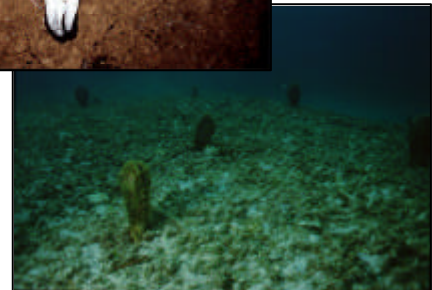


Project for the preparation of a Strategic Action Plan for the conservation of biological Diversity in the Mediterranean Region
(SAP BIO)

GUIDELINES FOR ELABORATING NATIONAL ACTION PLANS TO CONTROL FISHING PRACTICES AND GEAR HARMFUL TO THREATENED SPECIES AND HABITATS



Project for the Preparation of a Strategic Action Plan for the Conservation
of Biological Diversity in the Mediterranean Region
(SAP BIO)

**GUIDELINES FOR ELABORATING NATIONAL
ACTION PLANS TO CONTROL FISHING PRACTICES
AND GEAR HARMFUL TO THREATENED SPECIES
AND HABITATS**



**RAC/SPA - Regional Activity Centre for Specially Protected Areas
2003**

Note: The designation employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of RAC/SPA and UNEP concerning the legal status of any State, territory, city or area, or of its authorities, or concerning the delimitation of their frontiers or boundaries. The views expressed in the document are those of the author and not necessarily represented the views of RAC/SPA and UNEP.

This document was prepared within the framework of a Memorandum of Understanding (MoU) concluded between the Regional Activity Centre for Specially Protected Areas (RAC/SPA), and the Fisheries Department of the Food and Agriculture Organization of the United Nations (FAO) concerning the role to be played by FAO within the framework of the SAP BIO Project.

prepared by
Joseph Catanzano
Consultant FAO
June 2001

Cover photos
D. Cebrian
M. Relini

Foreword

The present document aims at giving guidelines for preparing National Action Plans to control fishing practices and gear harmful to threatened species and habitats and to reduce ecosystem damage resulting from fishing pressure. While running independently, national processes had to follow common guidelines with a view to providing comparable, compatible inputs to the Strategic Action Plan for the Conservation of Biological Diversity in the Mediterranean Region (SAP BIO). It's through this document, that such goal could be achieved for this important subject.

Contents

Foreword

1. Introduction

- 1.1. Context 1
- 1.2. Regional co-operation background 2
- 1.3. Institutional and international regulation background 4
- 1.4. Nature and scope of the National Action Plans 6
- 1.5. Preliminary technical recommendations 8

2. Developing a National Action Plan for reducing the ecosystem alteration resulting of fishing pressure in Mediterranean area

- 2.1. Preliminary assessment and analysis 9
- 2.2. Complementary analysis and research 10
- 2.3. Circulation and regulation 10

3. Some optional technical and operational measures for reducing the ecosystem alteration resulting of fishing pressure in Mediterranean area

- 3.1. Introduction 12
- 3.2. Reduce the impact of fishing on vulnerable groups and habitat 12
 - 3.2.1 On chondrichthyans 12
 - 3.2.2 On seabirds 14
 - 3.2.3 On turtles 16
 - 3.2.4 On Mediterranean monk seal 18
 - 3.2.5 On cetacean 19
 - 3.2.6 On seagrass beds 22
 - 3.2.7 On the seabed (soft and hard bottoms) and its associated benthic communities 23
- 3.3. Regulating the use of gears and fleets to limit negative fishing impacts 26
 - 3.3.1 Bottom trawling 26
 - 3.3.2 Longlining on large pelagic populations 27
 - 3.3.3 The ecosystem impact of artisanal gears 28
 - 3.3.4 The case of Mediterranean drifnet fisheries 29

Bibliography

30

1. INTRODUCTION

1.1 Context

The effect of fishing in the Mediterranean goes far beyond isolated impacts on over-fished target species, vulnerable non-commercial groups or sensitive habitats. Many groups have been shown to be especially vulnerable to human exploitation, fishing mortality resulting from both **direct fisheries** as well as high **by-catch** as a consequence of the use of low-selective gear.

