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REPORT OF THE FAO EASTMED SUPPORT TO THE FISHING TRIALS CARRIED OUT OFF THE SOUTH LEBANESE COASTS

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

REPORT OF THE FAO EASTMED SUPPORT TO THE FISHING TRIALS CARRIED OUT OFF THE SOUTH LEBANESE COASTS

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The conclusions and recommendations given in this and in other documents in the *Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean* series are those considered appropriate at the time of preparation. They may be modified in the light of further knowledge gained in subsequent stages of the Project. The designations employed and the presentation of material in this publication do not imply the expression of any opinion on the part of FAO or donors concerning the legal status of any country, territory, city or area, or concerning the determination of its frontiers or boundaries.

Preface

The Project "Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean- EastMed is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by Greece, Italy and EC.

The Eastern Mediterranean countries have for long lacked a cooperation framework as created for other areas of the Mediterranean, namely the FAO sub-regional projects AdriaMed, MedSudMed, CopeMed II and ArtFiMed. This made it more difficult for some countries in the region to participate fully in international and regional initiatives for cooperation on fishery research and management. Following the very encouraging experience of technical and institutional assistance provided to countries by the other FAO sub-regional Projects,

EastMed

was born to support the development of regional cooperation and the further development of multidisciplinary expertise necessary to formulate appropriate management measures under the FAO Code of Conduct for Responsible Fisheries and the principles of the Ecosystem Approach to Fisheries (EAF) to ensure rational, responsible and participative fisheries management

The project's **longer-term objective** is to contribute to the sustainable management of marine fisheries in the Eastern Mediterranean, and thereby to contribute to supporting national economies and protecting the livelihoods of those involved in the fisheries sector.

The project's **immediate objective** is to support and improve the capacity of national fishery departments in the sub-region to increase their scientific and technical information base for fisheries management and to develop coordinated and participative fisheries management plans in the Eastern Mediterranean sub-region.

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ABSTRACT

Lebanese coastal habitats are suffering from over-pressure from fishing activities being exposed at the same time to different sources of pollution. In order to evaluate the potentiality of offshore fishing grounds for local artisanal fishery, we carried out a short survey in the area between Tyre and Naqoura (South Lebanon), using both monofilament gillnets to target hake (*Merluccius merluccius*) and Spanish traps designed to catch the striped soldier shrimp (*Plesionika edwardsii*). A total of 11 hauls, 7 with gillnets and 4 with traps were carried out in spring 2012, between 8 and 420 m depth. The fish and shrimp specimens caught were measured (total length TL and carapace length CL) sexed, weighted and maturity stage recorded. A total of 34 species were caught in the gillnet hauls. In the offshore sampling stations, the hake was the most abundant species in the catch with CPUE up to 6.6 kg/km net day. Hake specimens ranged between 25.5 and 57.5 cm with a high occurrence of mature females. The traps for the soldier shrimps returned mean CPUEs of 210-310 g/trap/day higher of those obtained in other sectors of the Western Mediterranean. The composition of the catch showed large differences according to the depth: the higher abundance of large ovigerous females was observed between 200 and 300 m depth. On deeper depths (400-420 m) the catch was almost composed by males and immature females, while the smallest immature specimens were caught in the haul carried out between 100 and 150 m depth. The results of the survey, even if preliminary, showed the occurrence of potentially exploitable resources on the Lebanese upper slope. Further surveys are required to gather quantitative data on the spatio-temporal distribution of hake and striped soldier shrimp off-shore the Lebanese coasts and to identify the more suitable fishing periods and areas.

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REPORT OF THE FAO EASTMED SUPPORT TO THE FISHING TRIALS CARRIED OUT OFF THE SOUTH LEBANESE COASTS

1. Introduction

The objective to develop the Lebanese fisheries sector with a particular focus on the improvement of the fishing techniques and the associated regulations was raised by Lebanese delegate during the Co-ordination Committee of the EastMed project held in Antalya, Turkey, from 5-6 April 2010.

In this respect a series of activities have been planned by the EastMed project which started with a field survey carried out in July 2011. The aim of the survey was to review the main fishing techniques and gears in Lebanon, comparing their characteristics with international legislation and to propose approaches to develop more sustainable fishing gears (Sacchi and Dimech, 2011).

In the period March-May 2012 the EastMed provided technical assistance to the National Council for Scientific Research-Lebanon (CNRS-L) for the development of the project "*Assistance to the artisanal fishery in the port of Naqoura*" financed by the Italian Cooperation. The objective of the activities implemented by CNRS-L was to develop field activities with the local fishing community aiming at establishing a pilot testing unit for the use of new fishing techniques in Lebanon.

These activities had been implemented in the wider framework of the CANA Project "Establishing monitoring and sustainable development of the Lebanese sea" funded by the Italian Ministry of Foreign Affairs and implemented by the CNRS-L.

Two missions of an EastMed expert (Francesco Colloca) have been organized respectively between 15-18 March and 13-14 May 2012 in the South Lebanon with the general objective to assist the staff of CNRS working on fisheries science in the development of the planned activities, with a particular focus on the development of fishing trials and biological data collection. The activities have been supervised by the Scientific Coordinator of the CANA project, Mr. Stefano Lelli. Building the capacity of the staff of CNRS in terms of data collection and analysis, training the fishermen on the correct use of new fishing techniques, and presenting the results and good practices of the activity to the concerned stakeholders were among the requirement of the consultancy (see missions TOR on Annex 1). The scheduled activities and the list of person met are showed in Annex 2.

This report summarizes the results of the activities carried out during the two missions.

1.1 Environmental characteristics of the South Lebanon

The Southern Lebanese coast has the last partially unspoiled stretch of coastal habitat in Lebanon. The area is characterized by two main extended sandy beaches surrounding the town of Tyre. The Tyre Coast Nature Reserve is a wetland area of 3.800 km^2 which is also an important nesting site for the sea-turtles *Caretta caretta* and *Chelonia mydas.* Limestone base

rock headlands dominate wave-washed terraces and a series of gravely and rocky bays can be found between Tyre and Naqoura (fig. 1). The continental shelf becomes closer and steeper moving SW from Tyre to Naqoura. It is an area characterized by the occurrence of the Sour Canyon which breaks the shelf margin 4.6 km offshore, channelling large quantities of fine and coarse sediments into the adjacent deep-sea Levantin basin (Almagor, 1993).

The coastline is subject to dominant coastal winds with a south western swell, giving rise to a bidirectional drift. Wave climatological data attest to high energy sea states with wave heights of more than 5 m are measured every 2 years, and greater than 7 m every 15 years. The site is exposed to a wide swell window with a fetch of ca. 750 km from the northwest and ca. 650 km from the southeast (see Marriner *et al*., 2008 and references therein).

The pollution of marine waters has to be considered as one of the major threats for artisanal fisheries in South Lebanon. Saida is bordered by the Ghazieh industrial area where several tanneries, chemical industries and slaughter houses discharge their effluents directly to the sea. Similarly, Sour hosts the Bourj el Chemalli industrial area in addition to many sewage outlets. In the absence of operational wastewater treatment plants, effluents from coastal agglomerations are directly discharged into the sea while effluents from inland communities are disposed in rivers, streams, on open land or underground. Currently, there are 53 identified wastewater outfalls along the Lebanese coasts and moderately eutrophic areas have been identified (Abboud-Abi Saab et al., 2008). In addition coastal dump sites are present both in Saida and Tyre (Anonymous, 2006)

High levels of polycyclic aromatic hydrocarbons (PAH) were found in sediments and mollusc bivalves sampled in the area of Tyre Marine park, 2.5 km south of Tyre (UNEP, 2007).

Fig. 1. Southern Lebanese coast between Tyre and Naqoura

1.2 Artisanal fisheries in Lebanon

Nowadays, the Lebanese fisheries sector employs about 6,500 persons organized in 5 syndicates and, 45% of the fishers are organised in 33 cooperative. There are 44 harbours, most of which require infrastructural intervention, dredging and maintenance which in total host a fleet of around 2,860 boats.

The total catch is of about 9,000 t per year. This amount is not sufficient to cover the national fish consumption of about 35,000 tons, and more than 74% of the consumed fish is imported mainly from Turkey and Syria.

The fleet of Tyre is made up by 250 boats (mostly < 10 m length) involving 400-500 fishermen (Lelli *et al.*, 2007), whereas Naqoura port is much smaller, hosting 10-12 boats and 15-20 fishermen (Fig. 2).

Most of the fleet uses different types of bottom standing gear, such as trammel nets, set gillnets and bottom longlines, whereas purse seines and other fishing gear (floating longlines, traps) were used less frequently. Landing is composed by a great number of species, many of which were Lessepsian migrants. In 2005 a total of 25 different Lessepsian species representing 37% of the total landing were identified (Carpentieri *et al.*, 2009).

Despite the importance of the artisanal fisheries for the economy of the Lebanese coastal communities, few quantitative data on the abundance and composition of the catch as well as on the status of the exploited stocks are available. In addition there is a lack of information of the characteristics of fishing resources occurring on the deep shelf and upper slope (150-500 m) which can be used to plan the development of off-shore fishing activities. The expansion off-shore of the fishing activities may represent an important opportunity for a more rational exploitation of Lebanese fishing resources which would allow to reduce the current fishing pressure over the coastal stocks.

A large proportion of the Lebanese fleet (about 98%) is made up by open wooden made boats of length less than 12 m. This artisanal fleet uses a wide array of different fishing gears, including trammel nets, gillnets, longlines, small purse seines, traps) to target a large number of both demersal and pelagic species mostly in the coastal area up to 100-150 m depth. The fishing grounds are mostly located within 3/4 nautical miles from the landing site (Carpentieri *et al.*, 2005, 2009; Lelli *et al.*, 2007)

1.3 Objectives of the field missions

The activities implemented in Naqoura aimed at establishing a pilot testing unit for the use of new fishing techniques in the South of Lebanon. Lebanese coastal habitats are suffering from a well-proven over-pressure from fishing activities. At the same time coastal habitats are being exposed to different sources of pollution primarily as a result of direct sewage and industrial effluent discharges into the sea, as well as solid waste dumping on the shoreline (European Commission, 2006).

