Republic of Lebanon
Ministry of Environment

UN environment MAP SPA/RAC

National Monitoring Programme for Fisheries in Lebanon (EO3)

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Acronyms

FAO: Food and Agriculture Organization of the United Nations

MoA: Ministry of Agriculture

CNRS: National Council for Scientific Research

NCMS: National Center for Marine Sciences

CPUE: Catch Per Unit Effort

SSB: Spawning Stock Biomass

IE: Initial Evaluation

EM: Eastern Mediterranean

EO: Ecological Objective

GFCM: General Fisheries Commission for the Mediterranean

DCRF: Data Collection Reference Framework

I. Past and existing monitoring activities

The fisheries sector in Lebanon is known by its slow growth and lack of data. Lebanese fishing techniques need an enhancement in order to improve this particular field (Sacchi and Dimech 2011). A total of 44 ports are located along the coast of Lebanon with 7 main ones. There are 1460 licensed vessels with 98% small scale (<12m). Most fishing fleets are artisanal with no good conservation of the catch. Though the construction is acceptable, yet fleets are not prepared to face harsh environmental conditions.

According to Majdalani (2004), no general census of the fishing sector was done since 1963. Three sample-based surveys have been performed during 2000, 2001 and 2002. Lately, "the Census of Lebanese Fishing Vessels and Fishing Facilities" published in 2005 and carried out within the framework of the project Medfisis updated the fishery statistics (Majdalani 2005).

According to Pinello and Dimech (2013) the Lebanese fishing fleet consists of 1,460 licensed commercial fishing vessels. The marine capture fisheries production in Lebanon in the last 10 years was around 3,500 tons per year. The data was derived from the Food and Agriculture Organization of the United Nations (FAO) - Fisheries and Aquaculture Department. From 2006 on-wards the production has remained constant at 3,541 tons due to the fact that Lebanon has stopped sending data to FAO.

Rare were the studies dealing with the sustainable development of fisheries in Lebanon whether by the Ministry of Agriculture (MoA) or the Lebanese National Council for Scientific Research (CNRS). A preliminary report "Analysis of the Fishing Sector of Tyre" (Lelli 2005) had already described the technical aspect of fisheries in Tyre and provided information on the fleet composition. Moreover, a more recent study of the fisheries sector is presented in a doctoral thesis (2011) that focuses also on the human-socio-economic aspects of the fishing communities (Fakih 2011). Colloca and Lelli (2012) assessed the potentiality of offshore fishing grounds for local artisanal fishery and conducted a short survey in the area between Tyre and Naqoura in the south, using both monofilament gillnets to target hake (*Merluccius merluccius*) and Spanish traps designed to catch the striped soldier shrimp (*Plesionika edwardsii*). More recently a 'socio-economic analysis of the Lebanese fishing fleet was also performed in the framework of the EastMed project of the Food and Agriculture Organization (Pinello and Dimech 2013). Between 2012 and 2013, the Italian CIHEAM PESCA Libano project with the involvement of the Lebanese Ministry of Agriculture and the National Center for Marine Sciences (NCMS) – CNRS assessed the potentiality of the marine coastal resources in order to support the Lebanese Government in strengthening the management of the marine resources. A survey in the framework of this project was done in 2012 and 2013, where three types of gears were lowered in 62 different sites along the coast of Lebanon and at depths ranging from 10 to 600 m. Two doctoral studies and one bilateral study involving population biology and distribution of fish were conducted between 2011 and 2015 in the NCMS. One study involved the identification of stock for anchovies and sardines using otholiths shapes (Jemaa 2014). The other study dealt with the biology, distribution and diversity of cartilaginous fish species along the Lebanese coast, Eastern Mediterranean (Lteif 2015). The bilateral study dealt with the population biology of *Lagocephalus sceleratus* along the Lebanese and Syrian coasts (Khalaf et al. 2014). Finally, data on catch has been collected by the Balamand University since 2005 only northern of Lebanon, and by the MoA since 2014 from different ports along the coast.