Most of the major effects of fishing recorded in Mediterranean ecosystems vary from local effects on the sea bottom caused by damaging trawler gear to large-scale impacts on cetacean populations arising from the **animals getting entangled in long drift-nets**.

This variety is due to three main factors:

- ✂ the huge diversity of fishing gear and practice (mostly traditional),
- ✂ the very high intensity of fishing,
- ✂ sizeable biological diversity.

Fishing profoundly affects the complex structure of ecosystems, altering the way they function internally. Some recent attempts to evaluate the overall ecosystem effect of fishing in specific areas of the Mediterranean have concluded that the mismatch between the harvesting at lower trophic levels (TLs) and the expected increase of catch points to a disruption of the major energy pathways and a subsequent decrease in yield, resulting from the structural and functional degradation of the ecosystem.

The ecosystem effects of fishing in the Mediterranean are also conspicuous at systemic level, as highlighted by the massive ecological imprint of fishing or the marked effects on the food-web structure. These changes directly affect important ecosystem properties such as resilience to human interference.

The FAO Code of Conduct for Responsible Fisheries¹ encourages the development and application of selective, environmentally safe fishing gear and practices in order to maintain biological diversity and to conserve the population structure and aquatic ecosystems and protect fish quality. In addition, states and users of aquatic ecosystems are required to minimize waste, catch of non-target species and impact on associated or dependent species (Article 6.6 of the Code). Consequently, the coastal states are required to adopt appropriate measures to regulate the characteristics and conditions of the use of fishing gear as well as fishing methods. States are required to provide adequate protection for critical fisheries habitats in both marine and fresh water ecosystems so as to ensure the health and viability of the fishery resources (Article 6.8 of the Code). This can be done by elaborating National Action Plans to control fishing practices and gear harmful to threatened species and habitats and to reduce ecosystem damage resulting from fishing pressure.

Since conservation and management measures should be based on the best scientific evidence available, states should give priority to undertaking research and data collection in order to improve scientific and technical knowledge of fisheries (Article 6.4 of the Code). It is therefore crucial that they devise and implement mechanisms designed to collect information on the fishing

¹ The Code was unanimously adopted on 31 October 1995 by the FAO Conference.

activities undertaken by both foreign and national fishing vessels operating within waters under their jurisdiction and by national fishing vessels authorised to fish on the high seas.

In 1999, a Memorandum of Understanding (MoU) was concluded between the Regional Activity Centre for Specially Protected Areas (RAC/SPA), and the Fisheries Department of the Food and Agriculture Organisation of the United Nations (FAO) concerning the role to be played by FAO within the framework of SAP Biodiversity project. The SAP Biodiversity is expected to provide a logical basis for implementation of the 1995 SPA Protocol; it will analyse issues and identify action at national and regional levels.



Capture of juveniles by trawling in shallow water. M. Relini © RAC/SPA

1.2 Regional cooperation background

Regional cooperation was initiated in 1975 to protect Mediterranean biological diversity. The Mediterranean states adopted the Mediterranean Action Plan (MAP) within the framework of the UNEP regional sea programme. One of the main objectives of this Plan was to establish a framework convention for the protection of the Mediterranean environment.

The Barcelona Convention for the Protection of the Mediterranean Sea against Pollution, which was adopted on 16 February 1976 (entered into force on 12 February 1978) is supplemented by a series of 6 implementing protocols that deal with specific aspects of environmental protection². The 1982 Protocol Concerning Mediterranean Specially Protected Areas was adopted in Geneva on 1 April 1982 (entered into force on 23 March 1986). In 1995 and 1996 the MAP and the Barcelona system underwent important changes in order to reflect the evolution of international law in the field of environment protection, as embodied in the documents adopted by the United Nations Conference on the Environment and Development (Rio de Janeiro, 1992). With regard to the issue of protected areas, the Parties to the Barcelona Convention adopted a new text intended to replace the 1982 Protocol.

² These instruments are often referred to as the "Barcelona system".