Reducing the fishing effort on shallow waters, advising on alternative fishing methods, possibly in deeper waters and on poorly exploited resources can therefore be considered as priorities to enhance the sustainability of Lebanese fisheries.

Some experimental fishing trials using new fishing gears to target offshore resources were carried out in March and May 2012 along the Southern Lebanese coasts. The main aim of the fishing trials was to investigate the effectiveness of the new gears in terms of catch and potential revenue for the fishermen.

Fig. 2. Artisanal vessels in the port of Naqoura and Tyre

2. Fishing trials along the Southern Lebanese coast

The experimental fishing trials were carried out using both gillnets specifically rigged to target hake (*Merluccius merluccius*, Linnaeus, 1758) and traps targeting the striped soldier shrimp (*Plesionika edwardsii* Brandt, 1851). Local artisanal vessels were hired (Fig. 3) to carry out the task since the CANA-CNRS vessel was recognized as unsuitable for fishing with fixed gears, as discussed during a meeting with the staff of the CANA project. The vessel, previously equipped as a trawler in Italy, was renovated and reconverted into a scientific vessel particularly specialized in marine and environmental research. It was not yet equipped with a winch to retrieve nets on board and its dimension and engine power were considered as not appropriate for fishing with bottom fixed nets.

Fig. 3. The fishing vessel from Tyre used for the fishing trials in May 2012

2.1 Characteristics of the fishing gears

Gillnets and traps for shrimps are currently used by artisanal vessels in several areas of the Western Mediterranean Basin. Spanish traps for *Plesionika* are also used by some artisanal vessel of Cyprus (Scarcella pers. comm.). Both gears were also identified as potentially alternative fishing metiers for Lebanese fisheries by Lelli (2007) and Sacchi and Dimech (2011).

Monofilament nets for hake are widely used along the coasts of Italy, French and Spain in specific periods of the year and at depth ranging between 100 and 500 m depth. Along the NE Spanish coasts and the Gulf of Lion hake gillnets are used mostly between May and September (Martín *et al*., 1999; Sartor *et al*., 2001), whereas in the Tyrrhenian Sea the fishing season is mostly concentrated in winter-spring (Colloca *et al*., 2000; Sartor *et al*., 2001, Sbrana *et al*., 2007). Different mesh sizes are used, according to the local traditions, periods of the year and fishing depths. The gillnets are generally rigged with hanging ratio (E) around 0.5 to reduce their selectivity.

A trap fishery targeting *Plesionika edwardsii* has been developed in the western Mediterranean Sea, (García-Rodríguez *et al*., 2000) and in the eastern central Atlantic (Santana *et al*., 1997). The traps are generally rigged with a white net, with 1.0-1.5 cm mesh size and deployed on the continental slope between 200 and 400 m depth. The design and construction instructions are reported in Annex III. The vessels involved in this fishery are in generally over 10 m in length (Fig. 4). Experimental surveys have been done in several areas of the Mediterranean during the last ten years to test the performance of this gear (García-Rodríguez *et al*., 2000, Colloca, 2002, Possenti *et al*., 2007).

Fig. 4. A fishing vessel using Spanish traps for soldier shrimp in the Western Mediterranean (Tyrrhenian Sea).

2.1.1 Gillnets for hake

Three monofilament gillnets with stretched mesh sizes of 52, 60, 80 mm respectively, were manufactured in Lebanon following the net design and rigging characteristics adopted by the Italian artisanal fishermen of the island of Ponza (central Tyrrhenian Sea) who have long time traditions in exploiting hake with nets and longlines

The general characteristics of the nets are showed in Table 1. High tenacity double plait ropes were used for the headline and leadline. The floats are of 6.7 cm oval, for high depths. The hanging ratio is around 0.5 both on the float rope and head rope.

The nets have been rigged using the same hanging ratio (E) on the headline and leadline even though the request of the CNRS was for a higher E value on the leadline.

Table 1. Technical characteristic of the gillnets using during the fishing trials

		Net 1	Net 2	Net 3
Net yarn		26	30	40
	Material	PA mono-filament	PA mono-filament	PA mono-filament
	Diameter	0.26 mm	0.30 mm	0.30 mm
	Stretched mesh size	52 mm	60 mm	80 mm
	Panel height	4.4 m	3.9 m	3.9 m
	Panel length	500 m	471.7 m	500 m
	Colour	light green	light green	light green
Bolsh twin				
	Material	Twisted PE	Twisted PE	Twisted PE
	Diameter	1.2 mm	1.2 mm	1.2 mm
Float rope				
	Material	Twisted PE	Twisted PE	Twisted PE
	Diameter	12 mm	14 mm	16 mm
	Length	250 m	250 m	250 m
	N. bolshes	1920	1560	1250
	Bolsh size	0.13 m	0.16 m	0.20 m
	N. meshes per bolsh	5	5	5
	Hanging ratio	0.50	0.53	0.50
Floats				
	Material	PVC	PVC	PVC
	Size	6.7x4.0 cm	6.7x4.0 cm	6.7x4.0 cm
	N. floats	390	390	390
Lead rope				
	Material	Twisted PE	Twisted PE	Twisted PE
	Diameter	12 mm	14 mm	16 mm
	Length	250 m	250 m	250 m
	N. bolshes	192	156	125
	Bolsh size	0.13 m	0.16 m	0.20 m
	N. meshes per bolsh	5	5	5
	Lead weight	140 g/m	140 g/m	140 g/m
	Hanging ratio	0.5	0.53	0.5

2.1.2 Traps for shrimps

The traps used during fishing trials were semi-floating bottom traps of the type currently used by the Spanish commercial shrimp fishery in the western Mediterranean to target Pandalid shrimps (Gestin and Guennégan, 1989). Each trap was built with a frame of 3 mm diameter iron wire and green plastic net with 15-mm mesh size, and rigged with deep water floaters to keep the trap floating at 50 cm from the sea bottom (Fig. 5). A total of 6-9 traps, baited with clupeids fish, were connected at 10–15 m intervals to a ground line of 12-mm diameter weighted with an iron weight of 10 Kg at each end. Two polypropylene droplines extended from the bottom weights to buoys at the surface. The traps were left in the sea overnight and hauled in, emptied, rebaited, and reset in a new location the next day.

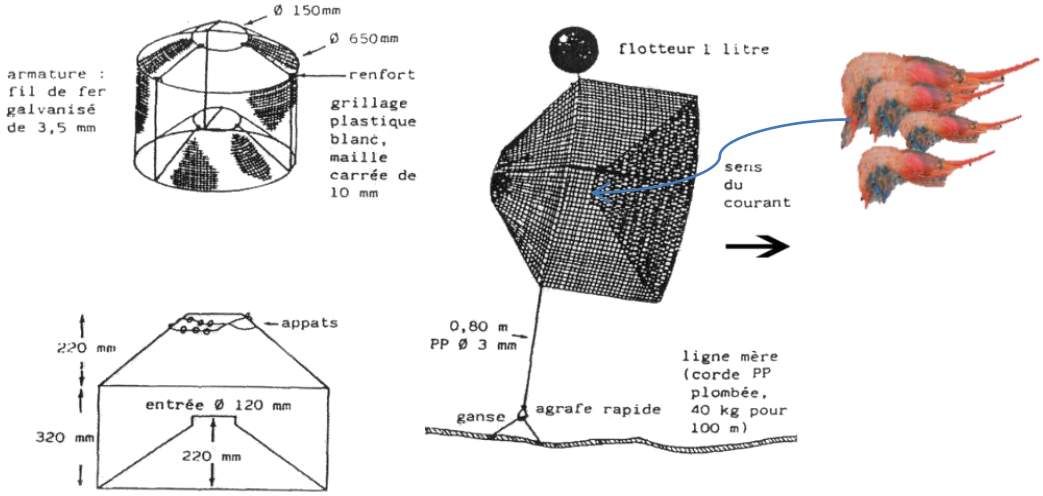

Fig. 5. Characteristics of the traps for soldier shrimp used in South Lebanon.

2.2 Study area and sampling stations

The fishing trials (7 hauls) were carried out in March-May 2012 in an area between 33°35' – 33°12'Lat N and 35°15' -35°11' Long E located between Naqoura and the North coasts of Tyre (Fig. 6). Table 2 summarize the characteristics of the hauls carried out during and after the two missions. A total of 11 hauls, 7 with gillnets and 4 with traps have been carried out in March and May 2012, between 8 and 420 m depth. The first two hauls were conducted close to the Naqoura port using gillnets on shallow waters (10-15 m) during the first mission period (March, 2012). The bad wheatear conditions did not allow conducting offshore hauls. It was agreed with the CANA staff to carry out two hauls in shallow waters to test the functioning of the gillnets and illustrate to the fishermen the general features of the nets. A vessel from Naqoura port of 9 m in length and engine power of 30 hp, equipped with a mechanical winch was hired (Fig. 7).

The inshore hauls were located within 1 nautical mile from the port of Naqoura taking less than 20 minutes to get to the fishing grounds. The offshore hauls were carried out between 4.2 and 6.55 miles from Tyre port. The time required to get the fishing grounds was between 45 and 75 min. A total of 20-30 minutes were required to set the fishing gear, both for the gillnets and traps. The retrieving time for the gillnets was up to 3 hours, even though the

deepest haul required more than 5 hours because the winch did not work properly at that depths. Not more than 30 min was the time necessary to retrieve the 9 traps used on board.