II. Fishery-related regulatory aspects/Legislation

National fishing legislation (Lebanese Ministry of Agriculture)

Decision 346/1 – 15/7/2010
Organizing and defining fishing gears and materials.
Decision 8/1 – 4/1/2012
Organizing and defining some fishing gears and materials.
Decision 1160/1 – 25/11/2014
General conditions of shark fishing.
Decision 952/1 – 26/10/2011
Sanitary conditions for the transportation vehicles of fresh, frozen, and cooled fish.
Decision 1234/1 – 31/12/2015
Related to the sanitary conditions for the transportation vehicles of fresh, frozen, and cooled fish.
Decision 202/1 – 14/4/1997
Organizing underwater spearfishing.
Decision 676/1 – 27/7/2011
Forbid the fishing, transportation, selling and consumption of some types of fish.

III. Monitoring programme of fisheries in Lebanon (National Level)

1. Objectives of the monitoring programme

The main objectives of the programme are to determine that the populations of selected commercially exploited fish and shellfish are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock

(ecological objective 3 " Harvest of Commercially exploited fish and shellfish"),

This programme is important to ensure the sustainability of commercially exploited fish stock by artisanal fisheries along the Lebanese coast.

2. Evaluation of the achievement of the Good Environmental Status (GES) and associated ecological objectives (EOs)

This programme makes it possible to inform the following EO and their common indicators (CI) of the Good Environmental Status:

Common Indicators of Ecological Objective 3 (Harvest of Commercially exploited fish and shellfish):

- • Common indicator 7: Spawning stock Biomass Common indicator 8: Total landings
- Common indicator 9: Fishing Mortality
- Common indicator 10: Fishing effort
- Common indicator 11: Catch per unit effort (CPUE)

3. **Common indicator 12: Bycatch of vulnerable and non-target species Evaluate the characteristics of the ecosystem and the pressures and impacts required to analyze the ecological status**

This programme provides information primarily about the Initial Evaluation (IE)following:

Stock assessment and pressure evaluation of the:

- Pelagic fish populations
- Demersal populations
- Elasmobranch populations

4. **Evaluation of the achievement of the ecological objectives and especially related operational objectives**

This programme allows the evaluation of the achievement of the following Ecological Objectives:

Eastern Mediterranean (EM):

To guarantee maintaining fishing pressure within biologically safe limits and sustaining the reproductive capacity of stocks

In particular:

- Control total catch (fishing capacity) and fishing effort by developing professional fishing practices consistent with sustaining the resources.
- Determine abundance of exploited fish stocks using CPUE, identify fishing areas and preserve nursery areas.
- Assess the exploitation level of the stocks by performing proper stock assessments using proper age-length keys for the specific stocks in the region.

IV. Organization

This programme consists of 3 sub-programmes. They are organized according the fish stock considered.
Sub- programme 1 – Small pelagic fish
Sub- programme 2 – Demersal fish
Sub- programme 3 – Elasmobranchs

V. General comments on the programme

The Lebanese fishing fleet is composed of small scale artisanal vessels less than 12 m in length and typical of many Mediterranean countries (Brême 2004; Carpentieri and Colloca 2005; Lelli

et al. 2006; Majdalani 2004; Majdalani 2005; Martin et al. 2006; PescaMed 2011; Sacchi and Dimech 2011). All the effort of the fleet is concentrated within the 6 nautical miles with higher percentage within the 3 nautical miles leading to a high fishing pressure on the coastal fisheries resources (Bariche et al. 2006; Colloca and Lelli 2012; Sacchi and Dimech 2011). Most of gillnets, beach-, and purse seines, have small mesh sizes (less than 2x2 cm). Because of the strict control by the military, the extensive fishing with explosives has been significantly reduced during the past few years. Ninety nine percent of the landings are recorded at family or higher level, leaving only the landings of Common octopus (*Octopus vulgaris*, 25 tons) and European conger (*Conger conger*, 9 tons) to be recorded at species level. The five most important species-groups are: *Clupeidae* (650 tons), *Carangidae* (400 tons), *Scombroidei* (400 tons), *Sparidae* (370 tons), and *Mugilidae* (365 tons) **Table 1** (Martin et al. 2006).

