	Ecosystem approach to fisheries
EAF–BL	EAF-Baseline Report
EastMed	Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean
FAO	Food and Agriculture Organization of the United Nations
FLOUCA	Fish landings operational utility for catch/effort assessment
GDP	Gross domestic product
GFCM	General Fisheries Commission for the Mediterranean
LOA	Letter of agreement
MCR–IOE–UOB	Marine and Coastal Resources Program at the Institute of Environment, University of Balamand
MOA	Ministry of Agriculture
MOPWT	Ministry of Public Works and Transport
NM	Nautical mile
PA	Polyamide (monofilament net)
PSSF	Purse seine sardine fishery
PSU	Practical salinity units
UOB	University of Balamand
USD	United States Dollars

1. INTRODUCTION

Fisheries have environmental costs that can threaten other species and the sustainability of the fished resources. Even though fisheries provide society with substantial benefits in terms of income, food and employment, they are often unsustainable and are frequently identified as an environmental threat. Moreover, marine species and fish stocks are transboundary in nature and move freely across human-made administrative boundaries. Migration allows fish stocks to live in the best possible conditions for feeding, growth and reproduction. Because migrating fish cross national boundaries, catches of fish in one area can affect catches of fish in another. Today, an increasing number of "candidate shared stocks" of fish species are being assessed and managed by groups of nations in order to avoid overfishing.

It is also well accepted that scientific advice on the status of fish stocks and the effects of fishing make only a small contribution to a complex management and decision-making process. This, and the fundamental understanding that managers and scientists have recently moved beyond the single species approach to fisheries management have pushed the sector towards a new perspective – a perspective that relies on managing the ecosystem in addition to the biological resource. Fishery managers face tremendous challenges because they are required to take account of the impacts of fishing on the natural ecosystem and to integrate sustainable development and conservation considerations into management plans. Therefore, sustaining marine biological resources needs a holistic approach which takes into account a range of different variables that affect the resource itself.

1.1 The Mediterranean Sea

The Mediterranean Sea is a semi-enclosed sea that covers an area of about 2.5 million km^2, corresponding to around 0.7 percent of the world's total ocean area (Figure 1).

FIGURE 1

Mediterranean Sea and the Geographical Subareas of the General Fisheries Commission for the Mediterranean. The red arrow indicates the position of the Suez Canal

Source: Map No. 3795 Rev. 3 UNITED NATIONS 2012

Its coastline extends for about 46 000 km and its depth extends to around 5 200 m, with an average depth of 1 500 m. Oceanographic environmental conditions create a unique circulation system, with many areas of upwelling and high productivity. The Mediterranean Sea is considered to be a biodiversity hotspot with a high degree of species richness. Regardless of its size, the Mediterranean Sea contains 7 percent of all marine fish species, with many endemic species and species of tropical origin (Malak *et al*., 2010; Galil *et al*., 2014).

Total fisheries landings in the Mediterranean Sea and the Black Sea increased irregularly from about one million tonnes in 1970 to almost two million tonnes in 1982. They remained relatively stable for most of the 1980s before declining abruptly in 1989 and 1990, largely due to the collapse of pelagic fisheries in the Black Sea. In the Mediterranean, landings continued to increase until 1994, reaching 1 087 000 tonnes, and subsequently declined irregularly to 787 000 tonnes in 2013. A group of 13 species accounts for approximately 65 percent of landings and anchovy (*Engraulis encrasicolus*) and sardines are the dominant species (GFCM, 2016). Based on the data reported by the General Fisheries Commission for the Mediterranean (GFCM), at least one-quarter of a million people are employed on fishing vessels in the Mediterranean Sea and the Black Sea (GFCM, 2016). It is estimated that the average landing price in the Western Mediterranean, Adriatic Sea and Ionian Sea is at least double that of the Eastern Mediterranean. Despite such differences, fisheries present a significant economic contribution to the Eastern Mediterranean regional economy, compared with other Mediterranean subregions (GFCM, 2016).

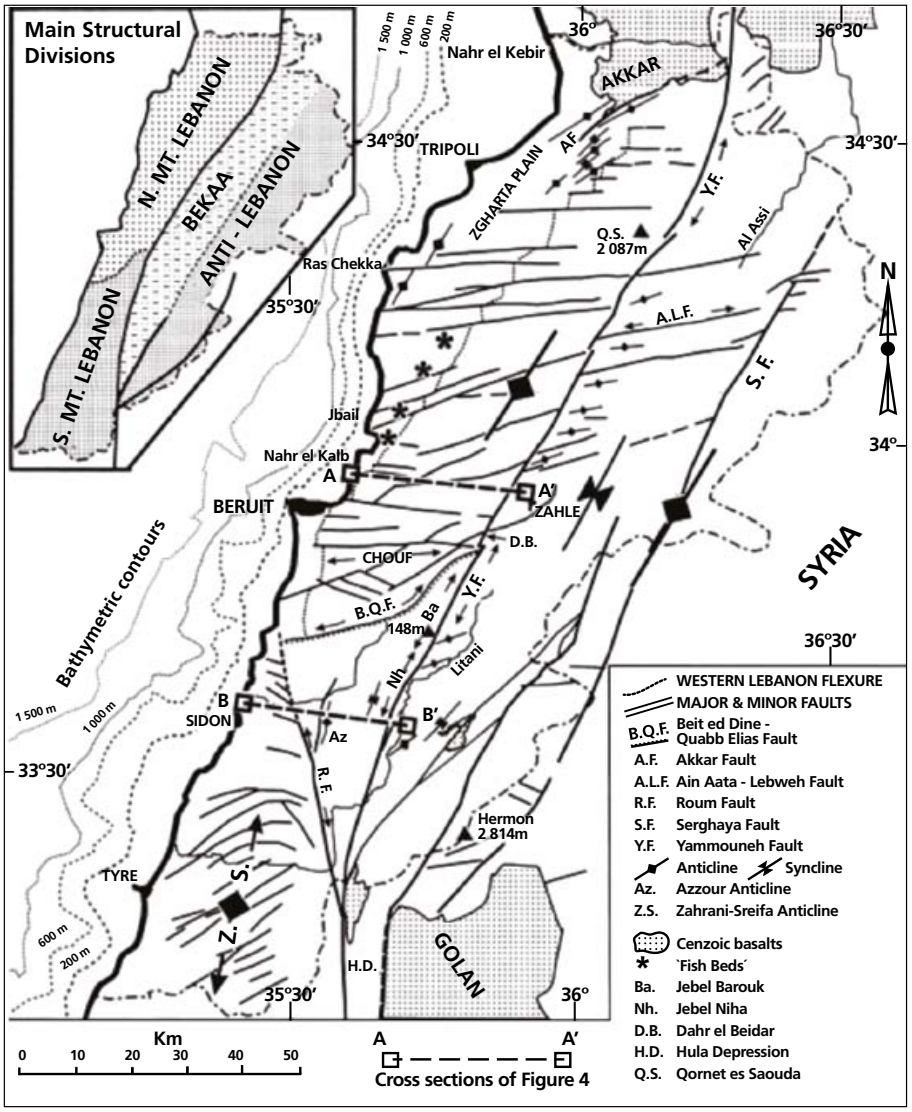
Many of the fisheries resources of the Mediterranean are under pressure because of overfishing. Most stocks are either fully exploited or overexploited (GFCM, 2016). Trends show that the lengths of fish captured are decreasing and juveniles are under significant fishing pressure (Malak *et al*., 2010; GFCM, 2016). Many efforts have been made by the GFCM to develop useful tools for the creation and improvement of fisheries data information systems (e.g. Task 1 – Rec. GFCM/33/2009/3). Obstacles emerged with the adoption of the GFCM Task 1 requirements for reporting and consequently, a new Data Collection Reference Framework (DCRF) was designed to reduce data requirements and incorporate them into a single, simple and easy-to-understand document, providing GFCM members with the necessary framework for the collection and transmission of fisheries data to the GFCM Secretariat. The information gathered should be adequate and sufficiently reliable for scientists to review the status of the different resources, assess the economic and social dimensions of the fleets and provide scientific advice on the status of resources. It should also allow members to prepare recommendations for managing those resources (GFCM, 2014).

In circumstances in which the pressure on resources is severe and management schemes fail, artisanal fisheries are the most severely affected because they cannot compete with the industrial fleets. Consequently, such situations call for innovative approaches to fisheries management and cooperation between all Mediterranean countries (GFCM, 2016).

1.2 The Lebanese coast

The Lebanese coast is about 225 km long and stretches along a north–south axis. Eighty percent of the coast is rocky, with the remaining 20 percent reported to be sandy with gravel on the landward side. The continental shelf is widest in the north (21 km), narrows in a north–south axis and then widens again to 8 km in the south (Figure 2). The shelf is characterized by submarine canyons with depths of 1 500 m or more, creating heterogeneous habitats for an array of marine organisms (Lakkis, 2011a, 2011b; Sacchi and Dimech, 2011).

FIGURE 2
The continental shelf of Lebanon



Source: Walley, 1998.

Sea surface temperature varies from 17 °C in February to a maximum of 30 °C in August, while salinity displays little fluctuation – between 39.25 practical salinity units (PSU) in April and 39.75 PSU in September (Abboud Abi Saab, 2008; Lakkis, 2011a, 2011b). The Eastern Mediterranean Basin is known to be oligotrophic and is characterized by the succession of two annual thermal phases: a cold phase in winter and a warm phase in summer, separated by two short inter-seasonal periods in spring and autumn. The spring season (March to May) is marked by a significant bloom of phytoplankton, considered to be the base of the food web and marine productivity. During the autumn period (October to November), a slight increase in nutrient levels and a moderate bloom of certain genera of phytoplankton are usually observed (Abboud-Abi Saab, 2008).

Lebanon's waters contain at least 1 685 animal species, with many being of commercial importance. In addition, they encompass a rich cultural and archeological heritage and several fresh water springs. The coast has played a major role in shaping the economic, political and cultural development of the country (Lakkis, 2011a, 2011b), and the area has been subject to many anthropogenic stresses from increased urbanization, the development of a number of economic sectors and resulting pollution

(Kouyoumjian and Hamze, 2012; Nader, Indary and Moniri, 2014). Furthermore, major changes in river discharge into the sea, as a result of dam building and the use of fresh water for drinking and agriculture, has lowered the nutrients and sediments carried by rivers into the coastal zone, resulting in the reduced productivity of marine ecosystems. The 2006 war with Israel resulted in 15 000 m^3 of fuel oil being spilled in Lebanese coastal waters through the bombardment by the Israeli Air Force of the Jiyeh Power Plant fuel tanks. The oil drifted northward and more than 150 km of the Lebanese coastline was contaminated. The spilled oil had a devastating impact on the Lebanese marine environment and its biological resources (UNEP, 2007; UN, 2011). Currently, marine resources are under serious pressure from urban coastal settlements and anthropogenic activities that result in various pollutants being discharged into coastal waters.

1.3 The ecosystem approach to fisheries

The increasing pressure on marine resources as a result of overfishing, pollution, destruction of habitats and the failure of classical management approaches has resulted in the collapse of numerous fisheries around the world. As a consequence, the livelihoods of coastal communities and the food security of countries have been threatened. In response, new fisheries management approaches have been developed to address concerns about, and weaknesses in, the present management practices. Such approaches have culminated in the development of the EAF – a holistic approach to the management of fisheries and marine resources from an ecosystem perspective (FAO, 2012).

The EAF is a management planning process for marine resources rooted in the principles of sustainable development and using risk assessment methodologies. The overall purpose of the EAF is to plan, develop and manage fisheries to meet the multiple needs of society without jeopardizing the options for future generations to benefit from the full range of goods and services, including non-fisheries benefits, provided by marine ecosystems (FAO, 2003). The EAF is a multidisciplinary approach because it is not limited to biological and physical factors but includes social and economic factors (FAO, 2012). Its approach is to combine ecosystem protection along with fisheries management. Dimech, Barros and Bianchi (2014) indicated that this new approach helps to shift the system to focus more on "social/economic sustainability". According to FAO (2005) "the key objective of the EAF is the sustainable use of the whole system and not just targeted species".

Introduction of the EAF for the purse seine sardine fishery in Lebanon

A first EAF stakeholders meeting was held at the UOB on 10 and 11 November 2015. It was hosted by the FAO-EastMed project and included representatives from the MOA, FAO-EastMed project, FAO-Lebanon, the Lebanese army, National Council for Scientific Research – National Centre for Marine Sciences (CNRS–NCMS), UOB, non-governmental organizations, and representatives of a number of fishers' cooperatives. On the first day, the EAF concept was presented and on the second day a round table discussion on the potential activities that could be implemented in Lebanon in an effort to introduce an EAF, took place. Several ideas were discussed by participants, including an idea to pilot the EAF on the PSSF. This idea is supported by the advances that the fisheries sector in Lebanon has made in the past decade which have paved the way for the introduction of the latest management approaches in fisheries, such as the EAF. The introduction of the EAF as a management tool for the sardine fishery in Lebanon is expected to be accomplished in three main phases:

- Initial process of planning and stakeholder support;
- Risk assessment;
- Development of a fishery management plan and action plan for capacity development.

2. OVERVIEW OF THE FISHERY AND EXPLOITED RESOURCES

Fisheries in the Mediterranean are recognized as important cultural and economic activities. Climate, temperature and other factors have favoured fishing in the Mediterranean Basin from ancient times and Mediterranean fisheries are known to support large coastal communities.