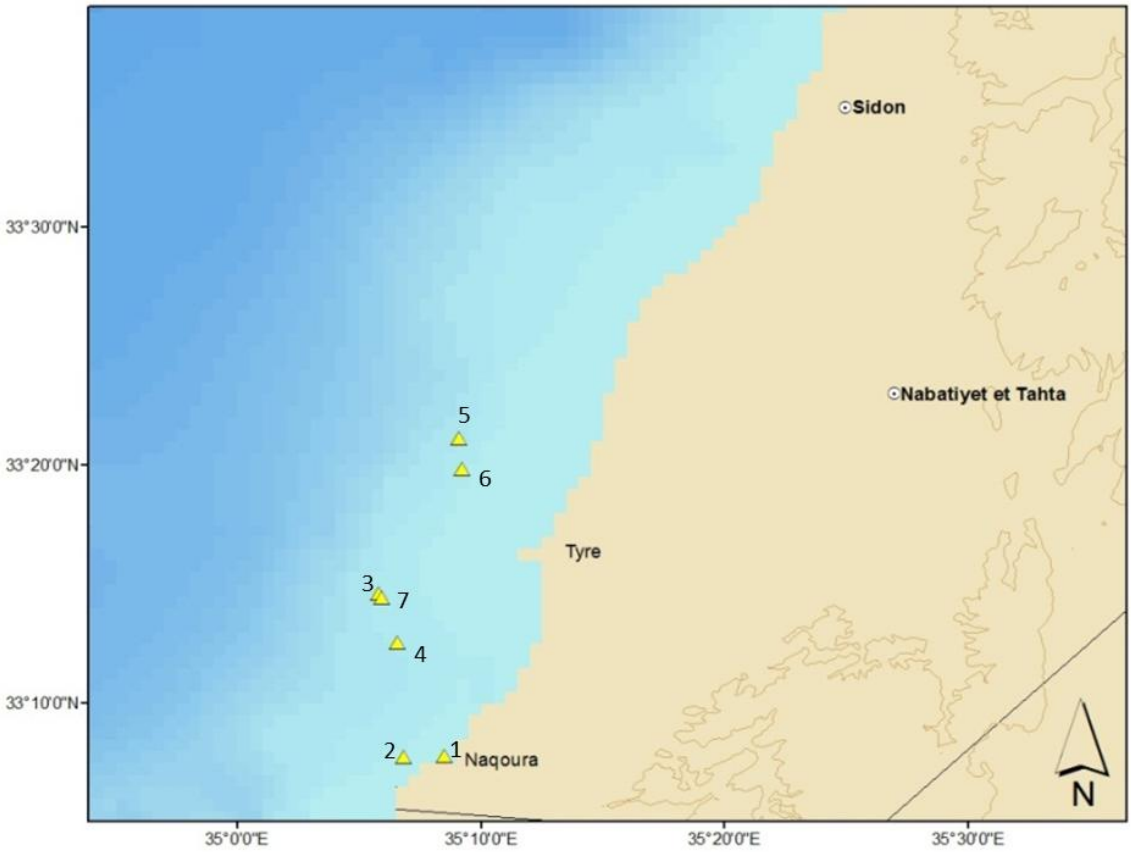

Fig. 6. Map of the study area showing the position of the gillnet sampling stations

Table 2. Gillnets and traps hauls carried out in South Lebanon

date	Code	DEPTH initial (m)	final (m)	SOAK TIME initial	final	LAT initial	LON final
16/03/2012	1	10	15	16:30	18:00	33.1304	35.142
17/03/2012	2	12	14	18:00	06:00	33.1297	35.114
17/05/2012	3	220	305	04:10	08:10	33.2437	35.0965
22/05/2012	4*	205	220	17:30	07:55	33.2409	35.0992
23/05/2012	5*	320	380	17:30	06:00	33.3303	35.1536
30/05/2012	6*	95	115	17:30	06:00	33.1485	35.0659
31/05/2012	7*	200	250	17:30	06:00	33.2601	35.1012

* gillnets and shrimps traps

In May 2012 another 5 hauls with gillnets and 4 hauls with Spanish traps were carried out at a depth range between 90 and 430 m using a commercial fishing vessel from Tyre. The vessel was a classical Lebanese fishing boat (flouka) of 10 m LOA, 1.3 GT and an engine of 60 hp, equipped with a mechanical winch to retrieve the nets on board and with three fishermen embarked. The hauls have been carried out between 90 and 430 m depth (Fig. 1). Both gillnets and traps were set fishing overnight with a soaking time of 12-14 hours (Table 1).

2.3 Biological data

The fish specimens caught have been measured (total length TL) sexed and weighed. The maturity stage was recorded following the 4 stage scale for fish adopted in the Medits survey until 2009.

Carapace length (CL, distance between the postorbital eye socket and the posterior median edge of the cephalothorax) of each shrimp collected was measured to the nearest 0.5 mm. The sex of immature individuals was determined according to the presence or absence of the appendix masculina on the endopod of the second pleopod (King and Moffitt, 1984).

Fig. 7. Fishing operations and catch obtained in Naqoura.

The maturity stage of females was verified by macroscopic examination of gonads and embryos using the Ceccaldi maturity scale (Ceccaldi, 1966) based on colour, aspect, and dimension both of gonads and embryos (Table 3). The percentage of immature (stages 1–3), maturing (4–5), and ripe females (stages 6–8) was calculated for each hauls as well as the proportion of females bearing eggs.

Table 3. Maturity scale for ovary and eggs of *P. edwardsii* modified from Ceccaldi (1966).

Stage	Embryo color	Embryo pigmentation	Eye pigmentation	Gonad color
Immature				
1	blue	no	no	white
2	blue	no	no	pink
3	turquoise-green	no	no	turquoise
Maturing				
4	turquoise	no	no	light blue
5	turquoise	yes	no	light blue
Ripe				
6	grey	yes	slight	dark blue
7	wine	yes	yes	dark blue
8	brown	yes	yes	dark blue

All the biological data have been collected using the facilities (tables, running water, fridge) of the Cooperative of the Fishermen of Naqoura and with the support of the CANA staff (Fig. 8).

Fig. 8. CANA project researchers collecting biological data on gillnet and traps catch in the premises of the Cooperative of the Fishermen of Naqoura.

3. Results

3.1 Monofilament gillnets for hake

Coastal hauls

Two hauls in shallow waters (10-15 m and 12-14 m), were conducted during the first mission period (March 2012). A gillnet of 500 m in length and 52 mm stretched mesh size was used in both hauls. The first haul (16/03/2012) was done at the sunset (16.30-18.00) and the net was left fishing for not more than 2 hours over a mixed sandy-rocky sea bottom. The catch composition is showed in table 4. The catch was dominated by *Siganus rivulatus* (marbled spinefoot) and *Pempheris vanicolensis*. The second haul was carried out by CANA researchers after the end of the mission (17/03/2012). It lasted 1 night at a depth of 12-14 m. The net caught a huge amount (311.3 kg/km net) of the squirrel fish *Sargocentron rubrum* (Fig. 7), requiring more than 10 hours to remove all the fish from the net.

Table 4. Composition of the catch obtained during shallow gillnet hauls carried out in Naqoura.

Sampling date	16/03/2012	17/03/2012
Depth (m)	10-15 m	12-14 m
Species	(Kg/km)	(Kg/km)
Sargocentron rubrum	0.29	311.35
Lagocephalus sceleratus		9.20
Siganus rivulatus	3.79	
Pempheris vanicolensis	0.76	
Muraena helena	0.46	
Siganus luridus	0.08	

Offshore hauls

A total of 29 species were caught in the 5 deep gillnet hauls carried out between 17 and 31 May 2012 (Fig. 9). Commercial species made up 64% in weight of the total catch. The most abundant species were hake (53% of the total catch) with high variable CPUE (366-6706 kg/km net) followed by the gulper shark, *Centrophorus granulosus*, a non-commercial species caught in haul 5 deeper than 350 m depth (Tab. 5). The other commercial species, such as *Helycolenus dactylopterus*, *Dentex macrophtalmus*, *Lophius piscatorius* occurred with few specimens. The cephalopods occurred in the catch with only 2 *Illex coindetii*. This species, along with other commercial species of squids is one of the main component of the gillnet catch from the Western Mediterranean. It is also important to point out than no Lessepsian species were caught on the continental shelf (depth < 200 m).

The highest CPUEs have been obtained in the hauls carried out between Tyre and Naqoura between 200 and 300 m depth, corresponding to the shallower part of the upper slope.

Table 5. Catch composition and mean CPUE (g/km net/day) of the gillnets hauls carried out on deep shelf and upper slope of South Lebanon in May 2012

Sampling date	17-mag	22-mag	23-mag	30-mag	31-mag		
Depth range (m)	220-305	205-220	210-410	95-115	200-250	Mean CPUE (g/km net *day)	SD CPUE (g/km net *day)
Code / Species	3	4	5	6	7		
Merluccius merluccius	9977.3	6706.7	1803.3	236.7	366.7	3818.1	4332.4
Centrophorus granulosus	0	0	9569.3	0	0	1913.9	4279.5
Lophius piscatorius	0	0	0	0	2400	480	1073.3
Raja montagui	963.3	0	0	0	0	192.7	430.8
Helicolenus dactylopterus	0	32	648	0	16	139.2	284.7
Muraena helena	0	0	0	535.3	0	107.1	239.4
Maja goltziana	0	0	0	90.7	595.3	137.2	259.1
Phycis blennoides	0	0	475.3	0	0	95.1	212.6
Dentex macrophthalmus	64.7	314.7	93.3	0	0	94.5	129.6
Zeus faber	0	0	0	376	0	75.2	168.2
Raja miraletus	0	0	0	370.7	0	74.1	165.8
Lepidorhombus whiffiagonis	0	0	346.7	0	0	69.3	155
Scorpaena elongata	16.7	0	223.3	0	0	48	98.3
Illex coindetii	0	142	0	95.3	0	47.5	67.1
Calappa granulata	0	0	0	0	222	44.4	99.3
Pagellus acarne	0	0	0	180	0	36	80.5
Scorpaena scrofa	0	0	0	0	169.3	33.9	75.7
Coelorhynchus coelorhynchus	20	139.3	0	0	0	31.9	60.7
Nemipterus randalli	0	0	0	128	0	25.6	57.2
Mullus surmuletus	0	114.7	0	0	0	22.9	51.3
Trachurus picturatus	0	0	0	79.3	0	15.9	35.5
Hoplostethus mediterraneus	41.3	15.3	0	0	0	11.3	18
Citharus linguatula	41.3	0	0	0	0	8.3	18.5
Parapenaeus longirostris	4	0	0	0	10.7	2.9	4.7
Serranus hepatus	0	0	0	8.7	0	1.7	3.9
Pagellus erythrinus	0	0	0	8	0	1.6	3.6
Paromola cuvieri	0	0	0	3.3	0	0.7	1.5
Aristeus antennatus	0	13.3	20	0	0	6.7	9.4
Gnathophis mystax	0	0	0	0	26.7	5.3	11.9

Fig. 9. Fishing trials with gillnets off the Southern Lebanese coasts

3.1.2 Biological data

Coastal hauls

The length composition of the *Sargocentron rubrum* and *Siganus rivulatus* caught in hauls 1 and 2 is showed in Fig. 10. In both cases the catch was composed almost by a single cohort of individuals, ranging between 12.5 and 17.5 cm TL (*S. rubrum*) and 14-17.5 cm TL (*S. rivulatus*).