Table 1: Lebanese marine capture production 2003, GFCM area (Martin et al. 2006)

Species (-groups)	**Scientific name**	**Ton**
Clupeoids nei	*Clupeoidei*	600
Carangids nei	*Carangidae*	400
Tuna-like fishes nei	*Scombroidei*	400
Porgies, seabreams nei	*Sparidae*	370
Mullets nei	*Mugilidae*	365
Mackerels nei	*Scombridae*	300
Barracudas nei	*Sphyraena spp*	250
Groupers, seabasses nei	*Serranidae*	250
Surmullets(=Red mullets) nei	*Mullus spp*	200
Scorpionfishes nei	*Scorpaenidae*	125
Picarels nei	*Spicara spp*	90
Marine crustaceans nei	*Crustacea*	60
Sharks, rays, skates, etc. nei	*Elasmobranchii*	60
Silversides (=Sand smelts) nei	*Atherinidae*	50
Gadiformes nei	*Gadiformes*	27
Common octopus	*Octopus vulgaris*	25
Cuttlefish,bobtail squids nei	*Sepiidae*, *Sepiolidae*	25
European conger	*Conger conger*	8
Flatfishes nei	*Pleuronectiformes*	8
Total		3 613

In this context, the programme is based on campaigns to monitor these fishing operations and monitor landings throughout the coast. It will also be based on fishing campaigns to be carried out in a periodic manner with the help of hired artisanal fishermen, as well as, periodic data collection of abundant and exploited fish stock from major ports along the Lebanese coast.

VI. Sub-programme 1: Small pelagic fish

1. Objectives and presentation

Pelagic fish are characterized by living between the ocean surface and its bottom which is also called "pelagic zone". They constitute a key to the trophic chain where their presence maintains ecosystem balance (Smith et al. 2011). They can control zooplankton abundance and "bottom-up" effect due to the fact of being planktonophages and depending on the situation (Bakun 1996). They represent 22% of the total worldwide marine capture in 2009 reaching almost 19.9 million tons (FAO 2011), therefore, entering in the diet of many populations living in poverty. In the Mediterranean, small pelagic fish constitutes 50% of total annual catch (Ramon and Castro 1997). As for the Lebanese coast, pelagic fish are targeted by purse seines or also known "schincholas" and therefore constituting the largest percentage of the catches (Sacchi and Dimech 2011). A total of 32 pelagic fish species were caught by purse seiners in 2003 and represented 29 genera and 19 families with anchovies and sardines having the highest percentage targeted at 0 age class (Bariche et al. 2007). Lack of data for fishing sector management is one of the reasons that led to the reduction of fish stocks over the years (Nader et al. 2014). Biological data for some indicator species should be collected along with socio-economic information to improve the exploitation of fisheries resources and to realize the stock status (Pinello and Dimech 2013).
Therefore, the objective of this sub- programme is to better identify the fishing pressures on these small pelagics and other species caught as bycatch in this commercial fishery, and keep it in a safe threshold. In addition, this sub- programme will aid to create a database of basic biological data to ensure the proper management of this fish stock.

2. **Relevant marine sub-regions**

The Lebanese coastal waters are involved provided that the purse seiners start their operations from Dora (central Lebanon) and Tripoli (Northern Lebanon).

3. **Parameters followed**

The parameters that should be covered in this sub- programme are:

- From fishery data:
  - Total catch and effort of purse seiner operations to calculate the CPUE and use it as an abundance index
- From biological data for stock assessment:
  - Total weight and length of the concerned fish stock to estimate the weight-length parameters 'a' and 'b' and define the allometry of the stock. Moreover, the length-frequency distribution can be made using total length data.
  - Sex and stages of sexual maturity to determine the sex ratio (for possible sexual segregation) and the length at 50% maturity.
  - Age from otolith reading to estimate proper Von Bertalanffy growth parameters (Linf, k, and t0) and constitute reliable age-length keys for the species concerned.

4. **Means/tools used/protocol elements**

The monitoring of purse seine fisheries and catches of pelagic fish species should be implemented by collecting fishing operation data and biological data from caught samples for targeted species.

Elements of protocol

The means, protocol elements and potential funding required for the implementation of this monitoring programme from purse seine fisheries are represented in **Table 2**.

- Total catch and effort should be obtained by visiting the ports where purse seiners land and collecting reliable catch and effort data from the main fisherman on the purse seine (collecting data from logbooks previously distributed to cooperative fishermen).
- Biological data should be collected from subsamples collected after purse seiner fishing operations during specified visits. These subsamples should be reliable and representative of the complete catch.

Table 2: The protocol, duration and potential cost for acquiring the parameters for this monitoring programme.