The 1995 Protocol extends the geographical range to all marine waters in the Mediterranean. It provides for establishing a list of Specially Protected Areas of Mediterranean Interest (SPAMI List), that must include sites which:

- ✍ ✍ "are of importance for conserving the components of biological diversity in the Mediterranean;
- ✍ ✍ contain ecosystems specific to the Mediterranean area or the habitats of endangered species; or
- ✍ ✍ are of special interest at the scientific, aesthetic, cultural and educational levels" (Article 8.2).

The 1995 Protocol requires Parties, in the areas subject to their sovereignty or jurisdiction, to "identify and compile lists of the endangered or threatened species of flora or fauna and accord protected status to such species" (Article 11.2). Parties are urged to provide these species with adequate protection by restricting and, where appropriate, prohibiting the taking, including the incidental taking, of these species (Article 11.3 (a)). With respect to migratory species whose range extends into the area to which the Protocol applies, the Parties "shall co-ordinate their efforts, through bilateral or multilateral action, including, if necessary, agreements for the protection and recovery of [these] migratory species" (Article 11.4).

The 1995 Protocol is completed by three annexes:

Annex I: common criteria for the choice of Protected Marine and Coastal Areas that could appear on the SPAMI List,

Annex II: the list of endangered or threatened species,

Annex III: the list of species whose exploitation is regulated.

In 1996, the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area³ (ACCOBAMS) was adopted within the framework of the Convention on the Conservation of Migratory Species of Wild Animals⁴. Under the terms of this Agreement, Parties are required to "take co-ordinated measures to achieve and maintain a favourable conservation status for cetaceans" and to "prohibit and take all necessary measures to eliminate, where this is not already done, any deliberate taking of cetaceans" (Article II.1). The Agreement is completed by annexes. Annex 2, dealing with the conservation plan, provides for the measures the Parties undertake to adopt, which include a prohibition from keeping on board a vessel, or using for fishing, one or more drift-nets whose individual or total length exceeds 2,500 m.

In 1993, France, Italy and Monaco signed a declaration on establishing a sanctuary for the protection of marine mammals in the Mediterranean. This international marine sanctuary, which in addition to the internal waters and the territorial seas of the three states would include areas of the high seas, is intended to ensure adequate protection for all species of marine mammal occurring therein. Among the various protection measures envisaged, the three states will prohibit within the marine sanctuary any deliberate catching or harassing of marine mammals, as well as the use and detention of drift-nets for fishing pelagic species.

³ As of writing, this Agreement has not yet entered into force.

⁴ This Convention was adopted in Bonn on 23 June 1979.

Under the UNCLOS, the Mediterranean Sea comes within the category of enclosed or semi-enclosed seas⁵. The Mediterranean Sea satisfies one of the two alternative criteria in that it is connected to the Atlantic Ocean by the narrow outlet of the Strait of Gibraltar. It would also satisfy the second alternative criteria if the coastal states proclaimed an exclusive economic zone⁶. This simply requires that the Mediterranean states bordering on the sea cooperate directly or through an appropriate regional organization to inter alia "coordinate the management, conservation, exploration and exploitation of the living resources of the sea" (Article 123).

1.3 Institutional and international regulatory background

To date, two regional fisheries organisations dealing with fisheries issues in the Mediterranean have been established, namely the General Fisheries Commission for the Mediterranean (GFCM)⁷ and the International Commission for the Conservation of Atlantic Tunas (ICCAT).

GFCM

The GFCM was created in Rome by the agreement of 24 September 1949. It entered into force on 20 February 1952 and was amended in 1963, 1976 and 1997. As of December 1997, twenty-one Mediterranean and Black Sea states and one non-Mediterranean state have been members of the GFCM⁸. The purpose of the GFCM is to promote the development, conservation, rational management and best utilization of living marine resources occurring in the Mediterranean, the Black Sea and connecting waters, both in areas under national jurisdiction and on the high seas. In order to achieve its goal, the GFCM can, by a two-thirds majority, adopt recommendations on measures for the conservation and rational management of living marine resources. These measures may regulate fishing methods and gear, prescribe the minimum size of species of fish, establish open and close fishing seasons and areas, and determine the amount of total catch and fishing effort as well as their allocation among member states (Article III.1 (b)). Member states must give effect to these recommendations, unless they object to do so within 120 days from the date of notification (Article V.3).