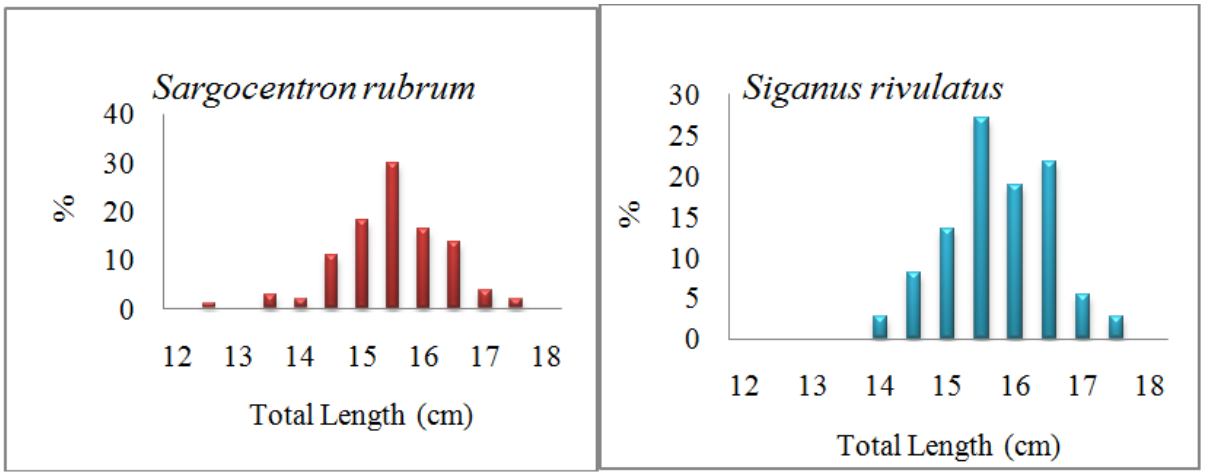

Fig. 10. Size composition of the catch of *Sargocentron rubrum* and *Siganus rivulatus* caught during the gillnets hauls carried out in Naqoura in March 2012.

The following length (TL)-weight (W) relationship was calculated for *S. rubrum*: $W=0.0124TL^{3.1163}$, where W is the weight of the individual and TL is the total length (Fig. 11)

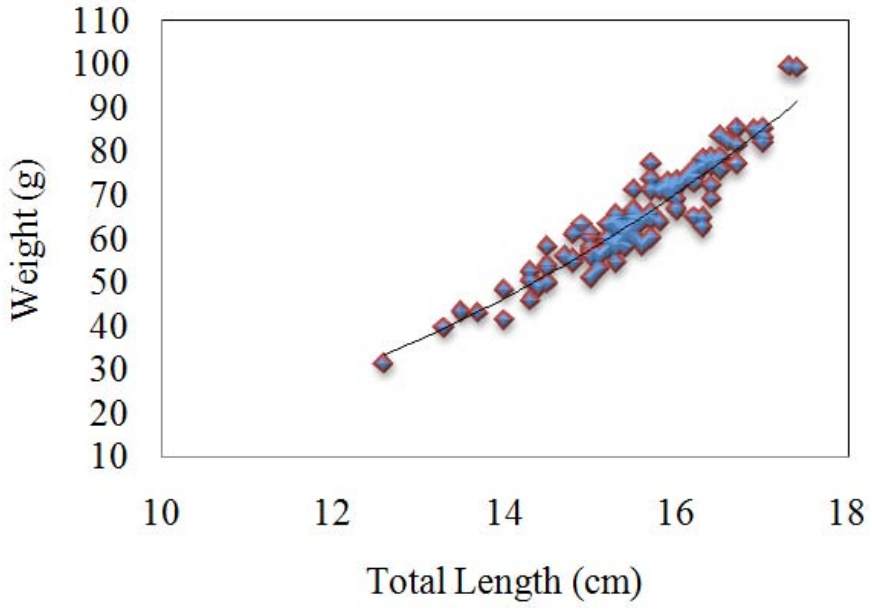

Fig. 11. Length-weight relationship for *S. rubrum*

Offshore hauls - Hake

The length structure of hake catch was the result of a combination of the use of three different mesh sizes and a range of sampling depths. The size of hake specimens was between 25 and 57 cm TL (females: 25.5-57.5 cm TL; males: 29-50 cm TL) with a higher proportion of males (58%). The number of hake specimens caught was not sufficient to investigate the effect of mesh size on the hake catch. As expected, the mean hake size however increased with the mesh size, from 36.4+/-7.4 cm (52 mm mesh) to 39.0 +/- 6.2 cm (60 mm mesh) and 45.5 +/- 8.1 cm (80 mm mesh), as showed in Fig. 12.

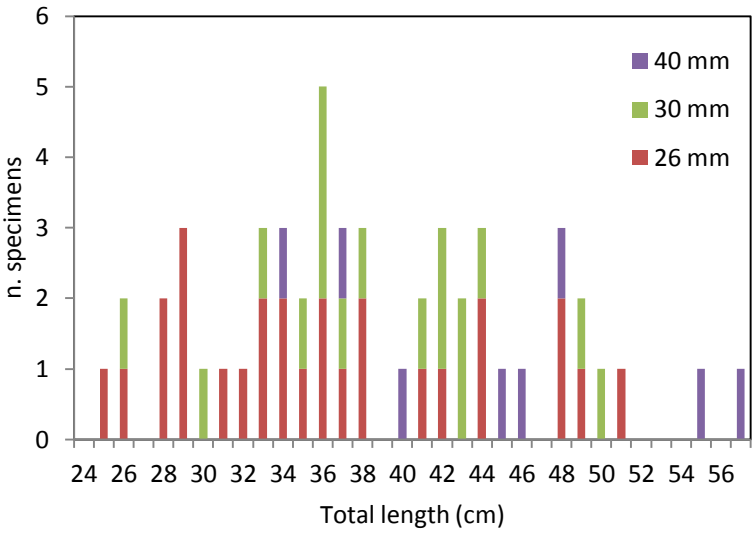

Fig. 12. Size composition of gillnet catch of hake by mesh size (26, 30, 40 mm), obtained in South Lebanon.

Figure 13 shows the composition of maturity stages by sex. A high proportion of females (78%) showed gonads in advanced (II) or mature stage (III) and another 11% was spent (stage IV). Mature males (stage III) accounted for 12% of the total, whereas 28% showed gonads in advanced mature state (stage II) and 16 % were spent (stage IV).

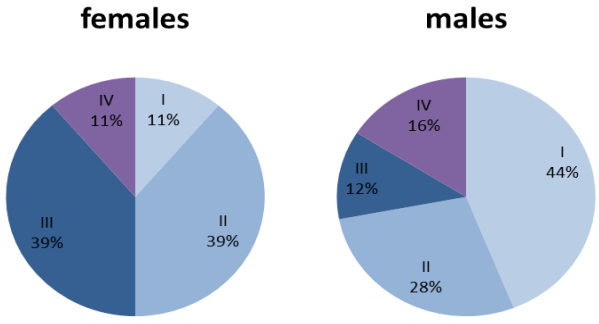

Fig. 13. Composition by maturity stage of females and males of hake caught in South Lebanon. I: immature-virgin; II maturing; III mature; IV spent-rest

The size of gulper shark, *Centrophorus granulosus*, ranged between 40 and 79 cm TL. Most of the specimens caught were mature males (69%).

3.2 Traps for the striped soldier shrimps

The Spanish traps resulted in a CPUE between 210 and 310 g/trap/day of striped soldier shrimp *Plesionika edwardsii* with an average value of 248 g/trap/day. The catch was almost monospecific, as the striped soldier shrimp represented more than 90% in numbers and weight (Table 6, Fig. 14). The bycatch was represented by small amount of *Plesionika narval*, caught in the shallower haul (95-115 m) and juveniles of sparids, such as *Dentex macrophtalmus,Pagellus acarne* and *Helicolenus dactylopterus* (table 6).