2.1 Lebanese fisheries overview

Lebanese coastal waters contain a rich variety of marine organisms, with more than 80 fish species being of commercial importance (Nader, Indary and Stamatopoulos, 2012). Lebanese fisheries are artisanal or traditional in nature, with most of the boats being motorized and smaller than 12 m in length (Sacchi and Dimech, 2011). Fishing for living marine resources is mandated by the MOA, while the Ministry of Public Works and Transport (MOPWT) is in charge of the fishing boat registry (Majdalani 2004; Nader *et al*., 2014). Fishing occurs in shallow waters, at an average depth of 50 m, and rarely takes place beyond three nautical miles (NM) from the coastline (Majdalani, 2004; Nader, Indary and Moniri, 2014). According to the DFW–MOA, the number of licensed fishing vessels in 2015 stood at 2 005 boats operating from 44 fishing harbours and landing sites along the entire Lebanese coastline (DFW-MOA personal communication). Most of the fleet keeps very simple safety gear (mainly oars) and vessels are rarely fitted with global positioning systems and life vests. Furthermore, few vessels are equipped with net winches and echo sounders for detecting fish.

Over the past few years, several initiatives (Annexure I) were implemented to bridge existing gaps in the fisheries sector. Among the listed initiatives, several biological studies and stock assessments of commercial fish species were conducted. Some of the studied species (Annexure I), especially the small pelagic species, are highly significant because they are the target species of the purse seine fisheries. In addition, among the studied fish species, certain are of great importance for Lebanon and for neighbouring countries because they are candidates for shared stocks (EastMed, 2011). Investigations of sardines and anchovy off the Lebanese coast have revealed specificity and differences when compared to their counterparts in the West Mediterranean basin. It is believed that this might be related to topography and oceanographic barriers, or to the existence of subspecies. Such hypotheses must be tested because little data exists from the southeast Mediterranean (Jemaa *et al*., 2015a, 2015b).

As can be seen in Annexure I, several scientific initiatives have been launched in the past few years on behalf of private and public institutions, with the financial and technical support of the FAO-EastMed project and other funding agencies. The results of such initiatives are providing clearer perspectives for managing the sector in particular and sustaining fisheries resources in general.

2.2 Fishing gear used and areas fished

Fishing techniques in Lebanon consist mainly of passive gears such as gillnets, trammel nets, longlines, purse seine nets, lampara nets and beach seines (Nader, Indary and Stamatopoulos, 2012; Sacchi and Dimech, 2011). The majority of gillnets and trammel nets have small mesh sizes (<20 mm). According to Brême (2004), nets with small mesh size make up over 50 percent of the fishing gear used in the major fishing harbours of Lebanon (e.g. Saïda, Qalamoun, Tripoli and Aabdeh). These target an array of fish species (Sacchi and Dimech, 2011; Table 1) adding to the complexity of sustainably managing the sector.

TABLE 1
Fishing gear in Lebanon

GEAR	DESCRIPTION	SPECIES TARGETED
Small mesh size gillnet	Has a 32 mm stretched mesh size and is made of a 0.33 mm diameter polyamide (PA) monofilament. The length of each net is about 50 m and the stretched height is 3 m. Gillnets are set between 10 m and 50 m depth for a short soaking time (less than 12 hours)	Demersal species and small pelagic species
Medium mesh size gillnets	These gears have a stretched mesh size ranging between 48 mm and 120 mm, built with a single wall of monofilament net. Their length ranges between a few hundred meters to more than 1 000 m	Demersal species and small pelagic species
Large mesh size gillnet	The nets are made of a mesh size ranging between 140 mm and 180 mm with 1.5 mm diameter built from a single wall of monofilament or multifilament net. Their length is from 300 m to 1 000 m and height up to 13 m	Large pelagic species
Encircling gear	Trammel nets are used with an inner panel mesh size of 28 mm to 40 mm and of 150mm to 1 000 m in length and 1.2 m to 2 m in height, at depths of between 5 m to 50 m. The nets are used for bottom dwelling species. They are generally made of PA multifilament or monofilament of 210/1 to 210/2 (approximately 40 000 m/kg)	Demersal species and small pelagic species
Longlines	Bottom longlines consist of blue PA monofilament mainline to 1 m long monofilament snoods with hooks, attached at regular intervals (around 5m to 6 m)	Demersal species
Traps	Have triangular mesh and 30 mm bar mesh size	Demersal species
Lampara net	A type of surrounding net without a purse line system in order to close the bottom of the bag. The net is made up of a PA multifilament panel of 10 mm to 14 mm stretched meshes and it is composed of two lateral wings framing a central "bunt", made of the smallest meshes and thickest twine. The total length can reach up to 200 m and the height not more than 25 m	
Purse seines "*shincholas*"	Used at a maximum depth of 50 m. The nets are made up of PA multifilament of 210/2 to 210/6 and of 10 mm to 14 mm mesh sizes	Small pelagic species
Handline"*Boulis*"	Line with several hooks at its end, rolled on a small wooden piece	Demersal species
Drifting Longlines "*Jarjaras*"	Uses large hooks 83 mm in length and 30 mm in width. Not commonly used by fishermen	Large pelagic species

Source: Sacchi and Dimech, 2011

The fishing area in Lebanon is bounded by law between 500 m to 6 NM from the shoreline and fishing is limited to 24 hours per trip. Seventy eight percent of fishers fish within 3 NM of the coast and less than 10 vessels operate beyond the 6 NM limit (Majdalani 2004; Sacchi and Dimech, 2011).

In Lebanon, and according to the GFCM–DCRF fleet segments, the length class of purse seine vessels falls between S–01 (<6 m) and S–02 (6–12 m) with very few vessels in the S–03 category (12–24 m) (Annexure II). The purse seine and the lampara fishing gears are classified under "surrounding nets" with the codes PS and LA, respectively (GFCM, 2014). There are no defined fishing grounds except the ones defined by the 2010 MOA Decree No. 346/1 for which the use of such gears is forbidden in water depths of less than 25 fathoms (45.72 m). Even though purse seines are considered one of the most effective gears for the exploitation of marine biological resources, there is a serious lack of studies describing their efficiency and/or impact in Lebanese waters. Among the few studies found were the socio-economic study of Pinello and Dimech (2013) showing catch per

unit effort (CPUE), fuel consumption and other parameters of purse seine fishing; and the studies of the diversity of juvenile pelagic fish species undertaken by Bariche, Alwan and El-Fadel (2006) and Bariche *et al.* (2007). Purse seiners mainly depend on the seasons to catch target species, and this is especially true for sardines and other small pelagics. They use artificial lights to attract the desired species and consequently they avoid fishing during the full moon phase when the light of the moon lessens the efficiency of artificial lights to attract fish. Purse seiners tend to have the largest horsepower and longest average boat length of the vessels in the Lebanese fishing fleet and are typically the newest vessels in terms of age (Pinello and Dimech, 2013).

Given the large quantities of fish that purse seiners catch, coupled with a very high CPUE (206.6 kg/day) (Pinello and Dimech, 2013), the fishery presents an opportunity to implement an EAF in Lebanon through the development of a management plan for the PSSF.

2.3 Importance of the fishery to the local/national/regional economy

Lebanon is a relatively small country with limited food resources. The nation depends on imports to meet demand for food. The agriculture and fisheries production sector has remained constant for the past ten years and plays a minor role in the economy, contributing about 6.24 percent of the national gross domestic product (GDP) and only meeting an estimated 30 percent of domestic food demand (Pinello and Dimech, 2013). However, the well-being of fishers is strictly dependent on fishing. It was estimated that in the mid-1990s, there were around 4 000 traditional small-scale fishers located all around the Lebanese coast (Pinello and Dimech, 2013). The 2004/2005 census conducted by the DFW–MOA, with the support of the Fishery Statistics and Information System in the Mediterranean (FAO-Medfisis) project showed that there are a minimum of 4 475 fishers active in the fishing fleet, while the average number is 6 480 and increases to 9 575 fishers during the peak season (Majdalani, 2005). Since updated data on the number of full-time and part-time fishers and other related information are not available, the DFW–MOA has adopted a new, computerized fisheries licensing system that is expected to provide additional details on fleet characteristics.

Pinello and Dimech (2013) showed that 81 percent of vessel owners depend on fishing as their main source of income. They also showed that the average age of fishers is similar to that of other Mediterranean countries: 47.9 years old, with an average of 1.2 individuals in each household involved in fishing activities. Nevertheless, the DFW–MOA states that the real average age of fishers differs from the statistical results. According to their daily observations, fisher communities are aging across most Lebanese regions. The high birth rate in the north and in the south of Lebanon means that younger individuals may become involved in family fishing activity and this might alter the national statistical results and averages. As to their education levels, fishers have the lowest education levels in the sector, followed by skippers. Economically, the average income per fisher is USD 3 000 per year, while the net profit per vessel, per year is about USD 4 400. Knowing that 45 percent of fishers are vessel owners, their annual income increases to an overall gross income of 7 400 USD per fisher, per year (for the fisher–owner). Pinello and Dimech (2013) conclude that the income of a vessel owner–fisher is lower than the national GDP per capita of USD 9 904.

Regarding purse seiners, Pinello and Dimech (2013) reported that in 2011, 60 purse seines and lampara nets were licensed and active, employing about 403 individuals (Annex II). On the other hand, and according to the latest numbers provided by the DFW–MOA, there are 98 licensed purse seines, including lampara nets, distributed along the Lebanese coastline. No information is available on their activities. As per the 2010 Ministerial Decision No. 346/1, the fishing season for purse seines is open from 16 April to 31 December each year. While the number of crew differs from one boat to another, the purse seiners seem to work exclusively with full-time fishers.

It is worthwhile noting that fishers are neither provided with an employment contract nor social security which might protect them from injury or support them during retirement. Many of the fishers pass their vessels to their sons on a hereditary basis. This clearly demonstrates that fishing in Lebanon is a family business, making it of great value to the fisher communities and of cultural value to the nation.

Value of the catches from the purse seine fishery per year (2011 to 2015)

Lebanon lacks a national record of fisheries data, but efforts at many levels over the past decade resulted in the MOA launching in 2014 a national monitoring system for the sector. The system uses the Fish Landings Operational Utility for Catch/Effort Assessment (FLOUCA) Web utility (Annexures I and III). Previously, fisheries data for the period after 2006 were provided by the MCR–IOE–UOB for North Lebanon using the FLOUCA utility (Annexures I and III). For the period 2006 to 2009, fishing gears in the FLOUCA utility at the MCR–IOE–UOB were divided into three categories – nets, lines and pots – and purse seines were included under the "nets" category. Between 2010 and 2013, purse seines and fyke nets were separated into independent categories and purse seine data for North Lebanon was collected from fishers, but mostly from a local fishmonger (Table 2). Starting in 2014, the GFCM-Task 1 framework for data collection and reporting was adopted and the FLOUCA Web utility was created and adapted accordingly. The GFCM–Task 1 system required details that proved very difficult and challenging to collect for small-scale, artisanal fisheries. These challenges contributed to the elaboration of a new GFCM–DCRF in 2014 that simplified data collection and reporting. However, this shift in data collection systems resulted in a severe discrepancy in data reporting for North Lebanon's purse seines by the MCR–IOE–UOB for the years 2014 and 2015. The low numbers recorded in those two years for North Lebanon are due to the complexity of the variables required by the GFCM Task 1. The 2014 and 2015 data for North Lebanon were therefore excluded from Table 2.

Table 2 presents the percentage of purse seine catches and their associated CPUE as part of the total fisheries catch in North Lebanon for the years 2011, 2012 and 2103. It clearly shows that purse seines contributed the majority of landings in that region. On the other hand, average prices per kilogram of fish caught by purse seiners were way below the average price per kilogram of the whole fishery for the three years respectively. This might be due to the fact that fishes caught by purse seines are mainly small and fetch low prices, even though they may be of very good quality.

TABLE 2:
Comparison between total catch in North Lebanon and the purse seine fishery from 2011 to 2013

	2011		2012		2013	
	Total catch	**Purse seines**	**Total catch**	**Purse seines**	**Total catch**	**Purse seines**
Catch (t)	3 229	1 701 (53%)	4 540	3 120 (69%)	1 792	1 017 (57%)
Price (LL/kg)	5 733	2 167	4 370	1 424	7 308	4 623
Value (million LL)	18 511	3 686 (20%)	19 839	4 445 (22%)	13 102	4 705 (36%)
CPUE (kg/day)	19.1	372	28	600	23	549

t: tonnes
LL: Lebanese Lira

Source: MCR–IOE–UOB.

On the other hand, the various initiatives implemented at different levels and which address gaps in the fisheries sector, have led to the adoption of a fisheries monitoring system by the DFW–MOA, namely the FLOUCA Web utility (Annexure I and III).

This Internet-driven system, functional since 2014, provided the first fisheries national report for Lebanon to be presented to FAO in the year 2014. The system offers a wide variety of statistical diagnostics that are in line with the latest requirements demanded by regional and international fisheries bodies (specifically FAO and GFCM). FLOUCA Web reported that the purse seine fishery represented more than 20 percent of the total national catch of Lebanon in 2014 and 2015 (Table 3).

TABLE 3
Comparison between total catch and the purse seine fishery in Lebanon for 2014 to 2015

	2014*			2015**		
	Total catch	**Purse seines <12 m**	**Purse seines >12 m**	**Total catch**	**Purse seines <12 m**	**Purse seines >12 m**
Catch (t)	2 989	609 (20%)	214 (7%)	7 305	1 608 (22%)	185 (2%)
Price (LL/ kg)	10 624	6 718	6 148	10 081	5 530	2 958
Value (million LL)	31 752	2 653	1 318	73 637	8 892	547
CPUE (Kg/ Day)	10.1	101.1	418.7	13.5	103.2	279.5

t: tonnes
LL: Lebanese Lira
* Official report presented by the DFW–MOA to FAO
**Unofficial report

Source: DFW–MOA.