It was not until 1995 that the GFCM formulated binding recommendations. It adopted ICCAT management measures regarding the taking and landing of bluefin tuna or *Thunnus thynnus* (Resolution No. 95/1). This resolution provides inter alia that: (i) large pelagic longliners exceeding 24 m in length will be prohibited from fishing bluefin tuna (*Thunnus thynnus*) during the reproduction period from 1 June to 31 July and (ii) the members of GFCM take all necessary measures to prohibit any taking and landing of bluefin tuna (*Thunnus thynnus*) weighing less than 6.4 kg. (It specifies that member states may tolerate

⁵ Definition by Article 122: "gulf, basin or sea surrounded by two or more States and connected to another sea or the ocean by a narrow outlet or consisting entirely or primarily of the territorial seas and exclusive economic zones of two or more coastal states".

⁶ The Mediterranean Sea would consist entirely of territorial seas and exclusive economic zones if coastal state proclaimed an economic exclusive zone. Hitherto, they have been reluctant to do so. One of the main reasons for this choice may have been the difficulty of delimiting maritime areas therein.

⁷ Initially known as the General Fisheries Council for the Mediterranean, the term Council was changed to Commission at its 22nd session, held in Rome on 13-16 October 1997.

⁸ Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Morocco, Romania, Spain, Syria, Tunisia, Turkey and Yugoslavia. Japan accepted the GFCM Agreement in 1997. In 1998, the European Union became a member of GFCM by a Council Decision of 16 June 1998 on the accession of the European Community to the General Fisheries Commission for the Mediterranean (OJ No. L190 of 4 July 1998, p. 34).

small proportions of incidental catch of bluefin tuna weighing less than 6,4 kg, provided that they do not exceed 15% of the total catch of bluefin tuna).

Three other binding recommendations were adopted in 1997. Resolution No. 97/1 prohibits any vessel flying the flag of GFCM Contracting Party from keeping on board, or using for fishing, one or more drift-nets whose individual length is more than 2.5 km. It specifies that throughout the area beyond the 12-mile coastal band, the net must, if it exceeds 1 km in length, remain attached to the vessel. The GFCM adopted a resolution reflecting the ICCAT recommendation on the banning of purse seine fishing for bluefin tuna during the month of August each year and the use of helicopters and planes in support of fishing operations in the month of June (Resolution No. 97/3). Furthermore, the GFCM calls upon states which are not members of the GFCM, but whose vessels engage in fishing activities in the region, to become members of the GFCM or otherwise cooperate on implementing the recommendations made by the Commission. It also urges member states to report to the Commission on any fishing activity by vessels flying the flag of non-member states which undermine the effectiveness of GFCM recommendations (Resolution No. 97/2).

ICCAT

The International Commission for the Conservation of Atlantic Tunas (ICCAT) was established in 1969, at a Conference of Plenipotentiaries, which prepared and adopted the International Convention for the Conservation of Atlantic Tunas, which was signed in Rio de Janeiro on 14 May 1966⁹. It is designed to ensure the sustainable exploitation of Atlantic tuna and tuna-like species in the Atlantic Ocean and adjacent seas (Article I) and thus applies to the Mediterranean. ICCAT, on the basis of scientific research conducted under its auspices, is empowered to make recommendations aiming at ensuring the maximum sustainable catch. These recommendations, if not objected to by a majority of Parties, are binding on all Parties, except those which register formal objections (Article VIII). Principal recommendations applicable to the Mediterranean Sea concern bluefin tunas (*Thunnus thynnus*)¹⁰.

There is a growing consensus on the potential use of Marine Reserves or Marine Protected Areas (MPAs) as a precautionary tool for the systemic management of fisheries (Roberts, 1997; Hall, 1998; Lauck et al., 1998; Hastings and Botsford, 1999). The use of this approach in the Mediterranean appears to be promising, given the preliminary results of some limited experiments with Marine Reserves (see above). The idea of rebuilding degraded ecosystems, mostly through MPAs, is gaining support within the scientific community (Pitcher and Pauly, 1998). These authors think the goal should be not to conserve ecosystems in their current state but rather to reconstruct past, healthier states that existed prior to their extensive

⁹ The Convention entered into force on 21 March 1969. Currently, there are 28 Contracting Parties, including France, Morocco, Libya, Croatia, the European Union and Tunisia. See ICCAT website at www.iccat.es/, which was last consulted on 18 September 2000.