Fig. 14. Fishing trials with shrimps traps

Table 6. Catch composition and mean CPUE of the hauls with shrimps tramps carried out in South Lebanon in May 2012

Sampling date	22/5/12	23/5/12	30/5/12	31/5/12		
Depth range (m)	205-220	210-410	95-115	200-250		
Code	2	3	4	5		
Species	CPUE (g/trap*day)				Mean	Stand. deviation
Plesionika edwardsi	210.0	250.0	225.0	308.3	248.3	43.3
Dentex macrophthalmus	28.7	13.3	27.5	0.0	17.4	13.5
Plesionika narval	0.0	0.0	81.7	0.3	20.5	40.8
Pagellus acarne	0.0	0.0	45.0	0.0	11.3	22.5
Helicolenus dactylopterus	0.0	0.0	0.0	4.0	1.0	2.0
Parapenaeus longirostris	0.0	0.0	0.0	2.7	0.7	1.3
Serranus hepatus	0.0	0.0	2.2	0.0	0.5	1.1
Pagellus erythrinus	0.0	0.0	2.0	0.0	0.5	1.0
Paromola cuvieri	0.0	0.0	0.8	0.0	0.2	0.4
Total	224.2	206.7	356.7	291.0	269.6	68.5

3.2.1 Biological data

The composition of the catch of *P. edwardsii* showed large differences according to the sampling depth: the higher abundance of large ovigerous females was observed between 200 and 300 m depth. In deeper depths (400-420 m) the catch was almost composed by males and big immature females, whereas the smallest immature specimens were caught in the haul carried out between 95 and 115 m depth (Fig. 15). Females size ranged between 13 and 27 mm CL with two main cohort at about 20 and 23 mm modal length respectively. Males were smaller belonging mostly to a main cohort between 15 and 24 mm CL. A cohort made up by small and undetermined specimens, corresponding probably to the new recruitment (age group 0), was found in the haul carried out at 95-115 m depth.

Females with mature or nearly mature eggs were more abundant between 200 and 250 m depth. In the shallow haul (95-115 m) the catch was dominated by small immature specimens with a high proportion of females without eggs. The proportion of immature females (stages 1-3) increased at about 80% between 400-410 m depth (Fig. 16). This pattern seems clear indicating a depth distribution strictly correlated with the eggs development. As soon as the eggs became mature females seems to move in the upper part of the slope. The recruitment takes place on the deeper shelf and maturing specimens move deeper as their size increases. Post-spawning specimens seems to concentrate on deeper depths. This pattern would need to be confirmed with further hauls to be carried out in a wider depth range and in different periods of the year.

The data collected did not allow to calculate the length at maturity for females. A high percentage of females with immature eggs were observed in each length class without any clear pattern of increasing proportion of mature specimens with body size (Fig. 17). However, the smallest ovigerous females had a carapace length of 15 mm, and the smallest females with mature ovaries measured 13 mm CL. No females smaller than 18 mm were found with mature eggs on the pleopods.

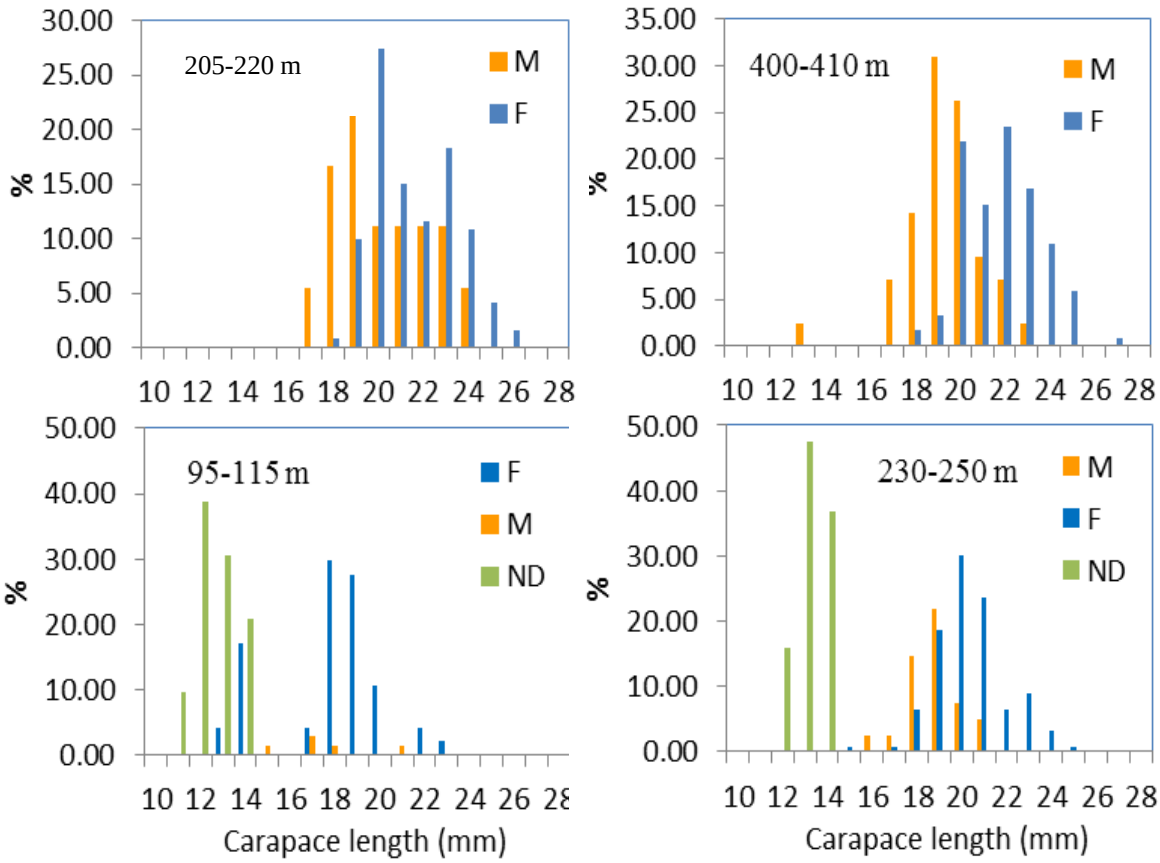

Fig. 15. Length composition by sampling depth of *Plesionika edwardsii* specimens caught off the south coast of Lebanon in May 2012: F: females, M: males, ND: undetermined specimens.

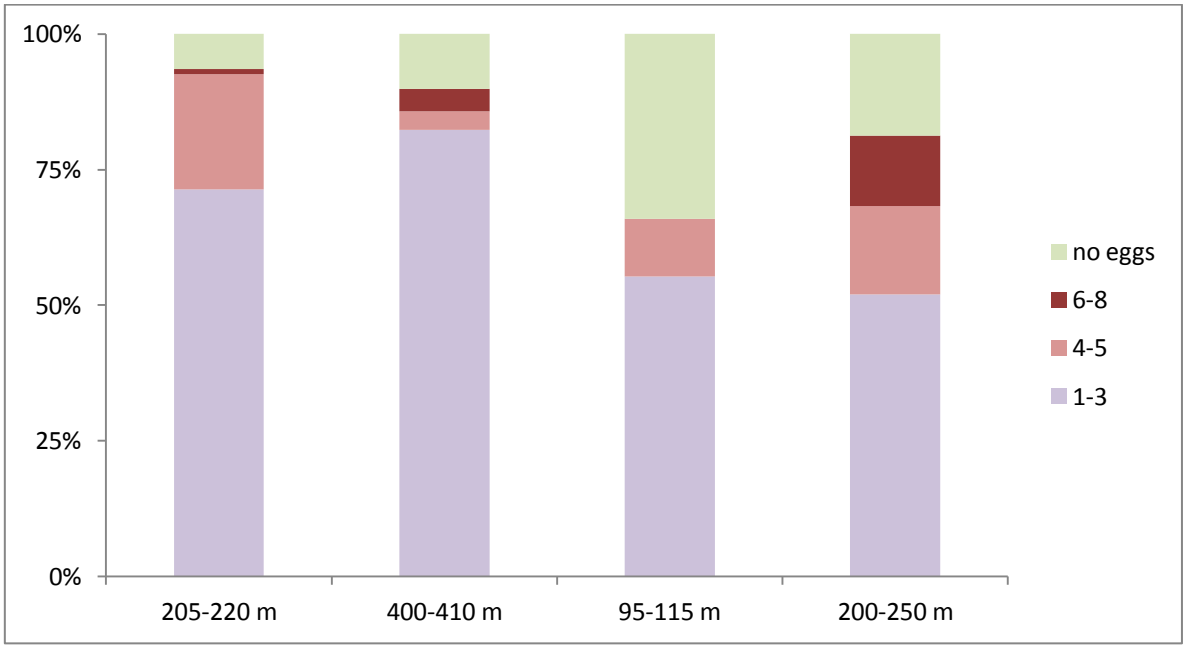

Fig. 16. Composition of the females catch by maturity stage (Ceccaldi's scale) and sampling depth. Maturity stages: 1-3 (immature), 4-5 (maturing), 6-8 (ripe).

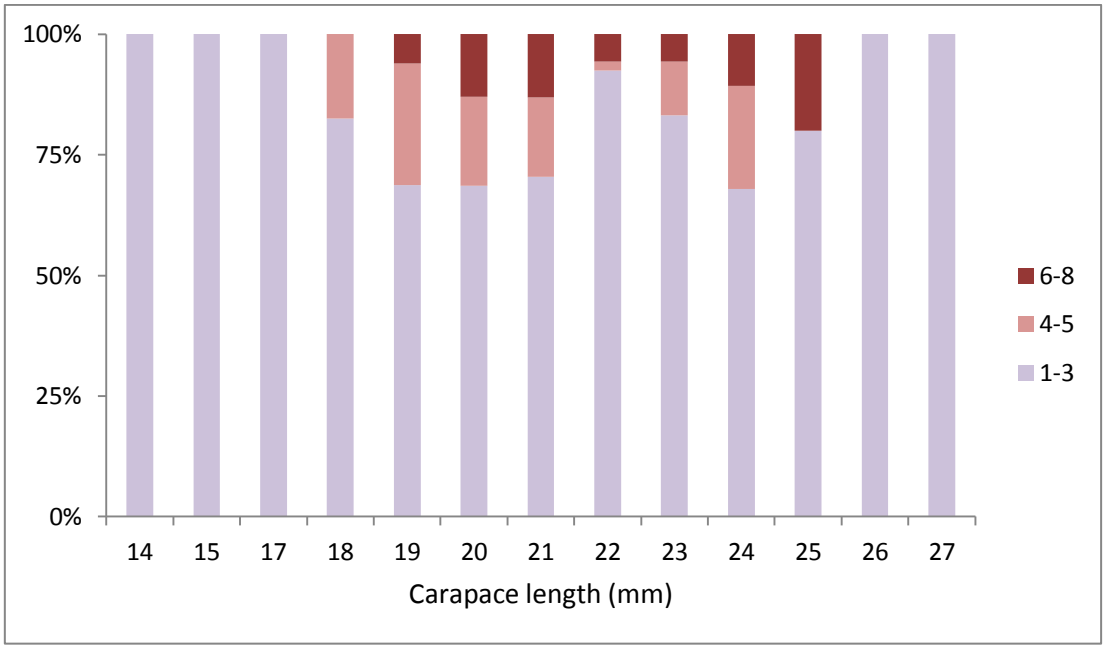

Fig. 17. Composition of the females by maturity stage (Ceccaldi's scale) and length class. Maturity stages: 1-3 (immature), 4-5 (maturing), 6-8 (ripe).