The same challenges were encountered by the MOA rangers in collecting data for the different variables as required by the GFCM Task 1 reporting system. For both the MOA and the MCR–IOE–UOB, the new GFCM–DCRF simplified the data collection process, and in 2015 a new categorization of the fleet was adopted at national level. Mainstreaming data collection on a national level began in 2016 and currently experience is being gained so as to reduce gaps and increase accuracy and reporting.

In addition, Pinello and Dimech (2013) in their socio-economic study covering the Lebanese fisheries sector, calculated the total value of fish landings at LL 40.6 billion (USD 26.98 million). In terms of total catch, purse seiners represented the largest volume of landings (43.5 percent) with a total value of USD 2.9 million. Nevertheless, there is considerable difference in the value of landings between purse seines and other gears where the higher prices (71.9 percent of value of landings) were fetched by fleet segments with minor gear compared to low prices (10.9 percent of value of landings) of fish landed by purse seiners. The average price per kilogram was calculated at LL 2 100 (USD 1.4) for purse seines, compared to LL 13 200 (USD 8.8) recorded for other fleet segments. This shows that the economic value per tonne of fish caught by the segment with minor gear is about six times higher than that of the purse seine fishery. As previously stated, it is believed that, even though the fish caught by purse seines might be of good quality, their small size lowers their price in comparison to fish caught by other gears.

Value of products and of jobs created in value-added industries linked to the sector

In Lebanon, even though the purse seine fishery employs a lower number of fishers (403 fishers) compared to fisheries using other gears (Figure 3), it is considered to be a fishery with high CPUE. The best yield is by purse seiners with an average value of 0.1 liters of fuel consumed per 1 kg of fish caught (Annexure II). In terms of gross productivity per vessel, considering the annual yield per vessel, the best performance was by purse seiners which, on average, produce revenues of approximately LL 73 million (USD 49 000; Sacchi and Dimech 2013). Purse seiners sell their catch fresh on local markets with no added value from packaging or processing. The main auctions are located in the largest cities like Tripoli, Karantina-Beirut, Saida and Tyre. However, most purse seiners sell their catch at the Karantina auction in Beirut. Currently, the number of employees involved in the post-landing phase of production is not known. It is believed, however,

that with an efficient management plan additional value could be added to the products landed by purse seiners, with positive financial implications for fishers.

FIGURE 3
Comparing purse seiners and other categories of gear

Fishery Benefits	Minor gear <6m	Minor gear 6–12 m	Purse seine 6–12 m
Revenues (value of landings)	4.6 million	19.3 million	2.9 million
Number of fishers employed	513	2 312	403
Annual catch for human consumption	528 tonnes	2 210 tonnes	2 112 tonnes
Salary per crew	USD 3 261	USD 3 143	USD 2 210
Annual fuel oil consumption	641 8401	3 414 205 l	306 869 l
Catch per tonne of fuel consumed	0.8 t =	0.6 t =	6.9 t =
Catch per unit of effort (CPUE)	9.8 kg/day	10.2 kg/day	206.6 kg/day

Source: Pinello and Dimech, 2013.

2.4 Available knowledge on the status of fisheries resources

Targeted species

While purse seines usually target sardine species, many other species of commercial value are also caught (DFW–MOA–FLOUCA web; Table 4; Table 5). Two species of sardines, *Sardina pilchardus* (Plate 1) and *Sardinella aurita* (Plate 2), represent the main species targeted and caught by purse seiners in Lebanon.

TABLE 4
List of fish species caught (in tonnes) by purse seiners (6–12 m) in 2014

SPECIES \ MONTH	1	2	3	4	5	6	7	8	9	10	11	12	Total
Clupeidae (herrings, sardines nei)				0.2			80.1	67.8	34			2.1	184.2
Boops boops (bogue)							67.2	0.9					68.1
Sphyraena sphyraena (European barracuda)	5.9		9	1.2					3.5	26.8			46.3
Oblada melanura (saddled seabream)	4.5		5.7	16							5.9	0.9	32.9
Sphyraena chrysotaenia (yellowstripe barracuda)								0.4			27.4	1.5	29.3
Sardinella aurita (round sardinella)					14.2								14.2
Atherina boyeri (big-scale sand smelt)												0.2	0.2
Caranx crysos (blue runner)			2.3					0.2					2.5
Diplodus sargus (white seabream)	0.5										3.9	0.2	4.6
Epinephelus costae (goldblotch grouper)									1.1				1.1
Epinephelus marginatus (dusky grouper)	0.1												0.1
Lithognathus mormyrus (sand steenbras)	0.1							0.2					0.3
Liza aurata (golden grey mullet)	1.2		0.6						0.8				2.6
Mullus surmuletus (surmullet)	0.1												0.1
Penaeidae (penaied shrimps nei)									1.5				1.5
Scomberomorus commerson (narrow-barred spanish mackerel)	0.4												0.4
Seriola dumerili (greater amberjack)	0.1							1.2				0.2	1.5
Siganus rivulatus (marbled spinefoot)	0.8							0.1	2.3				3.2
Trichiurus lepturus (largehead hairtail)				0.7									0.7
Umbrina cirrosa (shi drum)	0.1											0.2	0.3
TOTAL	13.8		17.6	18.1	14.2		147.3	70.8	43.2	26.8	37.2	5.3	394.3

Source: DFW–MOA–FLOUCA web, 2014.

TABLE 5
List of fish species caught (in tonnes) by purse seiners (>12 m) in 2014

SPECIES \ MONTH	1	2	3	4	5	6	7	8	9	10	11	12	Total
Clupeidae (herrings, sardines nei)	62				25	24.8							111.8
Boops boops (bogue)					19	31							50
Seriola dumerili (greater amberjack)											16.8		16.8
Euthynnus alletteratus (little tunny)												14.4	14.4
Sphyraena chrysotaenia (yellowstripe barracuda)											12		12
Scomberomorus commerson (narrow-barred Spanish mackerel)												0.5	0.5
Sphyraena sphyraena (European barracuda)											7.2		7.2
Trachinotus ovatus (pompano)											1.7		1.7
TOTAL	62				44	55.8					37.7	14.9	214.4

Source: DFW–MOA–FLOUCA web, 2014.

Identifying small fish at the species level is quite challenging. Owing to difficulties in their identification by both fishers and rangers, small fish are generally grouped under Clupeidae for the purpose of data collection. In addition, the European anchovy (*Engraulis encrasicolus*; Plate 3) is also caught but no records are available because of misreporting. Fishers mainly report this species as a juvenile sardine species ("*bizri*"). To minimize confusion in species identification and reporting, the MCR–IOE–UOB produced a *Guide for Commercial Fish Species of Lebanon*. That covers 78 commercial fish species and is used by the DFW–MOA. The compilation of the Guide was undertaken through a letter of agreement (LOA) between the FAO-EastMed project and the UOB.

The European pilchard or *Sardina pilchardus* (Plate 1) is a marine pelagic fish that is widely distributed throughout subtropical seas, including the Mediterranean Sea and the Black Sea. It belongs to the family Clupeidae and is considered to be of important commercial value. Its body is sub-cylindrical with a rather rounded belly (the body is more compressed in juveniles). The pelvic fin is inserted well behind the dorsal fin origin, while the last two anal fin rays are enlarged. A series of dark spots can be seen along the upper flanks, sometimes with a second or even a third series below. It is strongly migratory and lives in schools, often rising to 10 to 35 m at night. It can reach a maximum length of 27 cm but is commonly caught at a length of around 20 cm (www.Fishbase.org).

PLATE 1

Sardina pilchardus

SOURCE: FISHBASE

Sardinella aurita is commonly known as the round sardinella (Plate 2). It is a marine pelagic fish that is widely distributed throughout the tropical and subtropical seas of the world, including the entire Mediterranean Sea and the Black Sea (Froese and Pauly, 2003). It belongs to the family Clupeidae and is considered to be of important commercial value. Its body is elongated, usually subcylindrical, but sometimes a little

compressed. Flanks are silvery with a faint golden midlateral line preceded by a faint golden spot behind the gill opening. It is also identified by a distinct black spot at the hind border of the gill cover. It is strongly migratory and lives in schools, often rising to the surface at night and dispersing. It can reach a maximum length of 30 cm but is commonly caught at a length of between 14 cm to 21.5 cm (www.Fishbase.org).

PLATE 2
Sardinella aurita

SOURCE: FISHBASE

Engraulis encrasicolus is commonly known as the European anchovy (Plate 3). It is a small pelagic fish that is distributed throughout the Mediterranean Sea and the Black Sea, as well as in several parts of the Atlatic. It belongs to the family Engraulidae. It is characterized by a pointed snout and a short maxilla. It is predominantly a coastal marine species, forming large schools. It can reach a maximum length of 20 cm but is commonly caught at a length of 13 cm (www.Fishbase.org).

PLATE 3
Engraulis encrasicolus

SOURCE: FISHBASE

The aforementioned three species are among the top five species in terms of landing totals and percentages in the Mediterranean, including the Eastern Mediterranean Basin (Table 6).

TABLE 6
Mediterranean top five landings for 2009, 2010 and 2011

SPECIES	Total landings in the mediterranean (tonnes)	% of total landings in the mediterranean	Western mediterranean	Central mediterranean	Eastern mediterranean
European pilchard *(Sardina pilchardus)*	178 860	19.47%	60.19%	77.23%	26.31%
European anchovy *(Engraulis encrasicolus)*	124 293	13.53%	34.50%	76.54%	26.80%
Bony fish (*Osteichtyes*)	60 902	6.63%	NA	NA	NA
Round Sardinella (*Sardinella aurita*)	52 756	5.74%	NA	NA	25%
Jack and horse mackerels (*Trachurus* spp.)	42 348	4.61%	NA	NA	NA

Source: Lleonart, 2015.

Geographical distribution of the species

Sardinella aurita and *Sardina pilchardus* are caught all along the Lebanese coastline. They are considered to be candidates for shared stocks between Lebanon and the surrounding countries (EastMed, 2011). The Lebanese coastline is short in length (225 km) and does not show pronounced biotic or abiotic differences. Therefore, it is assumed that different fish species are found in similar quantities along the coastal zone. No specific habitats have been defined for sardine species to date and information about their migratory behaviour is lacking.

Annual catches from the earliest time available

The historical fish catch reconstruction study for the years 1950 to 2010 by Nader, Indary and Moniri (2014) estimated the total catch of Lebanon to be 7 100 tonnes for 2010. It revealed that the total reconstructed catches were dominated by the family Clupeidae (23 percent), followed by Scombridae (18.8 percent), Sparidae (11.5 percent), and Carangidae (9.6 percent). These results are highly indicative because these species represent 62.9 percent of the total reconstructed catch (Nader, Indary and Moniri, 2014) and are considered to be the main species targeted by purse seiners (Bariche *et al.*, 2007). Because Clupeidae are the main family caught, it is understandable that fishers use the term "sardine fishery" to indicate the purse seine fishery.

In another study by Bariche *et al.* (2007), it was found that Clupeidae comprise more than 55 percent of the total number of fish caught by purse seiners. The study also emphasized that most fish landed by purse seines and lampara nets are juveniles. This could be a consequence of several factors, such as that fishing takes place in shallow waters and nursery areas, that adult fish are concentrated in deeper zones or in areas far away from the Lebanese coast, and/or a lack of interest from consumers in large or middle-sized fish (Bariche, Alwan and El-Fadel, 2006; Bariche *et al.*, 2007).

MCR–IOE–UOB, through its FLOUCA utility, has been monitoring Clupeidae landings since 2006 in North Lebanon (Table 7). Up until 2014, all sardine species were grouped under Clupeidae because of the difficulty fishers experienced in identifying the different species. This was overcome with the Guide for Commercial Fish Species of Lebanon and data for 2015 is currently being processed accordingly. In addition, during 2006 and 2009, purse seines were logged under the "nets" category. Given the changes introduced to the utility over the years, catch data from North Lebanon is only reported for the period 2010 to 2013.

TABLE 7
Clupeidae purse seine fishery in North Lebanon from 2010 to 2013

	2010	2011	2012	2013
Catch (t)	606	425	2 293	995
Price (1 000 LL/kg)	1.6	0.5	1.1	2.5
Value (million LL)	992	232	2 526	2 544
CPUE (kg/day)	234	141	441	251

t: tonnes
LL: Lebanese Lira

Source: MCR–IOE–UOB.

On a national level, data for Clupeidae species and *Sardinella aurita* caught by purse seiners was collected by the DFW–MOA during 2014 and 2015 (Table 8). Unidentified sardines were grouped under Clupeidae, and only *Sardinella aurita* was easily identified and therefore appears independently in the database. Yearly fluctuations in catch data observed may be due to several reasons, including:

- The novelty of the data collection method to the MOA rangers. This is expected to improve dramatically with experience gained.

- The 2006 oil spill resulting from the Israeli War on Lebanon may have negatively affected the reproduction and recruitment of both species. However, the impact was not assessed at species level.
- The difficulty in collecting data after 2014, given the level of detail required by the GFCM–Task 1 system as previously explained (Section 2.3).
- Natural fluctuations in fish stocks due to ecological conditions in the East Mediterranean. Such conditions and their impacts off the Lebanese coast have not been assessed.
- Increasing pressure on the stocks from the surrounding countries. Stocks of these species are candidate shared stocks between Lebanon and nearby countries (EastMed, 2011). The drop in catches recorded in Lebanon might be the result of increased fishing pressure in neighbouring countries.
- More efficient gear used by fishers after 2009 dramatically increased the catch. This aspect should be investigated to better understand the increase in landings for all Clupeidae species.