¹⁰ See Recommendations N°74/1, 93/7, 94/7, 96/2 and 96/3

modification by man. This approach would be of particular interest in the Mediterranean given the profound transformation of the marine ecosystems due to centuries of intense human exploitation.

These precautionary ecosystem-based measures should be accompanied by general improvements in both intra- and inter-specific selectivity of gear and fishing practices, the mitigation of the physical damage these cause to the supporting environment, and parallel educational programmes for fishermen. Public subsidies diverted to these measures, which in some cases would involve the eradication of or tight restrictions on especially harmful fishing practices, would probably result in the improvement of fisheries and their related ecosystems.

A reductionist approach alone may not prove sufficient for satisfactorily tackling the issue of the conservation of Mediterranean ecosystems and their biological diversity. Furthermore, conservation policies that target vulnerable species or habitats should not be separated from fisheries management policies, given that they have essentially the same goal.

From many cases it has become clear that apart from issues linked to technical aspects, such as those concerning harmful gear or fishing practices, over-fishing is a central problem that underlies many of the other problems. Many instances have been reported of how intensive fishing exacerbates interactions between vulnerable groups and fisheries. The development and enforcement of integrated precautionary policies appears to be absolutely necessary.

Well-structured ecosystems maintain healthy predator population levels, tend to be more energy-efficient and more resilient to external disturbance, and constitute the bases for sustainable fisheries. In Mediterranean ecosystems, claims concerning the role of the increase in biological production due to the anthropic nutrient enrichment of waters add some element of uncertainty to the interpretations.

1.4 Nature, scope and objectives of the National Action Plans

The National Action Plan, which is a voluntary instrument, stipulates that states take certain actions and is also meant to address persons, interest groups or institutions, public or private, which are involved in or concerned with Mediterranean marine ecosystem resources.

Government authorities will increasingly have a key role to play in enhancing effective collaboration with and among many players, in order to promote a reduction of ecosystem damage resulting from fishing pressure.

Responsibilities will need to be shared among government authorities, fishermen, manufacturers and suppliers of fishing inputs, processors of and traders in fishery products, financing institutions, researchers, special interest groups, professional associations, non-governmental organizations and others.

Recognizing the principles and standards applicable to the conservation, management and development of the world's fisheries provided by the Code, the National Action Plans aim to encourage the development and application of selective, environmentally safe fishing gear and practices in order to maintain biological diversity and to conserve population structure and marine ecosystems and protect fish quality in Mediterranean Sea.

The following points are not exhaustive; the aim is to help prepare National Action Plans to reduce ecosystem damage resulting from fishing pressure.

The National Action Plan to reduce ecosystem damage resulting from fishing pressure is a Plan elaborated, implemented and followed through by each state before progressing from a National Plan to elaborating and applying a Regional Plan.

1.5 Preliminary technical recommendations

To implement the National Action Plans to reduce ecosystem damage resulting from fishing pressure, the states in the Mediterranean area must exercise control over fishing capacity, reduce excess capacity, minimize waste, catch of non-target species and impacts associated or dependant species, adapt appropriate measures to regulate the characteristics and the conditions of use of fishing gear and fishing methods.

States are required to provide adequate protection for critical fisheries habitats in both marine and fresh water ecosystems so as to ensure the health and viability of the fishery resources (Article 6.8 of the Code). This can be done by establishing Marine Protected Areas or proclaiming temporary or permanent fishing prohibited areas.

Since conservation and management measures should be based on the best scientific evidence available, states should give priority to undertaking research and data collection in order to improve the scientific and technical knowledge about fisheries (Article 6.4 of the Code). It is therefore crucial that they devise and implement mechanisms designed to collect information on the fishing activities undertaken by both foreign and national fishing vessels operating within waters under their jurisdiction and by national fishing vessels authorized to fish on the high seas.