The length-weight relationship was positive allometric indicating that large specimens increase in height or width faster than in length, either as the result of a change in body shape with size, or a better condition of the large specimens than the small ones (Fig. 18).

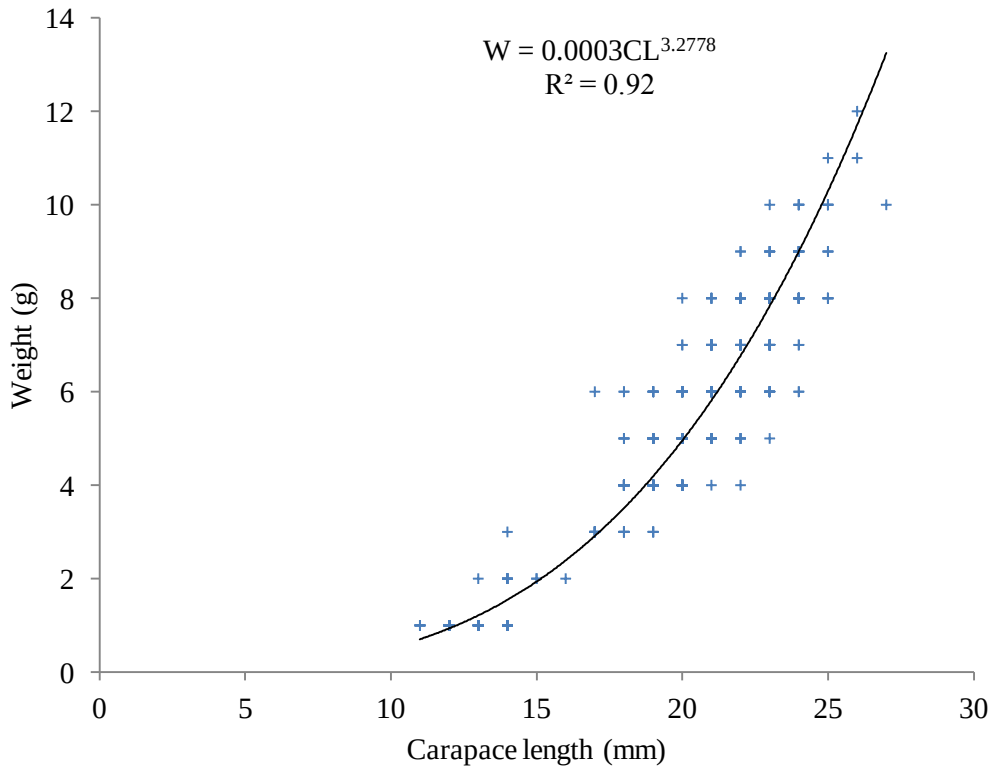

Fig. 18. Length-weight relationship of *Plesionika edwardsii* in South Lebanon

3.3 Estimates of the catch value

3.3.1 Gillnets

An estimation of the economic value of the catch obtained in the hauls carried out in the southern Lebanon was obtained considering the gross prize of the species on the local retail market of Tyre.

The first sale price per kg of hake was about 10 USD. Among the bycatch species, the goulper shark is discarded as well as anglerfish (*Lophius piscatorius*) and skates (Raja spp.). The prize of small sparids (e.g. *Dentex macrophthalmus*, *Pagellus acarne*) was 8/10 USD/kg. Scorpionfish of medium-small size (e.g. *Helycolenus dactylopterus*, *Scorpaena elongata*) was sold at about 4 USD/kg. The marble spinefoot (*Siganus rivulatus*) had a market price of 5 USD/kg and the rabbitfish (*Sargocentron rubrum*) 1 USD/kg if not discarded.

In the first two hauls carried out in inshore waters nearby Naqoura the catch was almost monospecific with few bycatch or discards. The estimated value of the catch was of about 10 and 160 USD for the first and second hauls respectively. The real value of the second hauls is probably unrealistic consider the very low request of rabitfish on the local market.

The composition by market category of the catch obtained during the hake gillnet fishing trials is showed in table 7. Hake made up most of the catch in hauls 3 and 4 whereas discards dominated the haul 4. A very poor catch of target and commercial species was obtained in hauls 5 and 6.

The net value of the catch was calculated by subtracting the estimated fuel costs from the gross value (table 8). The cost of fuel (price per litre of gasoline) was of about 1 USD. The daily fuel consumption ranged between 12 and 30 litres according to the distance of the sampling point from the Tyre port.

A positive economic income was obtained only in the hauls 2 and 3 with an estimate gain of 80 and 50 USD, respectively.

Table 7. Catch weight by market category of the catch obtained during the fishing trials using gillnets on the deep shelf and slope of South Lebanon

Haul	3	4	5	6	7
Category	catch weight (kg)				
Hake	9.98	6.71	1.80	0.24	0.37
By catch of commercial species	0.13	0.62	1.81	0.74	0.20
Species discarded	1.02	0.15	9.57	1.14	3.24
Total (kg)	11.13	7.48	13.18	2.11	3.81

Table 8. Gross and net catch value Catch weight by market category of the catch obtained during the fishing trials using gillnets on the deep shelf and slope of South Lebanon

Haul	3	4	5	6	7
Category	catch value (USD)				
Hake	99.8	67.1	18.0	2.4	3.7
By catch of commercial species	1.0	5.0	14.5	6.3	1.6
Species discarded	0.0	0.0	0.0	0.0	0.0
Total gross value (USD)	100.8 $	72.1 $	32.5 $	8.7 $	5.3 $
Total net value (USD)	80.8 $	51.1 $	7.5 $	-6.3 $	-4.7 $

3.3.2 Traps for shrimps

Considering that the market price of the striped soldier shrimp was of about 10/12 USD/kg, the gross catch values obtained during the project was between 2 and 3 USD/trap/day.

Considering an average price for the national fisheries landing of 10 USD/Kg (Pescamed country report, 2011), the species is well positioned as market value. However, with the help of some marketing action or campaign, an increasing in the price can be easily obtained. Furthermore, the commercial quality of the species is highly dependent on the handling and preservation procedures on board. An improvement in that phase will guarantee a further improvement of the market value of the species.

It is however important to point out that the striped soldier shrimp is one of the few shrimp species that could be exploited in Lebanon using artisanal fishing gears. The Spanish traps, together with the improvement in handling and preservation procedures on board and some marketing actions, may represent an opportunity for the Lebanese artisanal vessels to diversify their activities, to expand the range of exploited crustacean species and finally to add value to their catch, which eventually increase their revenues.

4.0 Training and community involvement

In March 2012 a seminar was organized in Naqoura, with the participation of the fishing community, the Vice-major of the Naqoura municipality, Mr. Stefano Lelli (scientific coordinator CANA project), Dr. Gaby Khalaf (Director of the CNRS-Marine Science Centre) and the CANA project staff. The aim of the seminar was to discuss the possibility to develop a target fisheries for hake (*Merluccius merluccius*) and the striped soldier shrimp (*Plesionika edwardsii*) in southern Lebanon. Participants were firstly introduced in the characteristics of these fisheries, including aspects related to the gear design and construction, fishing grounds, fishing seasons, by-catch species and biological cycles of the target species. The advantages and disadvantages of the development of these offshore fisheries in Naqoura and the South of Lebanon were therefore discussed with the fishermen. The general opinion was that the fishing vessels in Naqoura were not properly equipped to safely carry out offshore fishing. The boats were not more than 9 m in length and motorized with a low power and old engines. They were not equipped with hydraulic winches which are required to safely retrieve the fishing gears on-board. The area of Naqoura is also exposed to winds from different directions and the vessels going offshore face the risk to be drifted off the national waters in case of engine failure. This risk is also increased by the lack of radio equipment to communicate with the port or the municipality in the case of accident.

A second technical seminar was organized for the CNRS and CANA staff involved in fisheries research at the end of the mission in May (24/05/2012). The main subjects of the seminar were related to the MEDITS protocol for biological data collection and the use of the biological data collected for the calculation of the main stocks parameters. A special emphasis was given to the usefulness of some key parameters (e.g. length-at-maturity, length at first capture, spawning periods) for the management of fisheries resources.

The staff of the project and its coordinator, Mr Stefano Lelli, have been advised and supported during the different steps of the project, from the gear design to the collection of catch data.

5.0 Conclusions and recommendations

The reduction of fishing effort in the coastal zone, also through a displacement of part of the fishing effort towards deeper fishing grounds and slightly exploited species, has been recognized as a priority for a sustainable development of Lebanese fisheries (Lelli, 2007, Sacchi and Dimech, 2011).

In March and May 2012 EastMed supported the Naqoura pilot project, funded by the Italian Cooperation and coordinated by the CNRS, to develop a short survey using both gillnets for hake and Spanish traps for the striped soldier shrimp in South Lebanon with the involvement of the local fishers. The pilot study was supported by the CANA-CNRS vessel with its crew and supporting staff. However, given the recognized unsuitability of the CANA-CNRS vessel to manage appropriately the gillnets, it was necessary to hire local vessels to carry out the fishing trials.