TABLE 8
Clupeidae and *Sardinella aurita* caught by purse seines in Lebanon in 2014 and 2015

		2014*		2015**	
	Family/species	**Purse seine 6–12 m**	**Purse seine >12 m**	**Purse seine 6–12 m**	**Purse seine >12 m**
Catch (t)	Clupeidae	184	111	826	159
	S. aurita	14	-	86	-
Price (1 000 LL/kg)	Clupeidae	2.6	2.8	2.3	2
	S. aurita	10	-	2.5	-
Value (million LL)	Clupeidae	482 629	313 100	1 883	332
	S. aurita	141 714	-	216	-
CPUE (kg/day)	Clupeidae	131	1 215	118	439
	S. aurita	20	-	53	-

t: tonnes
LL: Lebanese Lira
* Official report presented by the DFW–MOA to FAO
**Unofficial report

Source: DFW–MOA–FLOUCA web, 2014.

During the EAF First Stakeholder Meeting (15 March, 2016), the fisher cooperatives of Dora and Ouzaii claimed to have purse seine landing records for previous years. During a preliminary visit (28 June 2016), Mr Fadi Najem, secretary of the Cooperative of Vessel Owners and Professional Fishermen of Mount Lebanon Coast, located at Dora Port, stated that boat owners and fishers share profits equally (50 percent for each) and therefore they both keep auction bills for double-checking. He offered to provide the EAF team with all available information for at least two purse seiners for the past five years (2011 to 2016). In addition, Mr Taleb Haraki, president of the Syndicate of Fishermen of Ouzaii and Neighboring Ports presented the logbook kept by the cooperative for all auctions held since 2011 and is ready to provide the data to the EAF team. The main challenge is that both datasets are in hard copy format and require tremendous time and effort to be digitized. If this can be accomplished, it will shed important light on the purse seine fishery in Lebanon.

Status of the stocks

With the support of the FAO-EastMed project, and in collaboration with the DFW–MOA, the CNRS–NCMS team is currently holding a stock assessment on *Sardinella aurita* in Lebanon. The study is ongoing but initial results show that the species is

under fishing pressure. This finding is consistent with the results presented during the GFCM meeting in November 2015 (Report of the Working Group on Stock Assessment of Small Pelagic species; available at http://www.fao.org/gfcm/reports/technical-meetings/en/). Authored by Dr Sherif Jemaa *et al*., the report's preliminary conclusions showed that the sardine fishery in Lebanon is slightly overfished (mortality of Gislason: E= 0.46 > than 0.4 exploitation ratio; personal communication, Dr Sherif Jemaa, CNRS–NCMS).

Also presented at the GFCM November 2015 workshop was compiled data from Lebanon, Egypt and Gaza that revealed that the stocks in the Geographical Subarea (GSA) 27 are also overfished (mortality of Gislason: E=0.54 > than 0.4 exploitation ratio; personal communication, Dr Sherif Jemaa, CNRS–NCMS).

The results for Lebanon are currently being validated through an in-depth stock assessment exercise currently being carried out by the CNRS–NCMS Lebanon (Annexure I).

Direct interactions with other fisheries

Some of the species targeted by purse seiners are commonly caught by various entangling nets which creates competition and tension between fishers. The fishers blame purse seines for the drop in the catch and abundance of many species of commercial value. On the other hand, purse seiners state that they do abide by laws and decrees while other fishers do not. Currently, the Lebanese Fisheries Law stipulates that mesh sizes of less than 20 mm are illegal; however, the law also exempts nets targeting migratory species from any mesh size limitations. Purse seiners state that their nets have to be of small mesh size to catch the targeted species. Furthermore, purse seiners blame other fishers for using illegal small mesh nets and other destructive gears. They claim that this negatively impacts the whole resource, especially because there are no specific fishing seasons for other nets and there is a lack of law enforcement.

Bycatch is not reported in Lebanese small-scale fisheries and is believed to be of minor importance given the artisanal nature of the sector. Usually, fishers utilize their entire catch including the bycatch, either as food for their families or as fishing bait.

Direct interactions with the ecosystem

No information about the impact of the purse seine fishery on the surrounding ecosystem is available in Lebanon. Nevertheless, Tudela (2004) evaluated the impact of purse seines on protected and threatened species around the Mediterranean. Purse seines do not seem to have a serious impact on marine turtle populations in some areas of the Mediterranean basin, while in other areas the animals are caught and killed in significant numbers. The monk seal appears to be more vulnerable to static gears (stationary nets set on the bottom) and abandoned nets (the "ghost fishing" effect). Dolphins are not caught in large numbers by purse seine operations directed at tuna, or by purse seine fleets targeting small pelagic fish. Finally, marine bird species are affected in different ways, depending on the behaviour and feeding habits of each species. Certain species are negatively affected by purse seiners, while others take advantage of the bycatch generated by similar fishing practices (Tudela, 2004).

Problems experienced in the fishery

The MOA rangers cover all the main fishing harbours in Lebanon. Their main task is to enforce the Lebanese Fishing Law and its related decrees and ministerial decisions. Decree No. 346/1 of 2010 regulates the use of several fishing gears, including purse seines, describes the gear and defines the seasons and conditions for their use. Several obstacles stand in the way of the optimum enforcement of laws, with the lack of adequate staff, resources and logistics topping the list. Rangers also cover the forestry sector, creating a tremendous challenge in terms of time and resources management.

Recently, the MOA succeeded in purchasing four patrol boats for monitoring fishing activities at sea and started patrols in collaboration with the Lebanese Navy in May 2016.

2.5 Legal and administrative frameworks

The MOA was created in 1943. Within the Ministry, the DFW is responsible for the management of the fisheries sector. Decree No. 5246 "Organization of Ministry of Agriculture" issued on 30/6/1994 defined the role of DFW as:

- Marine and freshwater fisheries and game hunting affairs.
- Applied research on aquaculture and establishment of training centres in different locations and at its Institute of Oceanography and Fisheries at Batroun.
- Fishing licenses.
- Establishing and modernizing fishing ports and fish handling facilities in coordination with the Ministry of Transportation.
- Regulating the fishing sector by assigning fishing seasons and protected areas.
- Organizing and regulating diving clubs and protected areas.
- Improving the livelihood of fishers by organizing cooperatives and syndicates.
- Conducting applied research on aquaculture.
- Developing and modernizing fishing techniques.
- Providing training on fishing boats.
- Preparing extension programmes.
- Hatching and distributing adaptable fish species.
- Running trials on local and introduced fish species.
- Surveying game species.
- Preparing general guidelines to preserve game species and regulating their hunting in coordination with the Ministry of Environment.
- Growing of game species and running trials on them.
- Enforcing fishing and game hunting laws and regulations.

Furthermore, the MOA owns the Oceanography and Fisheries Institute at Batroun and the Anjar and Chouaifat Aquaculture Centres. It also provides technical support to regional Departments of Rural Development and the Forestry and Fisheries centers (DFW-MOA, personal communication).

The major problems affecting the fisheries sector are not limited to law enforcement. There is also an urgent need to update and enact new laws so as to remain consistent with scientific and technological advances. Certain legal texts are unclear which affects their effective implementation (UOB/UNEP/MOE, 2013) and many concepts were taken from international standards and applied to the Lebanese context without adequate consideration of the environmental, social and economic situation in the country. With respect to international treaties and conventions, not much has been implemented, primarily because of the lack of application decrees, resolutions and guidelines (UOB/UNEP/MOE, 2013).

The primary law regulating the fisheries sector is Law No. 1104 (issued by Decision) promulgated on 14 November 1921. The law:

- Prevents fishing inside harbours and docks, except fishing with rods and lines with a maximum of two hooks.
- Bans dumping of all materials that would spoil the water or agitate, intoxicate and/or poison the fish on the coast or in the harbours designated for fishing. This ban also applies to industrial plants on the coast which are prohibited from disposing waste into the sea, except in accordance with the terms of the permission that they request.
- Forbids the use of explosives in fishing.
- Bans the use of firearms for fishing without special permission, and orders that every firearm found on fishing vessels shall be impounded.
- Forbids forcing fish into fishing nets by muddying the waters by any means.

After 1921, several laws, decrees and decisions directly related to fisheries were promulgated (Table 9), with the most relevant being Law No. 2775 "Monitoring of coastal marine fishing" passed in 1929. This law manages the fishing sector by:

- Identifying fishing, delimiting coastal fisheries, monitoring coastal fisheries, designating staff.
- Various prohibitions, including prohibited places, prohibited times, types of overfishing.
- Fishing gears – prohibited gears.
- Measures related to the organization and monitoring of fisheries and fishing by several vessels.
- Special provisions related to safeguarding juvenile fish and conservation of fish and shellfish – minimum sizes of fish and shellfish to be fished, transported and sold.
- Prohibited baits – various prohibitions.
- Arrangements and precautions related to fishing operations.
- Measures for practicing fishing by rod and line.
- Fees for fishing licenses and fishing gears.
- Aquaculture Institute.
- Penalties.

TABLE 9
Laws and regulations related to the fisheries sector in Lebanon

Regulation	No.	Year	Title
Law	1104	14/11/1921	The determination of the coastal zone scope and penalties related to the infringement of fishing rules
Law	144/S	10/6/1925	Definition of Public Maritime Domain
Law	372	25/6/1926	Regulations relating to navigation, fishers and fishing boats
Law	2775	28/9/1929	Monitoring of coastal marine fishing
Law	3178	18/6/1930	The passage of foreign fishing vessels not covered by the French Mandate
Law	70/L.R	5/5/1937	Regulation of coastal fishing
Law	86/L.R.	3/5/1939	Safety of maritime navigation and conditions on ships
Law	95/L	9/5/1939	Regulating sponge fishing
Law	153/L.R.	14/7/1939	Prevention of docking, trawling, use of fixed or dredge nets in the area where the marine cable between Tunisia and Beirut reaches land
Law		23/9/1946	Labour law
Law		02/18/1947	Maritime trade law
Law		19/11/1947	Subjecting river fishing to licensing
Decree	11882	3/6/1948	Regulation of fishing in rivers
Decree	7993	3/4/1952	Syndicates regulations
Decree	16225	13/6/1957	Definition of maritime navigation
Decree	6349	16/3/1961	Organization of technical troupe to monitor and control forests, hunting and fisheries (repealed by Decree No. 9924 of 20/2/2013)
Decree	8371	30/12/1961	The organization of the MOA and identifying its cadre
Law		25/5/1962	Amendment of Article 2 of Law of 5/5/1954 related to marine fishing
Decree	10121	20/7/1962	Zoning and licensing requirements for extracting gravel and sand from the Public Maritime Domain
Decree	17199	18/8/1964	Putting into effect the draft law for cooperative associations
Decree	17614	18/9/1964	Exploitation of Maritime Public Domain not presently exploited
Decree	3401	11/12/1965	Cooperatives (repealed by Decree No. 2989 of 17/3/1972)
Decision	31/1	26/1/1966	Ratification of Lebanese Ports System
Decree	4809	24/6/1966	Regulating the occupation of the Public Maritime Domain
Decree	4810	24/6/1966	System of occupation of Public Maritime Domain

Regulation	No.	Year	Title
Decree	9791	4/5/1968	Putting into practice the draft law aimed at monitoring the beaches
Decree	11541	23/12/1968	Organization of the special service responsible for monitoring the coast within the Internal Security Forces
Decree	11618	4/1/1969	Establishment of cooperation division within the MOA
Decree	15649	21/9/1970	Regulation for extraction of sand and other materials from the Public Maritime Domain and from the seabed
Decision	93/1	16/6/1971	The conditions imposed on the use of buoys in the field of marine fishing, swimming and docking
Decree	2989	17/3/1972	Repealing Decree No. 3401 of 11/12/1965 regarding cooperatives and replacing it with new provisions
Decision	347/1	11/12/1972	Regulation of free diving fishing
Legislative Decree	138	16/9/1983	Determining the breadth of the territorial sea areas and the forbidden maritime zones
Law	64	12/8/1988	Conservation of the environment against pollution from harmful waste and dangerous materials
Law	89	7/9/1991	Determination of Marine Fishing Licenses fees – 1991 Government Fiscal Budget Law (Annex 9)
Decision	108/1	11/9/1991	Creating a protected fishing and hunting area within the premises of Anjar Centre
Decision	129/1	23/10/1991	Establish a national maritime protected zone at the Oceanographic and Fishing Institute in Batroun
Decision	281/1	19/11/1991	Ban on fishing of sponges for five years
Decision	209/1	21/11/1991	Organization of maritime navigation, functioning of the ports, the equivalence of vocation certificates and services required by the MOPWT for maritime navigation
Law	121	9/3/1992	Establishment of two nature reserves (on some of the islands in front of Tripoli Beach)
Decision	62/1	16/3/1993	Ban of sardine nets within specific conditions
Decision	63/1	16/3/1993	Ban on fishing of sponges for five years
Decision	229/1	13/10/1993	Regulating the use, under certain conditions, of the newly introduced *Kerkari* nets to Lebanon
Decision	32/N	24/3/1994	Organization of sailing of fishing and recreational vessels within the territorial waters and beyond
Decree	5246	20/6/1994	The organization of the Ministry of Agriculture and identifying its cadre and conditions of employment in some of the functions for this cadre and the ranks and salaries of its professional staff (Article 100 – DFW)
Decision	183/1	27/10/1994	Ban of fishing in Lake Qaraoun
Decision	226/1	14/12/1994	Distribution of fishing nets and gear among fishers' cooperatives along the Lebanese coast
Decision	47/1	13/3/1995	Distribution of fishing nets and gear among fishers' co-operatives along the Lebanese coast
Decision	98/1	19/5/1995	Distribution of nets and fishing gear to development committees in the places that could not set up cooperatives to date
Decision	60/1	31/7/1995	Defining the specific conditions for the use of *Kirkari* (*Cianciolo*) nets
Decision	61/1	31/7/1995	Defining the specific conditions for the use of sardine nets (*Lux*)
Decision	254/1	8/12/1995	Regulating fishing–diving sport
Decision	255/1	8/12/1995	Regulating fishing–diving sport institutes
Decision	261/1	20/12/1995	Distribution of fishing nets and gear donated by FAO to fishers' cooperatives
Decision	131/1	15/3/1996	Organizing work at Oceanographic and Fishing Institute at Batroun in collaboration with the CNRS
Decision	156/1	20/3/1996	Forming the Examination Committee to settle the situations of amateur scuba divers
Decision	234/1	20/5/1996	Defining medical form needed to practice scuba diving
Decision	71/N/96	3/7/1996	Establishment of marine fishing port in the region of Halat
Decision	77/N/96	10/7/1996	Organization of sailing of fishing and recreational vessels within the Lebanese territorial waters