To facilitate its implementation, a National Action Plan must provide specific recommendations designed to improve fisheries law with respect to the protection of biological diversity. Recommendations have to be addressed in view of national study reviews of the various arrangements and organizations that have been established to promote regional cooperation in the fields of the environment and fisheries in the Mediterranean and analysis on the national fisheries laws enacted by each coastal state bordering on the Mediterranean basin, in order to determine whether the issues mentioned above aiming at minimizing the impact of fishing on biological diversity have been adequately addressed in the national legal frameworks.

Measures to be analysed are:

- ~~///~~ licensing of fishing activities,
- ~~///~~ fishing gear and methods,
- ~~///~~ fishing effort (including TAC and quota),
- ~~///~~ fishing capacity,
- ~~///~~ time and area restrictions,
- ~~///~~ minimum fish size,
- ~~///~~ protected species, Marine Protected Areas,
- ~~///~~ data collection and reporting,
- ~~///~~ incidental catch, artificial reefs and fish aggregating devices.

2. DEVELOPING A NATIONAL ACTION PLAN TO REDUCE ECOSYSTEM DAMAGE RESULTING FROM FISHING PRESSURE IN THE MEDITERRANEAN AREA

2.1 Preliminary assessment and analysis

The National Action Plan should be defined with reference to an assessment of the causes and the effects of fishery practice and gear on the ecosystem (commercial and non-commercial resources). The assessment should be included as the preliminary part of each National Action Plan.

These analyses would have to develop and use common indicators to facilitate a comparison between national situations by species, ecosystem and fleet and also to facilitate the defining of priorities for regulation.

Each state should make an assessment to produce a national analysis of:

- ?? the impacts of fishing on vulnerable groups and habitats
- ?? the impacts of gear and fleets on the ecosystem.

For this assessment, each state should carry out a set of activities in conjunction with relevant international and national public and private organizations. This assessment should include data collection and an analysis of each of the relevant following points:

- ☒ Indicators to evaluate the need for a National Action Plan
- ☒ Structure and activities of the fishing fleet
- ☒ Fishing methods and gear used in national fishery activities
- ☒ Measuring the fishing effort and geographical distribution
- ☒ Annual catch, by-catch, discard
- ☒ Summary and effects of the main topics covered by national fisheries legislation (licensing, fishing methods and restrictions on gear, Marine Protected Areas, fishing effort and capacity, protected species, time and area restrictions, minimum landing size, incidental catch discard, catch reporting, artificial reefs and FADs, TACs and quotas...)
- ☒ Indicators of compliance with national fisheries legislation
- ☒ Comparative analysis of national fisheries legislation for a regional framework
- ☒ Economic indicators of fishing pressure on specific fleets or specific species.

The assessment will include, but is not limited to, the collection and analysis of the impact of fishing on:

- ☒ chondrichthyans (demersal and pelagic fisheries),
- ☒ seabirds (direct and indirect effects),
- ☒ turtles (by specific species),
- ☒ Mediterranean monk seals
- ☒ cetaceans (by fishing methods and gear),
- ☒ sea-grass beds,

the seabed and associated benthic communities (soft or hard bottoms).

To develop the National Action Plan, experience acquired in regional management organizations should be taken into account as appropriate. FAO could help by providing a list of experts and a technical assistance mechanism for countries to use in connection with the development of the NAP.

States should take all the necessary steps to ensure that the binding measures adopted within the framework of regional fisheries arrangements or organizations to which they are party be incorporated in national law. In this regard, member states of the GFCM that have not yet incorporated into their national legislation the recommendations made by this organization with respect to drift-net fishing should do so as soon as practicable.

The National Action Plan should help ensure that documentation with regard to fishing operations, retained catch of fish and non-fish species and, as regards discard, information required for stock assessment as decided by the relevant management bodies, is systematically collected and forwarded to those bodies. It should, as far as possible, add to the programmes, such as observer and inspection schemes, in order to promote compliance with applicable measures.

2.2 Complementary analysis and research

The National Action Plan should analyse the economic conditions associated with each technology used, to facilitate the adopting of the appropriate technology for the best use and care of the retained catch.

The National Action Plan should define multidisciplinary programmes (ecology, technology and social) to facilitate the development and implementation of technologies and operational methods that reduce discard. Coordination at regional level should be encouraged by groups of states to facilitate the defining and adopting of standard research methodology.