Parameters	**Protocol**	**Duration**	**Potential cost**
Total catch	Obtained from 20 representative purse seiners (10 in Dora and 10 in Tripoli) using logbooks given to main fishermen on the vessel	Yearly between April and December	**$10000/year** For collaboration with fisheries and other stakeholders for data collection, and helping cooperating fishermen indirectly, such as, in the renewal of gear and boat and gear maintenance etc.
Total effort	Represents the number of fishing operations performed by each vessel (obtained from logbook)	Yearly between April and December	
CPUE	Estimated from catch and effort data (catch/effort)	Yearly between April and December	
Bycatch	Obtained by recording bycatch species from fishermen logbook records	Yearly between April and December	
Biological data (Weight, length, sex, maturity, and otoliths)	Taken by measuring and identifying fish from one box of one purse seine catch per region	Yearly between April and December	**$3000/year** For buying the boxes of the purse seine catches
Mortality and SSB	Estimated by using biological data	Yearly between April and December	-

5. Spatial coverage and sampling strategy

Spatial coverage

The coastal zones covered by this monitoring are the fishing zones where purse seiner fishing operations take place (zones with depth less than 50 m). Purse seiners in Lebanon are found in the Dora (central Lebanon) and Tripoli (northern Lebanon) ports, from where all their fishing operations initiate.

Sampling frequency weekly and by region

- Sampling for catch and effort

Sampling for purse seine total catch and effort should be collected on a daily basis from the 20 purse seiners in the two above ports. In this context, a logbook should be given to cooperative fishermen and periodic visits to these fishermen should be performed.

- Sampling for biological data of concerned stock

Biological data should be obtained from a reliable subsample to be collected from two purse seiner landings (one from each port) twice every month.

6. Implementation of the monitoring

Existing mechanisms for monitoring

Currently and in the framework of the EastMed project of the FAO, a project has been implemented by the Lebanese CNRS entitled: A proposal for a two-year fisheries data collection system in Lebanon in line with the new GFCM Data Collection Reference Framework (DCRF). This project has been ongoing since the start of 2015. It aims to assess the diversity of small pelagics in purse seine catches by sampling purse seiner catches once every month from April to December. Purse seiner total catch data is also being noted every month by the MoA.

7. Conclusions and recommendations of this sub-programme

This sub- programme is important to fulfil the EO3 and better identify the fishing pressures on these small pelagics and other species caught as bycatch in this commercial fishery. It is also indispensable due to the lack of data that can enable to perform reliable stock assessment models and evaluate the status of these stocks to ensure its sustainable management. It is recommended that purse seiner sampling should be relevant to the proposed monitoring programme and should complement the sampling done by the Lebanese CNRS/FAO project. The duration of the

sampling must be reviewed and increased, and otoliths must be collected to ensure a better age-length key for reliable stock assessment models.

VII. Sub-programme 2: Demersal fish

1. Objectives and presentation

Demersal fish live and feed on or near the continental shelf in coastal waters. Demersal fisheries are a very important component of total world catches. Although fisheries may be directed towards particular species or species groups, demersal fish are often caught together and comprise a mixed demersal fishery. Commercially important demersal food fish species include flatfish, such as flounder, sole, turbot, plaice, and halibut. Also important are cod, hake, redfish, haddock, bass and congers (Grainger and Garcia 1996). Lebanon is characterized by its artisanal vessels with a majority between 6 and 12 m (small-scaled) based mainly on bottom stationary gear (gillnets, trammel nets and longlines), purse seine nets (lampara) and beach seines. About 70% undergo fishing operations at least daily. Demersal species are mainly targeted by gillnets, trammel nets and bottom long-lines. More than 67 % of the vessels target demersal species (Majdalani 2005).

Lack of data for fishing sector management is one of the reasons that led to the reduction of fish stocks over the years (Nader et al. 2014). Demersal fish stocks can be prone to exploitation by Lebanese artisanal fisheries by direct fishing and/or bycatch. Biological data for some indicator species should be collected along with socio-economic information to manage the exploitation of fisheries resources and to evaluate the status of the stock (Pinello and Dimech 2013).

Therefore, the objective of this sub- programme is to better identify the fishing pressures (direct or bycatch) on the majorly exploited demersal fish and keep it in a safe threshold. In addition, this sub- programme will aid to create a database of basic biological data to ensure the proper management of any potentially exploited demersal fish stock concerned.

2. Relevant marine sub-regions

The Lebanese coastal waters are involved. Artisanal fishing operations take place throughout the coast with the majority at depth less than 50 m except for longlines.