Regulation	No.	Year	Title
Decision	324/1	22/7/1996	Amending Decision No. 156/1 of 1996 & Decision 254/1 of 8/12/1995
Decision	119/N/96	8/10/1996	Considering the area of maritime beach a fishing and recreational port
Decision	202/1	14/4/1997	Amending Decision No. 254/1 of 8/12/1995 regulating fishing–diving sport
Decision	381/1	25/11/1997	The activities programme of the Oceanographic and Fisheries Institute in Batroun
Decision	385/1	26/11/1997	Prohibition of fishing in river estuaries along the Lebanese coast
Decision	397/1	28/11/1997	Creation of a Fishing and Hunting Guidance Centre at the Institute of Oceanography and Fisheries in Batroun – Governorate of North Lebanon
Decision	398/1	28/11/1997	Creation of a Fishing and Fisheries Centre at the Institute of Oceanography and Fisheries in Batroun – Governorate of North Lebanon
Decision	1/18	2/2/1998	Establishment of Fisheries and Wildlife Extension Services Centers
Decision	50/1	6/3/1998	Settlement of situations for scuba divers holding diving certificates
Decision	115/1	23/6/1998	Organization of work at the Institute of Oceanography and Fisheries and defining the basis for cooperation with the CNRS
Decree	12841	7/8/1998	Organization of fishing and leisure ports, and regulation of their use and safeguarding
Law	708	5/11/1998	Creation of Tyr Coast Nature Reserve in Jaftlak Ras Al Ain – Tyr Real Estate Zone
Decision	279/1	19/11/1998	Ban on catching sea turtles
Decision	280/1	19/11/1998	Prohibiting fishing with beach seines along the Lebanese coast
Decision	281/1	19/11/1998	Ban on fishing of sponges for five years
Decision	290/1	23/11/1998	Defining the use of the sardine nets within specific conditions
Decision	291/1	23/11/1998	Restricting the use of *Kirkari* nets (purse seine) to specific conditions
Decision	42/1	24/3/1999	Organization of the hobby of underwater fishing
Decision	43/1	24/3/1999	Restricting the use of sardine and *Cianciolo* nets to specific conditions
Decision	78/1	29/6/1999	Amending article 4 of Decision No. 43/1 of 24/3/1999 regarding restricting the use of the sardine and *Cianciolo* nets to specific conditions
Decision	122/1	21/9/1999	Stop work for Decision No. 280/1 of 19/11/1998 prohibiting fishing with beach seines along the Lebanese coast
Decision	125/1*	23/9/1999	Prohibiting fishing of whales, seals and marine turtles
Decision	179/1	1/12/1999	Assigning classrooms for the disposal of official vocational agricultural school at the Oceanographic Institute
Decision	19/1	11/1/2000	Creation of a center for fishing, nursery and forestation in Abdeh in the Governorate of North Lebanon
Decision	267/1	27/11/2000	Stop work for Decision No. 280/1 of 10/11/1998 – Prohibiting fishing with beach seines along the Lebanese coast until 15/5/2001
Decision	126/1	23/5/2001	Regulating scuba diving sport
Decision	147/1	18/6/2001	Delegation of signing of the amateur scuba diving licenses
Law	444	29/7/2002	Protection of the environment
Decision	88/1	14/3/2003	Prohibition of fishing by beach seines along the Lebanese coast
Decision	127/1	9/5/2003	Stop work for Decision No. 88/1 of 14/3/2003 that prohibits fishing by beach seines along the Lebanese coast, until 15/5/2005
Decision	165/2T	23/7/2003	Establishing a cooperative for coastal protection and fishing and shellfish fishing in the province of Mount Lebanon
Decision	199/2T	19/8/2003	Establishing a cooperative for fishers in the Governorate of Mount Lebanon
Decision	321/1	31/10/2003	Stop work for Decision No. 88/1 of 14/3/2003 that prohibits fishing by beach seines along the Lebanese coast
Decision	15/1	21/1/2004	Legal sizes relating to fishing, transporting, buying and importing fish, shellfish and crustaceans in Lebanon

Regulation	No.	Year	Title
Law	571	11/2/2004	Permitting the government to join the Agreement to Preserve Cetaceans in the Black Sea, Mediterranean and the Contiguous Atlantic Area
Law	613	20/11/2004	Permitting the government to ratify the amendments to the Agreement Establishing the General Fisheries Commission for the Mediterranean
Decision	54/1	24/2/2005	Permission for DFW to catch marine organisms to conduct research
Decision	352/1	3/10/2005	Stop work for Decision No. 88/1 of 14/3/2003 that prohibits fishing by beach seines along the Lebanese coast for three years
Decision	104/FO	17/11/2005	Repeal of decisions regarding occupying riverine Public Domain
Decision	130/2T	13/6/2007	Establishing a cooperative for fishers in the Governorate of Mount Lebanon
Decision	408/1	2/11/2007	Defining types of marine fishing gears
Decision	1/1	1/1/2008	Stop work for Decision No. 408/1 of 2/11/2007 concerned with defining types of marine fishing gears
Decision	93/1	14/3/2008	Regulating scuba diving
Decision	459/1	14/8/2008	Establishing a port for marine fishing and excursion in the zone of Jall Al Bahr-Ain Almrayseh
Law	34	16/10/2008	Permission to the government to join the Convention on the Protection of the Marine Environment and the Coastal Region of the Mediterranean; which are the amendments made to the Protection of the Mediterranean Sea against Pollution
Decision	20/1	15/1/2009	Defining types of marine fishing gears
Decision	35/2T	5/3/2009	Establishment of a cooperative for the development of fishing in the Governorate of the North Lebanon
Decision	229/1	12/5/2009	Prohibiting the use of remains of slaughterhouses as feed for fish
Decision	346/1	15/7/2010	Regulating and defining some fishing types and gears
Decision	676/1	27/7/2011	Prohibiting fishing, transporting, selling and consuming of some fish species
Law	163	18/8/2011	Determination and announcement of the maritime areas of the Lebanese Republic
Decree	6433	1/10/2011	Delimitation of the Lebanese exclusive economic zone
Decision	952/1	26/10/2011	Hygienic regulations for fresh, chilled and frozen fish transport vehicles
Decision	8/1	4/1/2012	Regulating and defining some fishing types and gears (Fyke nets)
Decree	8633	7/8/2012	Fundamentals of environmental impact assessment
Decree	9924	20/2/2013	Organization of technical troupe to monitor and control forests, hunting and fisheries
Decision	792/1	16/8/2013	Amending Decision No. 108/1 of 1991 (creating a protected fishing and hunting area within the premises of Anjar Centre)
Decision	1154/1	9/12/2013	General conditions to protect cetaceans (repealed by Decision No. 215/1 of 16/3/2015)
Decision	1160/1	10/12/2013	General conditions for fishing sharks (repealed by Decision No. 215/1 of 16/3/2015)
Decision	1163/1	12/12/2013	Ban on catching seabirds
Decision	396/1*	12/5/2014	Ban on catching seabirds
Decision	482/1	9/6/2014	Correction of Article 2 of Decision No. 396/1 of 15/5/2014 (ban on catching seabirds)
Decree	639	18/9/2014	Joining the Integrated Coastal Zone Management Protocol in the Mediterranean emanating from the amendments to the Convention for the Protection of The Mediterranean Sea Against Pollution which was approved in Barcelona on 06/10/1995 and ratified by Law No. 34 Date 16/10/2008
Decision	1044/1*	25/11/2014	General conditions to protect cetaceans
Decision	1045/1*	25/11/2014	General conditions to catch sharks
Decision	215/1	16/3/2015	Repeal of Decision No. 1154/1 of 9/12/2013 and Decision No. 1160/1 of 10/12/2013
Decision	1234/1	31/12/2015	Amending Decision No. 952/1 of 26/10/2011 regarding hygienic regulations for fresh, chilled and frozen fish transport vehicles

* In accordance with GFCM recommendations

The FAO-EastMed report on the "Assessment of the fishing gears in Lebanon" (Sacchi and Dimech, 2011) described the legal status of fishing per gear. These regulations are mainly about gear/mesh sizes and fishing practices. For surrounding gears (purse seines and lampara nets), the law stipulates:

- No limitation on mesh size.
- No maximum length authorized.
- Maximum depth and maximum height 42.5 m (both).
- The use of this gear is forbidden from dawn till dusk.
- Maximum lamp power – 500 watts.
- The use of electricity generators is forbidden.
- The use of this gear is forbidden from 1 January to 15 April each year.

In the absence of integrating plans and laws related to several sectors exploiting resources on the Lebanese coastal zone, overlapping mandates and conflicting uses are negatively affecting the management of those resources. In addition to the MOA, several public authorities exert some kind of mandate related to the fisheries sector (Table 10; UOB/UNEP/MOE, 2013).

TABLE 10
Public authorities with mandates related to the fisheries sector

Public authority	Mandate
Ministry of Public Works and Transport	Vessel registration and seaworthiness and licensing for fishing vessels
Lebanese Central Administration of Statistics	Producing statistics related to natural wealth, including agriculture
Ministry of Finance	Maintains and publishes fish trade data (imports and exports)
Ministry of Environment	Protection of biodiversity and species from the risk of extinction
Ministry of Health	Quality of fisheries products for human consumption
Ministry of Interior and Municipalities	Enforcing related laws through the Internal Security Forces
Ministry of Defense	Enforcing related laws through the Lebanese Navy

It is worthwhile mentioning that currently there is a national policy for fisheries management aimed at the enforcement of laws, decrees and ministerial decisions, notwithstanding the overlapping of the jurisdictions of related public authorities. A new Lebanon Draft Fisheries Law has been formulated (Table 11) to replace Law No. 2775 of 1929. This draft law aims to minimize the overlapping of mandates of several ministries in relation to the management of marine and coastal resources and centralize it at the MOA. The fisheries sector is addressed in its entirety and clear definitions of terms and expressions related to fisheries management are provided.

Since the promulgation of laws in Lebanon requires several years, and due to the political/administrative situation of the country, the MOA is investing its efforts in implementing the current law despite its lack of sustainable development principles and until the stipulation of the new law (Table 11) and the promulgation of its application decrees (UOB/UNEP/MOE, 2013).

TABLE 11
Lebanon Draft Fisheries Law

Section	Chapter	Description
1. Definitions	1	Designates meanings of terms used in the draft law
2. Marine fishing	1	Fishing zones
	2	Prohibited locations
	3	Fishing vessels
	4	Professional fishers
	5	Fishing gear
	6	General rules for the use of fishing gear
	7	Professional coastal fishing licenses
	8	Professional distant and high seas fishing licenses
	9	Rules for recreational fishing
	10	Various prohibitions
	11	Time and location of fishing
	12	Special rules for the protection of living aquatic resources
	13	Foreign fishing vessels
3. Inland fishing	1	General policies
	2	Legal sizes and various prohibitions
4. Handling and marketing of various living aquatic resources	1	Post-harvest handling
	2	Living aquatic resources vending shops
5. Aquaculture establishments	1	Sets the procedure for the issuance of licenses for aquaculture operations
6. Preservation of the aquatic environment	1	Defines the role of the Ministry of Agriculture in the preservation of the aquatic environment
7. Fees	1	Sets the fees for all types of fishing, vending sites and aquaculture licenses
8. Monitoring, surveillance, pursuit, law enforcement and penalties	1	Monitoring, surveillance and pursuit
9. Establishment of division of fisheries and defining its jurisdiction	1	Defines under which Directorate the division will be established, its mandate and duties as well as the expertise of the required human resources

Source: DFW–MOA.

In addition, in 2014, the MOA produced a strategy for the years 2015 to 2019 under the framework of the Agriculture and Rural Development Programme (ARDP), funded by the EU (MOA, 2014). The strategy was set by integrating results of the SWOT (strengths, weaknesses, opportunities and threats) analysis carried out specifically for determining the strategy, and identified priorities and key issues. Regarding the fisheries sector, the strategy includes two actions:

- Improving the legal status of farmers and farmers' organizations through the preparation and enactment of a law and its organizational decrees to regulate the agricultural and fishing professions.
- Supporting investment in fisheries and aquaculture and improving the sustainable management of the sector.

The strategy also stated that in the next five years, the MOA is expected to contribute to:

- An increase in the number of registered fishermen from 6 000 in 2013 to 8 000 by 2019.
- An increase in the quantity of production per effort of fishing.
- An increase in the quantity of production of the aquaculture sector to 9 000 tonnes by 2019.
- An increase in the fish and aquatic stock over a period of ten years.