States should undertake a comprehensive review of their fisheries legislation to ensure that all the issues treated in this study be adequately dealt with and that all the provisions of basic fisheries legislation that require the devising of implementing regulations to be effective be adopted in due time.

2.3 Circulation and regulation

The National Action Plan should be encouraged with respect to research programmes for fishing gear selectivity and fishing methods and strategies, circulation of the results of such research programmes and the transfer of technology.

Where necessary, the National Action Plan should invite states to make laws and regulations to take into account the range of selective fishing gear, methods and strategies available to the fishery industry.

The National Action Plan should discourage the use of fishing gear and practices that lead to the discarding of catch by promoting educational, training and publicity actions and programmes aiming to encourage the use of fishing gear and practices that increase the survival rates of escaping fish.

States, as necessary, should modify or adapt their national fisheries law to provide for the licensing of national fishing vessels operating outside the waters under their sovereignty or jurisdiction.

States should broaden the scope of their regulations dealing with incidental catch and discard in order to provide a comprehensive legal framework that will be applicable to a wide range of species rather than only a handful of highly valuable species.

States, if it is deemed necessary in the waters under their jurisdiction, should adopt measures that aim at eliminating the impact of ghost fishing on fishery resources. If ghost fishing is recognized as a serious threat to fishery resources in the Mediterranean, this issue may be more effectively addressed at regional level.

States should take all necessary steps to ensure that conservation and management measures be properly enforced throughout the waters under their sovereignty and jurisdiction.



The mollusc *Pinna nobilis* is one of the species listed in the annex II of the SPAMI protocol. M. Relini © CAR/ASP

3. SOME OPTIONAL TECHNICAL AND OPERATIONAL MEASURES TO REDUCE ECOSYSTEM DAMAGE RESULTING FROM FISHING PRESSURE IN THE MEDITERRANEAN AREA

3.1 Introduction

The National Action Plan to reduce ecosystem damage resulting from fishing pressure in the Mediterranean area has to offer an opportunity for the state to:

- help assess fisheries activities and circulate the conclusions at regional level
- adopt and complete the latest international initiatives concerning regulation
- define specific regulations appropriate to the national fishery case.

3.2 Reduce the impact of fishing on vulnerable groups and habitats

3.2.1. On chondrichthyans

Improve and accept the conclusions of the assessment

Mediterranean fisheries are not exceptions in the context of the general decline of elasmobranch populations and their related fisheries around the world. The history of shark fisheries indicates that intensive fisheries are not sustainable and that complete collapses of fisheries are not rare. In the case of chondrichthyans, it seems that increased survival of juveniles rather than increased fecundity provides greater resilience to fishing pressure (Brander, 1981), highlighting this as the key factor for the conservation of these species.



Long line, a potential danger for several chondrichthyan species. Lamnid sharks: juveniles of *Isurus oxyrinchus* (above) and *Lamna nasus* (below). F. Garibaldi © CAR/ASP

Information on rays and other demersal species deserves special attention, in that these have proved to be highly vulnerable to fishing. The high elasmobranch by-catch (and even commercial catch) associated with many pelagic fisheries, notably longlining, also appear potentially dangerous for several species, e.g. **blue shark**, **white shark** and **stingrays**.

Given the usually high trophic level of these species, the conservation of the diversity of this group of important predators (some of them apical), is essential for the health of the ecosystems, since population changes could cascade down with unpredictable effects on many trophic webs.

Adopt and complete the latest international initiatives

Some international initiatives have been undertaken to deal with the problems related to the conservation of this group. They include:

- ✍✍ the creation of a Shark Specialist Group by the Species Survival Commission of the IUCN, and
- ✍✍ the agreement at the FAO Meeting held in Rome in October 1998 to set up an International Plan of Action for the Conservation and Management of Sharks.

CITES commissioned a study on the status of and trade in sharks, which resulted in the creation of a Technical Working Group in FAO on sharks. The CITES Convention held in Nairobi in April 2000, however, rejected including the white shark (*Carcharodon carcharias*) in Appendix I and the basking shark (*Cetorhinus maximus*) and the whale shark (*Rhincodon typus*) in Appendix II. In the Mediterranean, only Malta has adopted legislative measures to protect white and basking sharks.