3. Parameters followed

The parameters that should be covered in this sub-programme are:

- From fishery data:
  - Total catch and effort from fishing vessels using gillnets, trammel nets and bottom longlines to calculate the CPUE and use it as an abundance index
- From biological data for stock assessment:

- Total weight and length of the concerned fish stock to estimate the weight-length parameters 'a' and 'b' and define the allometry of the stock. Moreover, the length-frequency distribution can be made using total length data.
- Sex and stages of sexual maturity to determine the sex ratio (for possible sexual segregation) and the length at 50% maturity.
- Age from otolith reading to estimate proper Von Bertalanffy growth parameters (Linf, k, and t0) and constitute reliable age-length keys for the species concerned.

4. **Means/tools used/protocol elements**

The monitoring of gillnet, trammel net and bottom longline fisheries and catches of demersal fish species should be implemented by collecting fishing operation data and biological data from caught samples for targeted species.

Elements of protocol

The means, protocol elements and potential funding required for the implementation of this monitoring programme from demersal gillnet, trammel net and bottom longline fisheries are represented in **Table 3** and/or those for fishing scientific surveys in **Table 4**.

- Total catch and effort should be obtained by visiting the ports where fishing vessels using gillnets, trammel nets and bottom longlines land and collecting reliable catch and effort data from the main fisherman on these vessels (collecting data from logbooks previously distributed to cooperative fishermen).
- Biological data should be collected from subsamples collected after gillnet, trammel net and bottom longline fishing operations during specified visits. These subsamples should be reliable and representative of the complete catch for a concerned species.
- As a complement to fishery data (catch, effort or biological), scientific surveys can be implemented. Fishermen can be hired to lower the three types of artisanal gear in specific hauls (predefined depths) along the whole coast.

Table 3: The protocol, duration and potential cost for acquiring the parameters for this monitoring programme from fisheries.

Parameters	**Protocol**	**Duration**	**Potential cost**
Total catch	Obtained from: *3 bottom longline vessels* *3 gillnet vessels* *3 trammel net vessels* from each of the 3 ports (Tripoli, Dora, Sidon/Tyr)	Yearly	**$20000/year** For collaboration with fisheries and other stakeholders for data collection, and helping cooperating fishermen
Total effort	Represents the mesh and length of the nets or the	Yearly	

	number of hooks and length of the longline (obtained from logbook)		indirectly, such as, in the renewal of gear and boat and gear maintenance etc.
CPUE	Estimated from catch and effort data (catch/effort)	Yearly	
Bycatch	Obtained by recording bycatch species from fishermen logbook records	Yearly	
Biological data (Weight, length, sex, maturity, and otoliths)	Obtained by taking measurements from one sample of the potential demersal fish stock concerned monthly bought from: *1 bottom longline vessel* *1 gillnet vessel* *1 trammel net vessel* in each of the 3 above mentioned ports	Yearly	**$10000/year** For buying the fish samples
Mortality and SSB	Estimated by using biological data	Yearly	-

Table 4: The protocol, duration and potential cost for acquiring the parameters for this monitoring programme from scientific surveys.

Parameters	**Protocol**	**Duration**	**Potential cost**
Total catch	Obtained from 50 fishing operations: *10 bottom longline operations* *20 gillnet operations* *20 trammel net operations* throughout predefined hauls along the Lebanese coast	Yearly	**$30000/year** Cost of hiring fishermen vessels and producing/mending the gear
Total effort	For the operations mentioned: *500 m bottom longline with 200 hooks* *1 km gillnets of 26, 30 and 40 mm* *1 km trammel nets of 22, 24, 26, 28 mm*	Yearly	
CPUE	Estimated from catch and	Yearly	

	effort data (catch/effort)		
Bycatch	Obtained from recording bycatch species in each haul	Yearly	
Biological data (Weight, length, sex, maturity, and otoliths)	Obtained by taking measurements from all fish obtained from the survey operations	Yearly	-
Mortality and SSB	Estimated by using biological data	Yearly	-

5. **Spatial coverage and sampling strategy**

Spatial coverage

The coastal zones covered by this monitoring are the fishing zones where gillnet, trammel net and bottom longline fishing operations take place (majorly zones with depth less than 50 m except for longlines).