It is worth mentioning that presently there is no formal forum for discussions regarding the fisheries sector and for the implementation of the MOA strategy.

2.6 Management measures

Purse seines, in addition to several other gears, are currently managed according to the 2010 MOA Decision No. 346/1. Nevertheless, regulating purse seine nets (sardine/*Lux*, *Cianciolo/Kirkari*) started in 1993 with Decisions No. 62/1 and 229/1. Other decisions were issued in 1995 (60/1 and 61/1) and defined net heights. In 1998, Decision No. 290/1 defined mesh size to be a minimum of 8 mm x 8 mm for sardine nets and 20 mm x 20 mm for *Kirkari* nets. However, Decision No. 43/1 of 1999 limited the mesh size to a minimum of 6 mm x 6 mm for sardine (*Lux*) nets. Moreover, Decision No. 20/1 of 2009 defined net height to be 35 fathoms (64 m) for *Cianciolo/Kerkari* nets and 20 fathoms (36.6 m) for sardine nets. The regulation currently in effect – Decision No. 346/1 of 2010 that describes the gear (height, light, depth) and defines the legal season for fishing with purse seine sardine (*Lux*) nets – is summarized in Table 12.

TABLE 12
Management measures

Management measures	Description	Effectiveness
Required documents	• Boat registration deed • Navigation license • Fishing license • Fishers' ID	The major fishing ports are under the control of the Lebanese Army where fixed points are positioned
Spatial restrictions (e.g. closed areas, MPAs, etc.)	• Forbidden in depth above 25 fathoms (45.7 m) • Fishing activities are allowed beyond 500 m from coastline	Fishing is allowed beyond 500 m from shoreline. Deep water is a major challenge as continental shelf is narrow
Temporal restrictions (e.g. closed seasons)	• Forbidden from 1 January to 15 April • Forbidden during the day	Fishers requested to reconsider the closed season
Gear restrictions (e.g. forbidden gears, limits to mesh size, etc.)	• Net cannot be higher than 25 fathoms (45.7 m) • Mesh: >20 mm x 20 mm (for non migratory species) • Maximum four light holders can be used (500 Watt each) • Forbidden to use generators	Purse seines with large mesh size do not catch targeted species
Minimum fish size	• 15 cm (Decision No. 15/1 of 2004)	Sardine in Lebanon is commercialized and appreciated in small sizes. Large sardines are not attractive to consumers
Minimum mesh size	• There is no minimum limit for migratory species, including sardines, according to Law 2775 of 1929 • Sardine nets minimum mesh size of 6 mm x 6 mm is specified in Decision No. 43/1 of 1999	
Participatory restrictions (e.g. licensing, TURFs, etc.)	• No limits for numbers of fishing licenses	
Limits to fishing capacity (e.g. max. number of vessels; fleet reduction etc.)	• No limits for boat size and engine power	
Others	• Capture of protected and vulnerable species (whales, dolphins, marine turtles, sharks and rays, monk seals)	Bycatch is accidental in most cases for purse seiners

Compliance or enforcement problems being experienced in the fishery
According to DFW–MOA, one of the main challenges in managing the PSSF is the lack of reporting on violations. The MOA rangers work only during the day while purse seiners are strictly active during the night and land their catch very early in the morning. This tremendously limits the ability of the MOA rangers to effectively monitor the PSSF.

2.7 Main stakeholders

In Lebanon, there are 34 fishers' cooperatives under the General Cooperatives Union, grouped around 43 percent of vessel owners/operators. In general, the cooperatives do not function as a collective according to a defined plan, but operate mainly according to the initiatives of individuals. This means that such cooperatives are unable to make proper decisions for the benefit of fishers (CNRS, 2011). As for fishers' syndicates, five are active in the country (North, Beirut, Ouzaii, Saida and South). The role of the syndicates is to lobby for the improvement and development of the sector within Government. However, they do not appear to be capable of fulfilling their mission as evidenced by the socio-economic status of the fisher communities. In general however, syndicates and cooperatives do not differentiate between their relative roles and responsibilities towards the community. In addition to these two main stakeholders, several others have roles in the fisheries sector (Table 13; CNRS, 2011).

TABLE 13
Stakeholders involved in the fisheries sector

Stakeholders	Effect on the level of	Can affect the sector by
Fishers' syndicates	Lobby capacity	Improvement of lobby capacity
Fishers' cooperatives	Economic/quality of life	Improvement of lobby capacity
Local institutions	Policy approach	Local interests
Ministry of Environment	Environmental protection	Protection policy
Ministry of Agriculture	Sector consolidation	Sector governance
CNRS	Scientific research	Improvement of knowledge and staff professional capacity
Research institutes	Know-how and scientific research	Experiences exchange
Restaurants	Fresh products availability	High income
Mediators	Fresh products availability	High income
Consumers	Products quality and price	Human health
Banking system	Credit lines	Credit volume
International donors	Foreign policy	Bilateral relationship

Source: CNRS, 2011.

3. THREATS TO FISHERIES SUSTAINABILITY

The Lebanese coast is influenced by competing interests that affect the quality of coastal waters, ecological habitats and natural resources. Rapid demographic changes and urban sprawl have greatly increased the pressure on coastal resources and therefore negatively affected coastal biodiversity and the well-being of fisher communities. It is known that the Mediterranean region, including Lebanon, is an important tourist attraction and the coastal population of Lebanon increases dramatically in the summer. Consequently, the demand for marine products rises which creates considerable pressure on marine resources. A lack of information and documentation about the status of resources, which are essential for proper management, adds an additional challenge (Garcia and De Leiva Moreno, 2003; EastMed, 2010).

Other management challenges in Lebanon come in the form of invasive species, mainly entering from the Red Sea through the Suez Canal, and competing with native species (Figure 1; Nader, Indary and Boustany, 2012; Boustany, Indary and Nader, 2015). More than 5 percent of marine species in the Mediterranean are now considered non-native (Zenetos *et al*., 2012), with some of the invaders through the Suez Canal having been very successful colonizers of Mediterranean marine ecosystems (Golani, 2010; Zenetos *et al*., 2012). Galil *et al*. (2014) also state that the main routes for these species to the Mediterranean are the Suez Canal (53 percent) and vessels (24 percent). Invasive species are usually recorded after a relatively long period of migration and several of these species have drastically affected populations of native species (Aydin, 2011; Nader, Indary and Boustany, 2012; Otero *et al*., 2013; Boustany, Indary and Nader, 2015). Their introduction into the Mediterranean through the Suez Canal however, has created a relatively lucrative parallel industry for Levantine fisheries, in particular for species like the Kuruma prawn (*Marsupenaeus japonicas*) or the speckled shrimp (*Metapenaeus monoceros*).

3.1 Threats to ecological well-being

Research on the ecological impacts of unsustainable fishing practices in Lebanon is lacking. However, many of the globally known ecological effects of unsustainable fishing can be observed in the Lebanese fishing sector, including:

- Excessive quantities being fished thereby reducing the population size of certain species. This might be due to the challenges posed for law enforcement, coupled with a lack of stock assessments as scientific benchmarks for administrators.
- Bycatch of protected species. Several MOA decisions forbid catching protected species but no proper observations/records of bycatch for such species exist. Great effort is invested by the MOA rangers to control the catch and the marketing of protected species.
- According to Bariche, Alwan and El-Fadel (2006) there is excessive fishing of juvenile fish by purse seiners. In addition, Sacchi and Dimech (2011) stated that the use of entangling nets with illegal mesh size is widespread among Lebanese fishermen. These fishing practices are not sustainable and may have a serious negative impact on marine species including pelagic fish communities in this part of the Eastern Mediterranean.

3.2 Threats to community (human) well-being

The fisheries sector in Lebanon was neglected for decades. It is believed to be a dying sector with minimal economic value. Nevertheless, several recent initiatives were undertaken to elucidate the socio-economic situation of fishers and the availability and status of the resource (Annexure I). Purse seines present one of the major fisheries in the country. Pinello and Dimech (2013) showed that the total amount of revenue generated by the PSSF was USD 2.9 million, representing 11 percent of the national fisheries production value. Furthermore, a study conducted by the same authors in 2012 showed that this fishery includes 60 licensed purse seine and lampara net vessels. The DFW–MOA reported an additional 38 purse seines and lampara net licenses were issued between 2013 and 2016, making a total of 98 licenses, an increase of 63 percent. In addition, it is common practice for other fisheries to catch and use

sardines as bait. Therefore, it appears that the number of fishers involved in, and dependent on the PSSF is higher than currently reported in the available literature. In addition, their contribution to the fisheries national GDP is likely to also be higher than reported. If the resource becomes overfished and the stocks collapse, a whole economic sector that depends on fishing activities (carpenters, fishing gear suppliers, fish mongers, restaurants, etc.) will be negatively impacted, in turn threatening the well-being and the food security of the Lebanese people. An important and affordable source of protein will no longer be available. It is therefore highly recommended to evaluate the economic value and contribution of the PSSF to the fisheries sector (primary and secondary contribution), to the food security of the Lebanese population in particular, and to the Lebanese GDP in general.

3.3 Ability to achieve

Within the MOA, the DFW is responsible for the management of the fisheries sector. However, several public authorities share responsibility for fisheries. This creates overlaps and conflicting mandates that affect the management of the sector and its resources. In the absence of management plans for the entire fishery sector, including the PSSF, and given that the new Lebanon Draft Fisheries Law that will replace Law No. 2775 of 1929 is still pending, the ability of the MOA to achieve sustainable resource management is highly limited. The MOA primarily regulates the sector through the promulgation of decrees and ministerial decisions (Section 2.5). Even though this approach allows some form of regulation and management of the sector, it falls short of achieving long-term goals due to, among other things:

- Outdated laws and regulations.
- Unclear legal texts affecting the implementation of laws and regulations.
- International concepts applied to the Lebanese context but which ignore the environmental, social and economic situation of the country.
- Lack of issuance of decrees, resolutions and guidelines that allow for the application of international treaties and conventions.

On the other hand, the MOA has produced a strategy for the years 2015 to 2019 that includes two actions related to fisheries: 1) "Improving legal status of farmers and farmers' organizations through the preparation and enactment of a law and its organizational decrees to regulate the agricultural and fishing professions"; and 2) "Supporting investment in fisheries and aquaculture and improving the sustainable management of the sector" (Section 2.5). If these two actions are implemented, the ability of the MOA will increase substantially in terms of achieving fisheries management goals. Furthermore, the MOA lacks an adequate number of rangers who are fully dedicated to the fisheries sector. Currently, the rangers of the MOA are in charge of overseeing the use of both terrestrial (forests) and marine resources. Effort for monitoring and for data collection and processing is therefore dispersed and negatively affects the ability to achieve any agreed management goals. In consequence, achieving any management goals for the PSSF will require overcoming the many challenges identified in the current report with the main ones being (Section 2.6):

- Lack of reporting on violations by fishers.
- Limitations in the ability of the MOA rangers to monitor the PSSF.
- Syndicates and cooperatives do not differentiate between their relative roles and responsibilities towards the community.
- Purse seining is only allowed beyond 500 m while in some places the continental shelf is too narrow.
- Purse seines with large mesh sizes do not catch targeted species (juvenile sardines).
- In Lebanon, sardines are commercialized and appreciated in small sizes.
- There is a risk of bycatch for purse seiners.

The PSSF management plan that will be developed under the EAF will address identified challenges by suggesting practical, implementable solutions that will lead to the proper management of the purse seine fishery.

4. CONCLUSIONS

Even though the effort that has been invested in the research and development of the fisheries sector of Lebanon over the past decade is welcomed, studies that specifically address the PSSF are insufficient to provide a holistic overview of the fishery. The FLOUCA Web and the FLOUCA systems for monitoring fish landings operated by the DFW–MOA and the MCR–IOE–UOB respectively, have provided some essential, albeit preliminary and short-term data sets on catch and effort for the PSSF. These data sets have been supported by a few scientific publications by the American University of Beirut (AUB) and CNRS–NCMS researchers on the biology of sardine species and their associated fishing practices. In addition, some aspects of the sardine fishery were included in several reports on the socio-economics of the Lebanese fishery sector. These were published by the FAO-EastMed project. From this limited information, a number of conclusions may be drawn, including that purse seines are very effective in catching fish; that the PSSF has the highest CPUE in the fisheries sector of the country; that it employs a significant number of fishers; and that the fishery primarily catches juveniles. The latter point is very concerning, especially given that these juveniles fetch low average prices. This issue may be challenging to overcome because juvenile sardines are easily caught and are highly marketable, in contrast to the larger individuals. In the absence of fish processing plants, the prospect of re-focusing the fishery to catch large individuals for value-addition is not realistic at this stage.

Exacerbating such a situation is the legal context within which the fishery is managed. Although Lebanon has recently invested significant resources and effort in the development of fishery legislation, current laws and regulations regarding the fisheries sector in general, and the PSSF in particular, are outdated. The MOA has developed a new fisheries and aquaculture draft law to replace the almost 90-year-old Law No. 2775 of 1929 (Monitoring of fishing practices in coastal waters), but the draft law awaits its passing by the Lebanese parliament. This legal vacuum is leading to conflicts between the PSSF and other fishers and affecting the socio-economic status of all concerned.

Given the challenges identified, the PSSF is in need of extensive management and represents a prime candidate for the introduction of an EAF. This will allow resources to be sustained for future generations, while at the same time maintaining the livelihoods of fisher communities. Sustaining the resource while conserving ecosystem equilibrium will require the development of a management plan for the PSSF based on EAF principles, and the provision of adequate tools and resources to ensure its successful implementation. Experience gained can then be replicated in the management of other fisheries, and further enhance the productivity and maintenance of the sector with all the positive repercussions at ecosystem and socio-economic levels.