The results obtained can be considered as preliminary given the very low number of hauls carried out. A longer survey with an appropriate number of hauls positioned according to a spatio-temporal stratified sampling design would be necessary to collect the data necessary to identify the fishing periods and areas to exploit hake and striped soldier shrimps offshore in the Lebanese coasts.

5.1 Gillnets for hake

Nevertheless, the hauls carried out offshore the coasts of South Lebanon clearly showed the occurrence of potentially exploitable resources on the upper slope. In particular, the hake catch obtained in two hauls (4.5 and 6.6 Kg/Km net/day) was much higher than the catch (0.5 -2.1 Kg/Km net/day) obtained using gillnet offshore Tyre in June-July 2006 (Lelli, 2007). It was also higher than the gillnets catch observed in other Mediterranean areas. For instance in the south Tyrrhenian Sea (Italy) the observed CPUE of hake gillnets averaged between 4.1 and 4.7 Kg/Km net/day of hake (Colloca and Cerasi, 1998). Higher CPUEs between 6 and 10 Kg/Km net/day were obtained in the North Tyrrhenian Sea in the main fishing season (February-April, Sbrana *et al.*, 2007). High variability in daily CPUEs has been always observed, indicating that a rather high number of gillnet hauls is necessary to derive reliable abundance estimates of hake.

The results obtained during the Naqoura project are however encouraging if we consider that the fishing trials have been conducted in May, at the end of the traditional fishing period for hake (December-April) when the highest CPUEs can be obtained. Also the economic profitability of the catch was reasonably good for two out of five offshore hauls. In these two hauls a net value of the catch of about 50-80 USD was estimated.

The occurrence of a high proportion of mature hake specimens with ripe gonads in the catch clearly demonstrated that the southern Lebanese coast is a spawning ground of hake in the Levantine basin. This is an important output of this study, also when considering that the knowledge on hake ecology in this Mediterranean area is really poor and fragmented. Recent studies carried out along the Southern coasts of Turkey (GSA 24) showed clearly a negative relationships between the sea surface water temperature and hake abundance. The distribution of hake in this part of the Levantin basin seems to be strongly affected by the environmental conditions and change in the hydrology (Gucu and Bingel, 2011). Trawl survey data from this

part of Turkey showed the occurrence of medium size specimens whereas the small hake (recruits) and large spawners were not observed. This could suggest a different size spatial distribution of hake specimens in the Levantin basin. Gucu and Bigel (2011), based on the size and timing of appearance of hake in the NE Levantin, hypothesized that the core of the hake nurseries is located to the south of the island of Cyprus. The occurrence of hake spawners offshore the Lebanese coasts could support this hypothesis. Moreover, it is also important to consider that the offshore areas of Lebanon are interested by peculiar oceanographic conditions that may enhance the accumulations of larvae and juveniles and create favourable habitats for their growth and survivor. The Modified Atlantic Water (MAW) enters the Levant Basin through the Cretan Passage and the core of the jet branches southwest of Cyprus (Fig. 19). Part of it bypasses Cyprus to the south and reaches the eastern boundary of the basin. In some years, the mainstream flow is blocked off at the Latakia basin, between Cyprus and Syria (Hetch *et al*., 1998; Gucu and Bingel., 2011). In these years the drift of eggs and larvae eastward could be blocked in the SE Levantin. Moreover, increased retention of eggs and larvae could be associated with the Shikmona mesoscale anticyclonic eddy, generate offshore Lebanese-Israeli coasts. It should feature a predominately convergent flow pattern in the surface layer of the interior of the eddy, with attendant biological implications somewhat similar to those described for ocean surface fronts (Bakun, 2006).

Another important output resulting from the results of gillnet hauls carried out offshore the coast between Tyre and Naqoura is the absence of Lessepsian species on the continental slope. Red Sea migrants dominate the inshore communities (Carpentieri *et al.,* 2009) as also observed in the inshore hauls carried out in Naqoura, but they seem not able to colonize deeper depths.

5.2 Traps for striped soldier shrimp

The Pandalidae shrimp *Plesionika edwardsii* (Brandt, 1851) is a cosmopolitan species distributed in tropical and subtropical areas (Zariquiey Alvarez, 1968). It occurs on the deepest shelf and continental slope, generally between 150 and 600 m depth (Abello´ *et al*., 1988; Carbonell and Abello´, 1998). In the Mediterranean, this species is common in the western basin, whereas it has rarely been found in the eastern basin (Koukuras *et al*., 1998) and considered as not present in the Levant (Vafidis *et al*., 2005).

The hauls with Spanish traps carried out in May 2012 returned mean CPUE of 210-310 g/trap/day of *P. edwardsii*, which is lower than the CPUE (410 g/trap/day) obtained in 2005-06 in the same area (Lelli, 2007) but consistently higher of those obtained in other sectors of the Western Mediterranean. Off the SW coasts of Italy the catch rate ranged from 1.5 to 285 g/trap/day, and the mean total yield was 97 g/trap/day (Colloca, 2002). In the NW Mediterranean (Spain) the CPUE reached a maximum value of 300 g/trap/day and the mean was 108 g/trap/day (Garcia-Rodriquez et al., 2000)

The composition of the catch showed large differences according to the depth: the higher abundance of large ovigerous females was observed between 200 and 300 m depth. On deeper depths (400-420 m) the catch was almost composed by males and immature females, while the smallest immature specimens were caught in the haul carried out between 100 and 150 m depth.

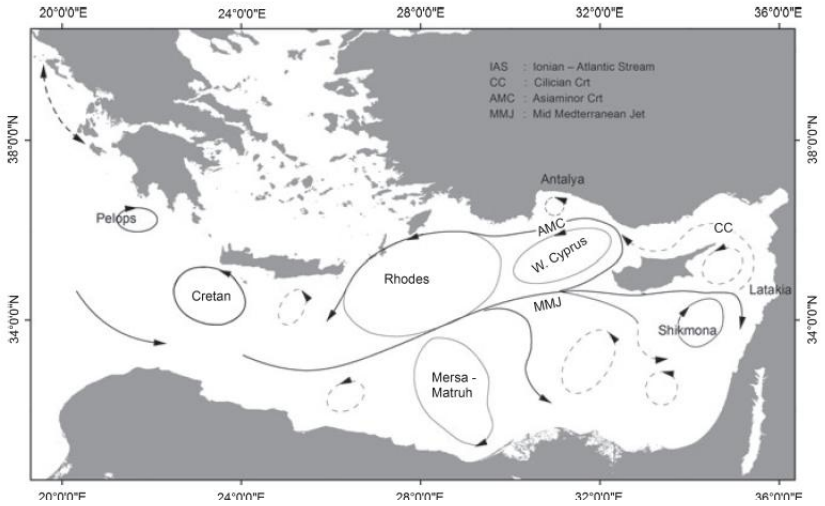

Fig. 19. Direction of main currents and main mesoscale hydrographic features, eastern Mediterranean. Dashed lines = temporal features (from Gucu and Bingel, 2011)

5.3 Recommendations

1. The data collected during this project demonstrated that gillnet surveys may represent a tool for collecting data on the abundance, distribution and ecological characteristics of commercial species. These data are of great importance to build the basis for a sound scientific management advice that would be required to improve fisheries management in Lebanon. This is particularly the case for a new fishing method for the country, such as hake gillnets and Spanish traps, where the only possible data can be collected through surveys. Furthermore since in Lebanon trawling is forbidden surveys using a trawl net are not possible. Although gillnets may not give a synoptic overview of the size composition of the stock, at the moment due to the survey limitations in the country, the only fisheries independent information that can be gathered is through surveys with passive gears.

2. The preliminary information gathered during this project indicated the occurrence of potentially profitable resources off the southern Lebanese coasts. One must take the results of this study with care since the number of stations conducted is too low, and many more replicate stations spread throughout the Lebanese waters must be conducted in order to have an accurate estimation of the resources. Nonetheless the insights obtained during this study shows that fisheries resources exist in deeper waters and that without a renewal of part of the fleet, with new vessels properly build and equipped to safely fish in offshore waters, the objective of an expansion of the fishing grounds toward deeper depths cannot be achieved.

3. The exploitation of offshore resources, such as hake, should be developed sustainably and in this respect, monitoring of the fisheries should be eventually required to assess the fishing impact on the target stocks. Both for hake and the striped soldier shrimp the catch of juveniles should be avoided through the adoption of ad-hoc minimum mesh sizes. In this respect selectivity experiments should be conducted.

4. The striped soldier shrimps occur with a high abundance offshore the Lebanese coasts. The exploitation of this species with traps represents an opportunity for the artisanal fleet to expand their catch including also commercial shrimps. *P. edwardsii* is one of the few crustacean species that can be profitably exploited by the artisanal vessels. Low investments costs to build the traps, reduced fishing times, availability and low cost of baits, are all features that make this fishing method a reliable alternative to the traditional inshore fisheries (e.g. trammel nets, traps for Siganidae, etc.). However, further surveys are required to gather quantitative data on the spatio-temporal distribution of *P. edwardsii* offshore the Lebanese coasts to identify the more suitable fishing periods and areas, and to determine the level of fishing that may be considered sustainable.

5. The CANA-CNRS vessel, its staff and crew represents an opportunity for the development of fisheries research in Lebanon. The vessel is however currently not equipped with winches for retrieving nets on board and its suitability to carry out fishing with fixed gears has been argued during the project. It would however be advisable to promote a feasibility study, requiring the expertise of fishing engineers and eventually skilled fishers, to evaluate the possibility to adapt the vessel to fishing with different types of fishing gears and eventually estimate the costs required.