Sampling frequency weekly and by region

- Sampling for catch and effort

Sampling for gillnet, trammel net and bottom longline total catch and effort should be collected daily from 3 longline vessels, 3 gillnet vessels and 3 trammel net vessels from each of the representative ports along the Lebanese coast. Sampling should be done in the Tripoli port (to represent the northern part of the coast), Dora port (to represent the central part of the coast) and the Sidon or Tyr ports (to represent the southern part of the coast). In this context, a logbook should be given to cooperative fishermen and periodic visits to these fishermen should be performed.

- Sampling for biological data of concerned stock

Biological data should be obtained from reliable subsamples of the species concerned to be collected from one gillnet, trammel net and bottom longline landing once every month in each of the above- mentioned ports.

- Sampling through a scientific survey

Predefined hauls should be chosen as representatives of all fishing zones along the Lebanese coast. The three types of gears (various defined mesh sizes) should be lowered in each of these hauls. Catch and effort data should be collected from monitoring the fishing operations and biological data should be collected by assessing the whole catch from each haul.

6. Implementation of monitoring

Existing mechanisms for monitoring

- Past and current scientific fishing surveys

Previously between 2012 and 2013 and in the framework of the Italian CIHEAM PESCA Libano project with the involvement of the Lebanese MoA and the NCMS– CNRS a survey was done, where three types of gears were lowered in 62 different sites along the coast of Lebanon and at depths ranging from 10 to 600 m. Biological and catch data of the whole catches in each haul were recorded and assessed as a first step to assess the potentiality of the marine coastal resources in order to support the Lebanese Government in strengthening the management of these resources.

After this survey and in the framework of a Lebanese CNRS project (2015 and 2016), trammel nets were also lowered in 15 hauls/season in Tripoli region. The biological and catch data were also assessed.

Currently and in the framework of the CANA+ project (in collaboration with the Italian government), the Lebanese CNRS is performing a fishing survey and lowering trammel nets and gillnets in several regions along the Lebanese coast (i.e. Batroun, Beirut, Sidon…). Biological and catch data from these surveys are being recorded for each haul will be assessed eventually.

- Current data collection

Currently and in the framework of the EastMed project of the FAO, a project has been implemented by the Lebanese CNRS entitled: A proposal for two-year fisheries data collection system in Lebanon in line with the new GFCM Data Collection Reference Framework (DCRF). It has been ongoing since 2015. In the framework of this project, monthly data collection has been implemented for *Pagellus erythrinus* and *Lithognathus mormyrus* from small-scale gillnet, trammel net and longline catches where biological data has been recorded for the two species to constitute basic data for stock assessment.

7. Conclusions and recommendations of this sub-programme

This sub-programme is important to fulfil the EO3 and better identify the fishing pressures on demersal fish stocks exploited by direct fishing (gillnets, longlines, trammel nets) and/or bycatch. It is also indispensable due to the lack of data that can enable to perform reliable stock assessment models and evaluate the status of these stocks to ensure its sustainable management. It is recommended that sampling should be relevant to the proposed monitoring programme and should complement the sampling done by the Lebanese CNRS/FAO project. Otoliths must be collected to ensure a better age-length key for reliable stock assessment models. Discard and bycatch data must also be noted.

VIII. Sub-programme 3: Elasmobranchs

1. Objectives and presentation

Chondrichthyans make up one of the oldest and most ecologically diverse vertebrate families: sharks and their relatives, the batoids (including skates, rays, guitarfishes and sawfishes) and chimaeras are all chondrichthyans, or cartilaginous fishes (Fowler 2005). Elasmobranchs consist only of sharks and batoids. They are characterized by their conservative life-history traits. They have the latest maturity and the slowest reproduction of all vertebrates; they display long gestation periods and some of the highest levels of maternal investments in the animal kingdom (Cortés 2000). These life history traits have been leading to low population growth rates and less compensation in juvenile survival, making them intensively vulnerable to elevated fishing exploitation and mortality (Cortés 2002; Dulvy and Forrest 2010; García et al. 2008; Musick 1999). According to FAO (FAO 2011), elasmobranch landings have increased progressively to peak in 2003 and then showed a decline since then; and rays have shown to dominate the landings in the past four decades. Elasmobranchs fish catches represent only 1.1 percent of the total landings in the Mediterranean Sea (Serena 2005). The Lebanese fishery being artisanal and traditional (Fowler 2005; Majdalani 2004) is composed of small scale artisanal vessels. Trawlers are legally forbidden. According to Martin et al. (2006), the Lebanese production of elasmobranchs was 60 tons in 2003 accounting for 2% of all groups caught. Some elasmobranch catches are incidental, and others target certain commercially important species such as the Common Guitarfish *Rhinobatos rhinobatos* (Lteif et al. 2016). Other elasmobranch species are also targeted by artisanal fishermen. For example, many heavy weighted sharks or rays such as members of the Hexanchidae, Carcharinidae or the Lamnidae for sharks and the Dasyatidae and Myliobatididae families for batoids are often encountered in fisheries in some Lebanese regions northern (Tripoli) and southern (Sidon) of the country.