5. REFERENCES

Aydin, M. 2011. Growth, reproduction and diet of puffer fish *Lagocephalus sceleratus* (Gmelin, 1789) from Turkey's Mediterranean Sea Coast. *Turkish Journal of Fisheries and Aquatic Sciences*, 11: 589–596.

Abboud-Abi Saab, M. 2008. Tintinnids of the Lebanese coastal waters (Eastern Mediterranean). CNRS–Lebanon/UNEP/MAP/RAC/SPA. National Centre for Marine Sciences, National Council for Scientific Research. 192pp.

Bariche, M., Harmelin-vivien, M. & Quignard, J.-P. 2003. Reproductive cycles and spawning periods of two Lessepsian siganid fishes on the Lebanese coast. *Journal of Fish Biology*, 62: 129–142.

Bariche, M., Alwan, N. & EL-Fadel, M. 2006. Structure and biological characteristics of purse seine landings off the Lebanese coast (Eastern Mediterranean). *Fisheries Research*, 82(1–3): 246–252.

Bariche, M., Sadek, R., Al-Zein, M.S. & El-Fadel, M. 2007. Diversity of juvenile fish assemblages in the pelagic waters of Lebanon (Eastern Mediterranean). *Journal of Hydrobiologia*, 580: 109–115.

Bariche, M., Alwan, N., El-Assi, H. & Zurayk, R. 2009. Diet composition of the Lessepsian bluespotted cornetfish *Fistularia commersonii* in the Eastern Mediterranean. *Journal of Applied Ichthyology*, 25: 460–465.

Boustany, L., Indary, S. & Nader, M. 2015. Biological characteristics of the lessepsian pufferfish *Lagocephalus sceleratus* (Gmelin, 1789) off Lebanon. *Cahier de Biologie Marine*, 56: 137–142.

Brême, C.H. 2004. *Analyse situationnelle de la Pêche côtière. Aspects techniques, économiques, sociaux et commerciaux. Rapport mission au Liban TRANSTEC, CE*.

CNRS (National Council for Scientific Research). 2011. Sustainable aquaculture development and support to the fishery sector. Final Report of the CANA–CNRS Project "Establishing Monitoring and Sustainable Development of the Lebanese Sea". CNRS and Italian Ministry of Foreign Affairs.

Dimech, M., Barros, P. & Bianchi, G. 2014. What is the ecosystem approach to fisheries management? *Journal of Academic Documents for Fisheries and Aquaculture*, 3: 137–143.

EastMed. 2010. *Report of the sub-regional technical meeting on the Lessepsian migration and its impact on Eastern Mediterranean fishery*. EastMed Technical Documents No. 04. GCP/INT/041/EC–GRE–ITA/TD-04. Athens, EastMed. 140 pp.

EastMed. 2011. *Report of the first meeting of the Permanent Working Group on Stock Assessment, Demre, Turkey, 27 June – 1 July 2011*. EastMed Technical Documents No. 08. GCP/INT/041/EC–GRE–ITA/TD-08. Athens, EastMed. 50 pp.

FAO. 2003. *Fisheries management. 2. The ecosystem approach to fisheries*. FAO Technical Guidelines for Responsible Fisheries 4, Suppl. 2. Rome. 112 pp.

FAO. 2005. *Putting into practice the ecosystem approach to fisheries*. Rome, FAO. 76 pp.

FAO. 2012. *EAF toolbox: The ecosystem approach to fisheries*. Rome, 172pp.

Froese, R. & Pauly, D., eds. 2003. Fishbase [online]. [Cited 6 September 2018]. http://www.fishbase.org

Galil, B.S., Marchini, A., Occhipinti-Ambrogi, A., Minchin, D., Narščius, A., Ojaveer, H. & Olenin, S. 2014. International arrivals: widespread bioinvasions in European seas. *Ethology, Ecology and Evolution*, 26(2–3): 152–171.

Garcia, S. & De Leiva Moreno, I. 2003. Global overview of marine fisheries. Rome, FAO.

GFCM (General Fisheries Commission for the Mediterranean). 2014. GFCM data collection reference framework. Rome, FAO. 50 pp.

GFCM (General Fisheries Commission for the Mediterranean). 2016. The state of Mediterranean and Black Sea fisheries. Rome, FAO. 152 pp.

Golani D. 2010. Colonization of the Mediterranean by Red Sea fishes via the Suez Canal – Lessepsian migration. *In* D. Golani & B. Appelbaum-Golani, eds. *Fish invasions of the Mediterranean Sea: change and renewal*, p. 145–188. Sofia-Moscow, Pensoft Publishers.

Jemaa, S., Bacha, M., Khalaf, G., Dessailly, D., Rahbi, K. & Amara, R. 2015a. What can otolith shape analysis tell us about population structure of the European sardine, *Sardina pilchardus*, from Atlantic and Mediterranean waters? *Journal of Sea Research*, 96: 11–17.

Jemaa, S., Dussene, M., Cuvilier, P., Bacha, M., Khalaf, G. & Amara, R. 2015b. *Comparaison du regime alimentainre de l'anchois (Engraulis Encrasicolus) et de la sardine (Sardina pilchardus) en Atlantique et en Mediterranee. Lebanese Science Journal*, 16 (Special Issue): 7–22.

Kouyoumjian, H. & Hamze, M., eds. 2012. Review and perspectives of environmental studies in Lebanon. INCAM-EU/CNRS. Lebanon. 328pp.

Lakkis, S. 2011a. *Le Phytoplancton Marin du Liban (Mediterranee Orientale), Biologie, Biodiversité, Biogéographie. Beirut, Publications de l'Université Libanaise*. 303 pp.

Lakkis, S. 2011b. *Le Zooplancton Marin du Liban (Mediterranee Orientale) Biologie, Biodiversité, Biogéographie. Beirut, Publications de l'Université Libanaise*. 565 pp.

Lleonart, J. 2015. Mediterranean fisheries. Stocks, assessments and exploitation status. *In Mediterranean Yearbook 2015*. Barcelona, Spain. European Institute of the Mediterranean.

Majdalani, S. 2004. The present status of fishery and information system in Lebanon. GCP/INT/918/EC-TCP/INT/2904/TD-4.1. Fishery Statistics and Information system in the Mediterranean (MedFisis) Technical Document No. 4.1. 45 pp.

Majdalani, S. 2005. Census of Lebanese fishing vessels and fishing facilities. Bir Hasan, Ministry of Agriculture, Lebanon.

Malak, D.A., Livingstone, S.R., Pollard, D., Polidoro, B.A., Cuttelod, A., Bariche, M., Bilecenoglu, M., *et al.* 2010. *Overview of the conservation status of the marine fishes of the Mediterranean Sea*. The IUCN Red List of Threatened Species regional assessment 2010. Gland, Switzerland, International Union for Conservation of Nature (IUCN).

MOA (Ministry of Agriculture). 2014. Ministry of Agriculture Strategy 2015–2019. Government of Lebanon and EU Agriculture and Rural Development Programme.

Nader, M., Indary S. & Boustany L. 2012. *The Puffer Fish Lagocephalus sceleratus (Gmelin, 1789) in the Eastern Mediterranean*. EastMed Technical Documents No. 10. GCP/INT/041/EC–GRE–ITA. Athens, EastMed.

Nader, M., Indary, S. & Stamatopoulos, C. 2012. Assessment of the commercial fish species of the coast of north Lebanon 2006–2011. Proceedings of the International Conference on Land-Sea Interactions in the Coastal Zone, November 2012, Lebanon.

Nader, M., Indary, S., & Moniri, R. 2014. *Historical fisheries catch reconstruction for Lebanon*. Fisheries Centre, University of British Columbia Working Paper Series No. 2014–11. Vancouver, Canada, University of British Columbia.

Otero, M., Cebrian, E., Francour, P., Galil, B. & Savini, D. 2013. *Monitoring marine invasive species in Mediterranean marine protected areas (MPAs): a strategy and practical guide for managers*. Malaga, Spain, IUCN. 136 pp.

Pinello, D. & Dimech M. 2013. *Socio-economic analysis of the Lebanese fishing fleet*. EastMed Technical Documents No. 16. GCP/INT/041/EC–GRE–ITA/TD-16. Athens, EastMed. 81 pp.

Sacchi, J. & Dimech, M. 2011. *Report of the FAO-EastMed assessment of the fishing gears in Lebanon*. Lebanon, 18–22 July 2011. EastMed Technical Documents No. 9. Athens, EastMed. vi+47 pp.

Tudela, S. 2004. *Ecosystem effects of fishing in the Mediterranean: an analysis of the major threats of fishing gear and practices to biodiversity and marine habitats*. Studies and reviews. General Fisheries Commission for the Mediterranean No. 74. Rome, FAO. 44 pp.

UOB/UNEP/MOE. 2013. Environmental Resources Monitoring in Lebanon (ERML) project. Analysis of the Institutional and Legal Frameworks Related to Management and Monitoring of Coastal and Marine Areas. 89pp. (also available at http://erml.moe.gov.lb).

UN (United Nations). 2011. General Assembly 65th session (14 February 2011). *Oil slick on Lebanese shores*. Resolution adopted by the UN General Assembly (a/res/65/147), p. 181.

UNEP (United Nations Environment Programme). 2007. Lebanon rapid environment assessment for greening recovery, reconstruction and reform – 2006. Beirut, UNEP. 409 pp.

Walley, C. 1998. Some outstanding issues in the geology of Lebanon and their importance in the tectonic evolution of the Levantine region. *Tectonophysics*, 298(1-3): p. 37-62.

Zenetos A., Gofas, S., Morri, C., Rosso, A., Violanti, D., García Raso, E., Cinar, M.E. *et al.*, 2012. Alien species in the Mediterranean Sea by 2012. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part 2. Introduction trends and pathways. *Mediterranean Marine Science*, 13(2): 328–352.

Annex I

OVERVIEW OF THE FISHERIES SECTOR IN LEBANON

1 Status reports

Under the FAO-Medfisis project (2004–2005) a comprehensive report describing the state of the fishing sector in Lebanon entitled "*The present status of fishery and information system in Lebanon*" was published by the DFW–MOA (Majdalani, 2004). A census was initiated covering the whole Lebanese fishing fleet and serves as an essential and solid stepping stone for initiatives aimed at addressing the gaps and needs of the fisheries sector in the country (Majdalani, 2005).

2 Catch and effort initiatives

In 2006, the MCR–IOE–UOB launched a catch/effort data collection programme for the commercial fisheries of the Mohafaza (Governorate) of North Lebanon and Akkar, covering approximately 45 percent of the Lebanese coastline. Currently, information about fishing gear, species caught, volumes landed, price and size is collected on a weekly basis for commercial fish species from the four major ports of North Lebanon: Batroun, Qalamoun, Tripoli and Abdeh (Figure 4).

FIGURE 4
Fishing harbours where catch/effort data is collected by the MCR–IOE–UOB

Source: wikimedia.org

Gathered information is entered in the FLOUCA utility, allowing for the generation of monthly and yearly trends for catch, CPUE and average price for the monitored species, among other things. The main goal of the initiative is to establish long-term monitoring of commercial fish landings and effort. The FLOUCA utility was developed by the MCR–IOE–UOB, based on the generic software and standard statistical methodology made available on the Internet by FAO. This is expected to contribute to developing appropriate management plans based on scientific data, to protect the diversity of valuable marine biological resources and to sustainably benefit from the resource (Nader, Indary and Stamatopoulos, 2012; Nader, Indary and Moniri, 2014). Data collection has been on-going since 2006 and time series for a period of 10 years for all parameters is currently available.

Furthermore, the CANA project (Establishing monitoring and sustainable development of the Lebanese sea) is implemented by the CNRS (www.cnrs.edu.lb), through the NCMS. This project was funded by the Italian Cooperation for Development in Lebanon and Syria and the Lebanese Government. The main objective is to increase the knowledge of coastal and marine environments in order to achieve sustainable development and to prepare proper guidelines for an integrated coastal policy. In addition, the Italian Ministry of Foreign Affairs, in collaboration with the CNRS–NCMS and the CANA team, launched in June 2012 the project *PescaLibano* to provide "technical assistance to the MOA in the field of fishery development" (Nader, Indary and Moniri, 2014).

In 2013/2014, the project entitled "Pilot Survey on Fisheries Dependent Data Collection in Lebanon Including Training" was launched through a LOA between the FAO-EastMed project and the MCR–IOE–UOB. The objective was to improve and implement the national fisheries dependent data collection programme through training relevant staff of the Lebanese MOA through the expansion of the original FLOUCA into FLOUCA Web. The relevant staff of the MOA was trained on the different aspects of data collection and data entry. Field guides for commercial fish species and for fishing gear were developed, produced and delivered to simplify the data collection process. The FLOUCA Web application was expanded to function as an Internet-driven system and is quite transparent in its operations. It also offers a wide variety of statistical diagnostics that are in line with the latest requirements demanded by regional and international fisheries bodies, specifically FAO and the GFCM. FLOUCA Web is currently being piloted by the MOA prior to deciding whether to adopt it as its reporting system (Nader, Indary and Moniri, 2014).