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ANNEXES

Annex I List of People met

Date	Name	Position	Institution
15/03/2012	Stefano Lelli Gaby Khalaf CANA staff Ali Moumen Marie-Luise Hayek Mouïn Hamzé	Naqoura project coordinator Director NCMS CANA staff FAO Representative in Lebanon Staff Secretary General	CNRS CNRS CNRS FAO FAO CNRS
16/03/2012-	Stefano Lelli CANA staff Ms Samira Yazbeck Fishermen of Naqoura	Naqoura project coordinator CANA project Vice major Naqoura	CNRS CNRS
17/03/2011-	Stefano Lelli CANA staff Ms Samira Yazbeck Fishermen of Naqoura	Naqoura project coordinator CANA project Vice major naqoura	CNRS CNRS
18/03/2012	Stefano Lelli CANA staff Fishermen of Naqoura	Naqoura project coordinator CANA project	CNRS CNRS
20/05/2012	Stefano Lelli Sharif Jemaa	Naqoura project coordinator CANA staff	CNRS CNRS
21/05/2012	Stefano Lelli Sharif Jemaa Elie Tarek Fishermen of Tyre	Naqoura project coordinator CANA staff CANA staff	CNRS CNRS CNRS
22/05/2012	Sharif Jemaa Elie Tarek Fishermen of Tyre	CANA staff CANA staff	CNRS CNRS
23/05/2012	Sharif Jemaa Elie Tarek Fishermen of Tyre	CANA staff CANA staff	CNRS CNRS
24/05/2012	Stefano Lelli Gaby Khalaf CANA staff	CNRS Director NCMS CANA project	CNRS CNRS CNRS

Annex II Terms of Reference

Activities to be implemented by CNRS in the framework of the "Project Naqoura

Under the general supervision of the EastMed project coordinator and in close collaboration with the EastMed technical officer and the national experts of the Centre for National Research (CNRS) in Lebanon, the consultant will provide technical assistance in a pilot testing phase for the use of new fishing techniques in Lebanon.

The consultant is requested to supervise field activities and to provide training and information at different levels. Building the capacities of the staff of CNRS in terms of data collection and analysis, training the fishermen on the correct use of new fishing techniques, and presenting the results and good practices of the activity to the concerned stakeholders. The main duties of the consultant will be:

1. Train the fishing community of Naqoura in the use of new fishing techniques
2. Define the most appropriate sampling design for the testing of the fishing gear
3. Supervise the preparation of the fishing gear
4. Supervise the field activities for the testing of new fishing techniques in the area of Naqoura
5. Supervise the collection of data on board the vessel
6. Analyze the data in collaboration with CNRS as per standard methodologies

Annex III Schedule of activities

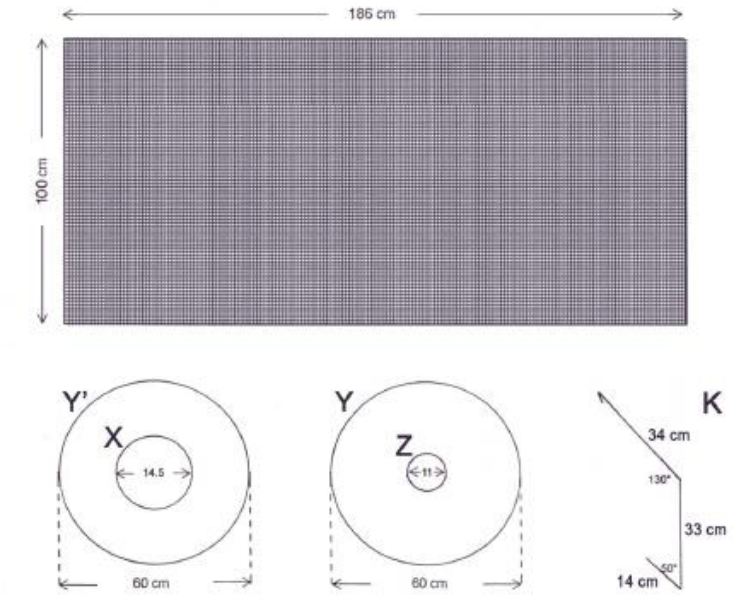
Date	Place	Activity
14/03/2012	Rome-Beirut	Travelling to Beirut
15/03/2012	Beirut	Meeting with Stefano Lelli and the CANA project staff, meeting with the FAO officer
16/03/2012	Naqoura	Visit to Naqoura port and meeting with local fishermen and the vice-major of the municipality
17/03/2012	Beirut-Naqoura	Preparation of a presentation for the seminar and fishing test
18/03/2012	Naqoura	Seminar with the fishermen and fishing test
20/03/2012	Beirut-Rome	Travelling to Rome
20/05/2012	Rome-Beirut	Travelling to Beirut
21/05/2012	Tyre	Meeting with Stefano Lelli, CANA project staff and Tyre fishermen to plan the fishing trials
22/05/2012	Tyre	Fishing trials, meeting with Naqoura fishermen
23/05/2012	Tyre	Fishing trials, meeting with Naqoura fishermen
24/05/2012	Tyre-Beirut	Seminar at the CNRS with CANA's staff
25/05/2012	Beirut-Rome	Travelling to Rome

Annex IV Required materials to build the shrimp trap

Adapted from Lelli (2007)

Required materials to build one trap

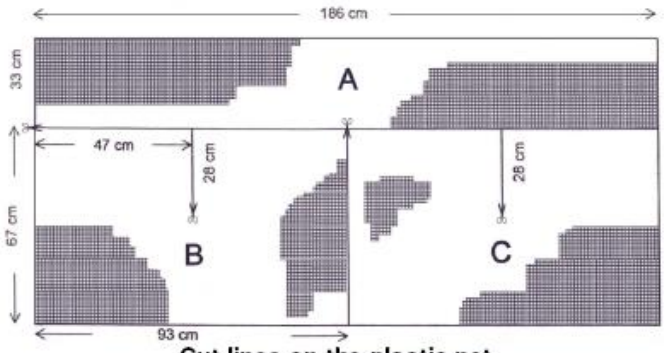
1. White plastic net (186 x 100 cm), 10/15 mm mesh size;
2. approximately 100 plastic tie wraps;
3. approximately 7 m of galvanized iron wire, diameter 3.5/4 mm;
4. 80 cm of polypropylene rope, diameter 3.5 mm;
5. 1 spherical float suited for deep waters, volume 1 liter; or 6 cylindrical floats suited for deep waters.



Net, rings and rib required to build a Spanish trap.

INSTRUCTIONS

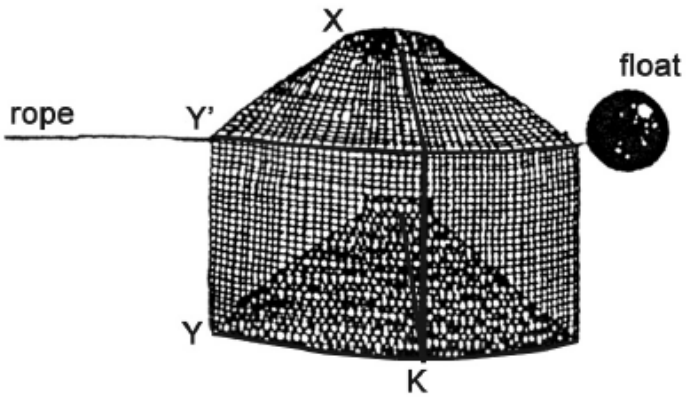
1. Cut the plastic net in three pieces (A, B, C), carving the pieces B and C as shown in the following picture:



Cut lines on the plastic net

2. Shape a cylinder, joining the ends of the net portion A and fix the two iron rings Y and Y' (Ø = 60 cm) at the extremity of the net.
3. Wrap the net portion B in order to form a cone.
4. Join the base of the cone B with the base of the cylinder (ring Y).
5. Insert the ring Z (mouth of the trap) on the tip of the cone B.
6. Cut the tip of the net cone and fasten the extremity of the net with the ring Z.
7. Wrap the net portion C in order to form a cone.
8. Join the base of the cone C with the other base of the cylinder (ring Y').
9. Insert the ring X (entrance for baiting the trap) on the tip of the cone C.
10. Cut the tip of the net cone and fasten the extremity of the net with the ring X.
11. Fasten the three ribs (K, K' and K") at the same distance around the trap.
12. Cut a square of net (20 cm x 20 cm) and provisionally fasten as a lid of the entrance for baiting the trap (ring X).
13. Knot the rope at the base of the cone C, where the ring Y' meet one of the rib.
14. Join the float on the base of the cone C, exactly at the opposite side of the rope, as shown in the picture below;

Rings, ribs and net are assembled with plastic tie wraps.



A completed Spanish trap

Annex V Some pictures of the fishing trials

Images of catch and by-catch species from Tyre and Naqoura. From the upper left side: *Scomberomorus commerson* catch in the premises of the Naqoura cooperative, *Sargocentron rubrum* caught with gillnets in Naqoura, *Pempheris vanicolensis* from Naqoura, *Plesionika edwardsii* caught with Spanish traps between Tyre and Naqoura; hake caught during fishing trials with bottom gillnets off Tyre, mature female of hake; commercial catch of *Helycolenus dactylopterus*, hake and *Hexanchus griseus* of a vessel from Tyre using bottom longlines; *Dentex macrophthalmus* a common by catch species of gillnets on the slope.

Images taken during the fishing trials carried out off the coasts between Tyre and Naqoura. The species from the left are *Scorpaena elongata*, *Plesionika edwardsii*, *Centrophorus granulosus*, *Lepidorhombus whiffiagonis*.

Beneficiary countries

Countries with waters included in the GFCM
Geographical Sub-Areas (GSAs) 19-20 and 22-28

Donors

Greece

- Ministry of Foreign Affairs
- Ministry of Rural Development and Food

Italy

- Ministry of Agriculture Food and Forestry Policies

European Community

- Directorate General of Maritime Affairs and Fisheries (DG-MARE)

Hellenic Ministry of Foreign Affairs

Hellenic Ministry of Rural Development and Food

ITALIAN MINISTRY OF AGRICULTURE, FOOD AND FORESTRY POLICIES

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