Basic biological information needed for stock assessment is lacking for many of these eastern Mediterranean elasmobranchs, including minimum, maximum, and average sizes, as well as length-to-weight relationships. Being demersal, many elasmobranchs are prone to exploitation by Lebanese artisanal fisheries by direct fishing and/or bycatch. Biological data is essential to understand the growth rate, age structure, and other aspects of population dynamics and manage the exploitation of fisheries resources and to evaluate the status of the stock (Pinello and Dimech 2013).

Therefore, the objective of this sub-programme is to better identify the fishing pressures (direct or bycatch) on the majorly exploited elasmobranchs and keep it in a safe threshold. In addition, this sub-programme will aid to create a database of basic biological data to ensure the proper management of any potentially exploited elasmobranch stock concerned.

2. Relevant marine sub-regions

The Lebanese coastal waters are involved. Artisanal fishing operations take place throughout the coast with the majority at depth less than 50 m except for longlines.

3. Parameters followed

The parameters that should be covered in this sub-programme are:

- From fishery data:
  - Total catch and effort from fishing vessels using gillnets, trammel nets and bottom longlines to calculate the CPUE and use it as an abundance index
- From biological data for stock assessment:
  - Total weight and length of the concerned fish stock to estimate the weight-length parameters 'a' and 'b' and define the allometry of the stock. Moreover, the length-frequency distribution can be made using total length data.
  - Sex and stages of sexual maturity to determine the sex ratio (for possible sexual segregation) and the length at 50% maturity.
  - Age from vertebrae or spine reading to estimate proper Von Bertalanffy growth parameters (Linf, k, and t0) and constitute reliable age-length keys for the species concerned**.**

4. Means/tools used/protocol elements

The monitoring of direct or incidental catches of elasmobranch species should be implemented by collecting fishing operation data and biological data from caught samples for targeted species directly or indirectly (bycatch).

Elements of protocol

The means, protocol elements and potential funding required for the implementation of this monitoring programme from demersal gillnet, trammel net and bottom longline fisheries are represented in **Table 5.**

- Total catch and effort from elasmobranch landings should be obtained by visiting the ports where fishing vessels targeting elasmobranchs land and collecting reliable catch and effort data from the main fisherman on these vessels (collecting data from logbooks previously distributed to cooperative fishermen).
- Biological data should be collected from elasmobranch subsamples collected after fishing operations during specified visits. These subsamples should be reliable and representative of the complete catch for a concerned species.
- Elasmobranch bycatch should be monitored by visiting the ports where fishing vessels using gillnets, trammel nets and bottom longlines land and collecting

elasmobranch bycatch data from the main fisherman on these vessels (adding bycatch data to logbooks).

Table 5: The protocol, duration and potential cost for acquiring the parameters for this monitoring programme from fisheries.

Parameters	**Protocol**	**Duration**	**Potential cost**
Total catch	Obtained from: *10 elasmobranch targeting vessels (direct fishing)* from each of the 3 ports (Tripoli, Dora, Sidon/Tyr)	Yearly	**$20000/year** For collaboration with fisheries and other stakeholders for data collection, and helping cooperating fishermen indirectly, such as, in the renewal of gear and boat and gear maintenance etc.
Total effort	Represents the mesh and length of the nets or the number of hooks and length of the longline (obtained from logbook)	Yearly	
CPUE	Estimated from catch and effort data (catch/effort)	Yearly	
Bycatch	Obtained from: *4 bottom longline vessels* *3 gillnet vessels* *3 trammel net vessels* targeting bony demersal species from each of the 3 ports (Tripoli, Dora, Sidon/Tyr) Elasmobranch bycatches will be obtained from fishermen logbook records.	Yearly	**$20000/year** For collaboration with fisheries and other stakeholders for data collection, and helping cooperating fishermen indirectly, such as, in the renewal of gear and boat and gear maintenance etc.
Biological data (Weight, length, sex, maturity, and otoliths)	Obtained by taking measurements from one sample of the potential elasmobranch stock concerned monthly bought from: *3 bottom longline vessel* Directly targeting the concerned elasmobranch stock in each of the 3 above mentioned ports	Yearly	**$8000/year** For buying the elasmobranch samples
Mortality and SSB	Estimated by using biological data	Yearly	-