The latest initiative was the signature of an LOA between the FAO-EastMed project and the MCR–IOE–UOB in 2015 for "The implementation of a pilot case study on the EAF in Lebanon". It aims to support the implementation of a pilot case study on the EAF in Lebanon within the framework of the FAO–EAF component and for the benefit of the MOA. The project focuses on the purse seine fishery (locally called the sardine fishery) that targets pelagic species, more specifically sardines, bogue, scomber, barracuda, anchovy, little tunny and many other species. The action is funded by the FAO-EastMed project "Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean" (GCP/INT/250/EC Year 6) and implemented in collaboration with the EastMed project, the MOA and FAO–Lebanon.

3 Stock assessment and biological studies

Stock assessment is an essential tool in fisheries management because it determines the status of stocks and the effect of exploitation on fish mortality, and can predict future trends, allowing fisheries managers to make informed decisions. In recent years, biological parameters and stock assessment studies in Lebanon have been undertaken for several selected species, providing a partial image of the status of resources. Studied species were selected according to their economic and ecological values.

Dr Michel Bariche at the AUB studied the structure and biological characteristics of several fish species landed by purse seines off the Lebanese coast (Bariche *et al.*, 2006; Bariche *et al.*, 2007). In addition, he studied the biological parameters and behaviour of other species, such as the Lessepsian *Signaus luridus*, *Signaus rivulatus* and *Fistularia commersonii* (Bariche, Harmelin-vivien and Quignard, 2003; Bariche *et al.*, 2009).

The MCR–IOE–UOB investigated the biology and growth of *Boops boops, Diplodus sargus sargus*, and *Lagocephalus sceleratus* and has conducted single species length-based stock assessments for the three species (2011 to 2012). This work investigated the status of the stocks of the commercial species *Boops boops* and *Diplodus sargus sargus* and the status of the population of the Lessepsian species *Lagocephalus sceleratus* (Boustany, Indary and Nader, 2015). The same study was repeated for *Boops boops* and *Diplodus sargus sargus* in 2014 to 2015 for comparative purposes and added the evaluation of the stock of *Portunnus pelagicus*. Results are currently being processed and are expected to be published in related scientific journals.

In addition, the CNRS–NCMS investigated the biological parameters of *Sardina pilchardus* and *Engraulis Encrasicolus* with a comparative study of specimens from Lebanon and France (Jemaa *et al.*, 2015a, 2015b). In 2015, the CNRS–NCMS, with the support of the FAO-EastMed project started assessing the stocks of *Lithognatus mormyrus, Pagellus erythrinus* and *Sardinella aurita*. Data is being collected and results will be published once the study is complete.

4 Historical fish catch reconstruction

The MCR–IOE–UOB collaborated with the Fisheries Center of the University of British Columbia (UBC), Vancouver, Canada, in order to reconstruct the Lebanese historical catch for Lebanon for the period 1950 to 2010, based on available historical data. The study states that the total sum of catches – those of subsistence, commercial and recreational origin – is 345 000 tonness for the period 1950 to 2010, which is 2.4 times the 141 000 tonnes reported by the FAO on behalf of Lebanon. The reconstructed peak in catches was for the year 2010 with a total landing of 7 100 tonnes (Nader, Indary and Moniri, 2014).

5 Socio-economic initiatives

A preliminary assessment of the socio-economic situation of the Lebanese fisheries sector was undertaken in 2012/2013, funded and supported by the FAO-EastMed project. In order to undertake such an assessment, an economic survey based on direct interviews was conducted from March to May 2012. The study was split into two phases. In the first phase, the information on the technical characteristics of the present fleet was obtained. This was then followed by the second and main phase, which included the socio-economic sample survey and the socio-economic analysis. The results showed that in general, the Lebanese fishing fleet is making a profit of about 24 percent of the revenue that is comparable to other fleets in the Mediterranean with similar characteristics. The income per fisher–owner (USD 7 400) and fisher (USD 3 000) is 20 percent and 70 percent less, respectively, than the national GDP per capita. Furthermore, the analysis showed that a fisher earns about 25 percent less than the minimum wage of the country (Pinello and Dimech, 2013).

6 Capacity building and awareness raising initiatives

The ReadyMed Fish project (http://www.readymedfish.eu/the-project/) is co-financed by the European Programme ENPI CBC MED (European Neighbourhood and Partnership Instrument for Cross-Border Cooperation in the Mediterranean) and implemented under the ENPI CBC Med Programme under the second call for standard projects. Project partners include *Lega Pesca* (Italy, beneficiary); *Regione Puglia*–Policies Area for Rural Development (Italy); Mediterranean Agronomic Institute

of Bari (Italy); General Direction of Fishing and Aquaculture (Tunisia); Fishery Development Group in Ajim Djerba (Tunisia); General Authority for Fishes Resource Development (Egypt); National Union Cooperative Fish Resources (Egypt); Ministry of Agriculture – Directorate of Rural Development and Natural Resources (Lebanon); and Cooperative Association for Fishery in Sahil Khaizarane (Lebanon). The project started in November 2013. ReadyMed Fish aims "at enhancing the professionalization of young fishery operators to boost the private entrepreneurship and at improving the normative framework of the Mediterranean fishery sector multifunctionality". Fishers and other related persons delegated by the MOA participated in different project activities. In addition, nine "Information and Assistance Desk" offices were established in Lebanon to provide fishers with guidance for achieving the project goals. Other activities and outcomes generated by the ReadyMed Fish Project were:

- Revision of the Lebanese fisheries legislation and elaboration of normative proposals.
- A territorial strategic plan for sustaining small-scale fisheries activity in Lebanon (with a special focus on the area of Sarafand).
- Training on multifunctionality:
  - MOA staff training in Bari, Italy
  - local fisher training in Bari, Italy
  - localization of training toolkit on multifunctionality
  - training young fishers in Lebanon (12 sessions).
- Fisher meetings (geographical action groups).
- Realization of a photobook for fishery activities in ReadyMed Fish Project partner countries.

In addition, Lebanon was a partner in the Mediterranean network of sustainable small-scale fishing communities (FISHINMED; http://www.fishinmed.eu/en) project, funded by the ENPI CBC MED Programme and implemented by public administrations and research institutions: Apulia Region – Regional Ministry for Agro-Food Policies – Department of Hunting and Fishing (Italy) as lead partner; Mediterranean Agronomic Institute of Bari (Italy); LAORE Regional Agency (Italy); Sicily Region Department of Fisheries (Italy); Hellenic Centre for Marine Research (Greece); Ministry of Agriculture – General Direction of Fishing and Aquaculture (Tunisia); Agricultural Research Center – Central Laboratory for Aquaculture Research (Egypt); and DFW–MOA, Lebanon. The project duration was three years, from November 2011 to November 2014, but was extended until October 2015 and implemented in Lebanon by the DFW– MOA. FISHINMED aimed "to favour the social and economic development of small fishing communities by promoting the diversification of economic activities and the integrated enhancement of coastal territories, thus increasing employment opportunities as well as preventing the uncontrolled exploitation of sea resources". Some outputs of this project were as follows:

- Regulatory framework
  - database collection of the legislative framework
  - working document for the improvement of the regulatory framework (Arabic).
- "Multifunctionality experiences in the small-scale fisheries sector in the Mediterranean Basin". Mediterannean Basin multifunctionality report with 82 small-scale fisheries multifunctionality best practices database.
- Socio-economic survey and database for fishing communities along the Lebanese coast.
- Six fisher meetings.
- Local desk and charter of service.
  - Training of operators.

- "Survey and analysis of the environmental, cultural and landscape attractions of coastal territories".
- Development of a service charter.
- Development of a Local Development Strategy.
- Establishment of a Small-scale Fishery Regional Desk (SSFRD) with the purpose to provide technical and administrative information to people and stakeholders that could be directly and indirectly interested in the versatility of the services and activities. It is addressed to tourists, ordinary people, fishing-related companies and bodies as well as all the parties that could be a part of this service charter activity.

In addition, some lectures were given about the importance of multifunctionality in the fishing sector in Lebanon and its contribution to sustainable development and the creation of new business opportunities and a better livelihood for fishers.

Annex II

TOTAL AND MAIN CHARACTERISTICS OF THE LEBANESE FISHING FLEET IN 2011

TABLE 14

Values for number of vessels, engine power (hp), length overall (m), fishing days, fuel consumption (LL 1 000), volume of landings (t), value of landings (USD 1 000) and employment onboard.

The values in parenthesis show the standard error of the mean. Differences between fleet segments were tested using one-way ANOVA. Bold P values indicate significant differences between the fleet segments.

Fleet characteristics	Minor gear with engine <6 m	Minor gear with engine 6–12 m	Purse seine 6–12 m	Total fleet	ANOVA P value
Capacity					
Number of vessels	355	1 045	60	1 460	
Total engine power (hp)	7 261	32 531	3 538	43 330	
Total length overall (m)	1 750	8 386	584	10 720	
Mean technical characteristics of the vessels					
Mean power (hp)	22.0 (±0.93)	31.4)±1.04)	62.1 (±9.17)	30.5 (±0.89)	**<0.05**
Mean length (m)	4.9 (±0.04)	8.0 (±0.05)	9.7 (±0.29)	7.3 (±0.05)	**<0.05**
Mean vessel age	20.8 (±0.06)	23.1 (±0.38)	17.0 (±0.99)	22.3 (±0.31)	**<0.05**
Total landings					
Volume of landings (tonnes)	528	2 210	2 2112	4 850	
Value of landings (USD 1 000)	4 632	1 398	2 949	26 979	
Mean landing variables per vessel in 2011					
Mean landings (tonnes)	1.5 (±0.16)	2.1 (±0.14)	35.2 (±8.12)	3.3 (±0.26)	**<0.05**
Mean landings (USD 1 000)	13.1 (±1.9)	18.6 (±1.10)	49.2 (±8.59)	18.5 (±0.82)	**<0.05**
Total effort					
Fishing days	53 822	217 244	10 221	281 287	
Fuel consumption (1 000 L)	642	3 414	307	4 363	
Mean effort variables per vessel					
Mean fishing days	152 (±11)	208 (±5)	107 (±16)	192 (±4)	**<0.05**
Mean fuel consumption (1 000 L)	1.81 (±0.18)	3.27 (±0.16)	5.11 (±0.56)		
Total crew or employment					
Employment on board (total)	513	2 312	403	3 229	
Employment on board (PT)	355	1 145	2	1 502	
Mean employment variables per vessel					
Mean employment on board (total)	1.45 (±0.08)	2.21 (±0.06)	6.72 (±0.89)	2.40 (±0.5)	**<0.05**
Mean employment on board (part time)	1.00 (±0.00)	1.10 (±0.02)	0.04 (±0.03)	0.57 (±0.01)	**<0.05**

Source: Pinello and Dimech, 2013.

Annex III

FLOUCA WEB

A web-based utility for monitoring small-scale fisheries

The EastMed Project (www.faoeastmed.org) executed by FAO in collaboration with the MOA in Lebanon, is supporting the development of regionally consistent fisheries management plans in the Eastern Mediterranean countries. Within this context, an agreement was signed in 2012 between the FAO-EastMed project and the MCR–IOE–UOB to initiate a "Pilot survey on fisheries dependent data collection in Lebanon including training". The MCR–IOE–UOB contributed to improving and implementing the national fisheries dependent data collection programme through training relevant staff of the Lebanese MOA. The data collection programme entailed reconfiguration of the FLOUCA utility into a web-based utility to serve as the official fish catch reporting system for the Lebanese Government to FAO.

FLOUCA Web is based on the original FLOUCA utility adopted by MCR–IOE–UOB after 2006 for monitoring the artisanal fisheries sector in North Lebanon. FLOUCA was modified into FLOUCA Web and updated to meet national and FAO–GFCM reporting needs.

FLOUCA Web is one of the main fisheries catch/effort monitoring programmes in Lebanon. It operates as an Internet-driven system with outposts at selected major ports on the Lebanese coastline. FLOUCA Web has advanced security features and accommodates four levels of users: administration, data operations, privileged users and public users. Data inputting and estimations are performed locally but are visible throughout the network. FLOUCA Web is robust and fairly error-free due to several options provided by the system. It also offers a wide variety of statistical diagnostics that are in line with the latest requirements demanded by regional and international fisheries bodies (specifically FAO and GFCM). Data exchange is an integral component of the system in order to regularly submit GFCM-related records.

FLOUCA Web functions in English but was developed to also perform in French and Arabic (translation of commands and functions is still required; the two languages to be used for diffusing reports to regional and international fisheries bodies). The system was modified and updated throughout the period of the project according to the needs and feedback of data collectors. Access to FLOUCA Web administration, data operations and privileged user functions requires a valid user name and a password. FLOUCA Web is 100 percent Internet-driven and enabled, so that it is able to run from all standard Internet browsers. Currently, it is characterized by:

- Its optimization for web retrieval/updates.
- Its user-friendliness, with smooth movement between forms to complete the desired tasks, and it provides smart tips and error messages to help users.
- In view of the fact that its users are not expected to be information technology specialists, FLOUCA Web is intuitive and easy to follow and incorporates the use of uniform function key commands.

FLOUCA Web has been functional since 2014. It covers the fisheries sector of Lebanon and is a useful tool for administrators, allowing them to monitor and manage small-scale fisheries. It can be adapted to the needs of any country around the Mediterranean and beyond.

This technical paper presents a baseline report for the small-scale purse seine fisheries in Lebanon. It documents all the available information about the fisheries, including the species fished, the geographical areas covered, the socio-economic characteristics of the fisheries and the institutional arrangements for their management. The baseline report was prepared under a pilot case study on the ecosystem approach to fisheries in Lebanon. The case study was implemented within the framework of the FAO Mediterranean Project EastMed (Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean).

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of FAO and can in no way be taken to reflect the views of the European Union.

ISBN 978-92-5-132125-6 ISSN 2070-7010

9 789251 321256

CA7533EN/1/02.20