5. **Spatial coverage and sampling strategy**

Spatial coverage

The coastal zones covered by this monitoring are the fishing zones where elasmobranch targeting fishing operations take place (mainly bottom longlines - zones with depth more than 50 m).

Sampling frequency weekly and by region

- Sampling for catch and effort

Sampling for elasmobranch fishing operations total catch and effort should be collected daily from 10 bottom longline vessels that target elasmobranchs in each of the representative ports along the Lebanese coast. Sampling should be done in the Tripoli port (to represent the northern part of the coast), Dora port (to represent the central part of the coast) and the Sidon or Tyr ports (to represent the southern part of the coast). In this context, a logbook should be given to cooperative fishermen and periodic visits to these fishermen should be performed.

- Sampling for biological data of concerned stock

Biological data should be obtained from reliable subsamples of the species concerned to be collected from 3 bottom longline landings once every month in each of the above- mentioned ports.

- Bycatch sampling

Elasmobranch bycatch data should be obtained daily from 4 bottom longline vessels, 3 gillnet vessels and 3 trammel net vessels targeting bony demersal species from each of the 3 ports (Tripoli, Dora, Sidon/Tyr). Elasmobranch bycatches will be obtained from fishermen logbook records.

6. **Implementation of monitoring**

Existing mechanisms for monitoring

- Elasmobranch bycatch data from scientific fishing surveys

Previously between 2012 and 2013 and in the framework of the Italian CIHEAM PESCA Libano project with the involvement of the Lebanese MoA and the Lebanese NCMS – CNRS, a survey was done, where three types of gears were lowered in 62 different sites along the coast of

Lebanon and at depths ranging from 10 to 600 m. Biological and catch data of the whole catches, as well as, elasmobranch bycatch data in each haul were recorded and assessed as a first step to assess the potentiality of the marine coastal resources in order to support the Lebanese Government in strengthening the management of these resources.

After this survey and in the framework of a Lebanese CNRS project (2015 and 2016), trammel nets were also lowered in 15 hauls/season in Tripoli region. Elasmobranch bycatch data was also recorded.

Currently and in the framework of the CANA+ project (in collaboration with the Italian government), the Lebanese CNRS is performing a fishing survey and lowering trammel nets and gillnets in several regions along the Lebanese coast (i.e. Batroun, Beirut, Sidon…). Biological and catch data, as well as, elasmobranch bycatch data from these surveys are being recorded for each haul will be assessed eventually.

- Current elasmobranch catch and bycatch data collection

In 2015, a thesis project related to cartilaginous fish was implemented in Lebanon (Lteif 2015). Throughout this project, data on elasmobranch catches was obtained from fisheries, where the common guitarfish *Rhinobatos rhinobatos* (Lteif et al. 2016) and other elasmobranch species were found to be directly targeted by Lebanese artisanal fisheries. These elasmobranchs were only monitored during the course of this thesis project (2012-2015). Currently, there is no monitoring plan or project that implements elasmobranch catch or bycatch data collection along the Lebanese coast. There is only an ongoing project in the Lebanese University, where vertebrae of *R. rhinobatos* are being collected from specimens caught in Tripoli for potential age determination. Spines of the little gulper shark *Centrophorus uyato* will also be treated for age determination in the framework of the latter project.

7. Conclusions and recommendations of this sub-programme

This subprogramme is important to fulfill the EO3 and better identify the fishing pressures on elasmobranch species exploited by direct fishing (mainly bottom longlines) and bycatch. It is recommended that sampling and data collection should be relevant to the proposed monitoring programme, in order to better reflect the status of this subgroup along the Lebanese coast and propose measures to manage its direct fishing and decrease its bycatch.

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