Actions needed

Among the necessary shortest-term measures:

- Establishing Marine Protected Areas in nursery grounds or in areas of special interest
- Completely eliminating the most impacting gear, such as drift-nets, and
- Improving the selectivity of surface longlining and bottom trawling in order to reduce by-catch.

Accurate monitoring of catch and **assessment of the impacted populations** should be done to decide how and where to launch measures effective in reducing fishing mortality on target or by-catch chondrichthyan species.

Given the apex predator role of many elasmobranch species, **systemic management** leading to the adequate conservation of the whole ecosystem, including healthy levels of other fish populations, appears to be necessary.

Finally, the **overall management policy** on the exploitation of elasmobranch populations, including commercial fisheries, and the related commercialisation processes should perhaps be revised in the light of the latest indicators that point to the non-sustainability of current practices.

3.2.2. On seabirds

Improve and accept the conclusions of the assessment

Very little attention had been paid until recently to the impact of Mediterranean fisheries on seabird populations. The effects of fishing on bird populations may be directly responsible for mortality, as when caused by low-selective fishing practices, or more indirect, as when acting as an external disturbance that fundamentally affects food supplies and subsequently leads to major modifications in trophic habits, demographic parameters and inter-specific relationships. The key feature affecting seabird populations is indeed mortality rates. Procellariiforms, as well as Pelecaniforms and Laridae species are generally long-lived and their populations are highly sensitive to changes in survival. The additional mortality induced by accidental captures in fisheries is therefore a significant danger to them (Lebreton, 2000).

Longline fishing is evidently the main cause of seabird mortality in Mediterranean fisheries. Bottom and surface longlining are both implicated since bird mortality is associated with the process of longline setting and independent of the depth targeted by the gear.

Tackling the issue of the impact of fisheries on seabirds related to the increase in food availability appears to be very difficult, since there is apparently no clear consensus on what human effects are positive or negative at ecosystem level.

Discard itself constitutes a negative effect of fishing on the overall ecosystem that should be minimised.

The distinction between direct (fishing mortality) and indirect (trophic availability) effects of fishing is nonetheless somewhat vague, highlighting the complexity that underlies ecosystems.

Adopt and complete the last international initiatives

The International Plan of Action-Seabirds on accidental bird catches in longlines (FAO, 1999) is open to the voluntary adhesion of all countries with longline fleets. BirdLife started a Program for the Conservation of Sea Birds in 1997 as a result of the resolution on Incidental Mortality of Sea Birds in Long-lines, adopted by the IUCN at its First World Conservation Congress. Three Mediterranean seabird species are currently covered by specific Action Plans designed by BirdLife International, approved by the Ornithological Committee (EU DG Environment) and endorsed by the Bern Convention Standing Committee. They include Audouin's gull (*Larus audouinii*), the Balearic shearwater (*Puffinus mauretanicus*) and the Mediterranean shag (*Phalacrocorax aristotelis desmaresti*).



Longline fishing is the main cause of seabird mortality in Mediterranean fisheries. Shearwaters are among the species most frequently caught with this gear.
D.Cebrian

Actions needed

- **Nocturnal setting** prevents birds preying on bait, and there are reports that this measure, which involves a change in fishing habits, has already been implemented spontaneously by fishermen in the area in order to prevent the negative economic consequences arising from interaction with birds. This appears to be the most realistic remedy for traditional fisheries, though its efficacy is reduced on full-moon nights.
- Other complementary measures such as **training lines with floats attached** to frighten birds away are also in use in that region to some effect. As for the commercial fleets, i.e. large surface longlines that target large pelagics potentially affording higher investment, Martí (1998) acknowledges the feasibility of using pipe devices, i.e. the Mustad design, which allow lines to be set underwater, precluding any possibility of bait predation by birds.
- Demersal populations in the region are heavily fished or even over-fished and restrictions on fishing are urgently needed (Leonart, 1990; Irazola et al., 1996).

3.2.3. On turtles

Improve and accept the conclusions of the assessment



Caretta caretta is one of the endangered species in the Mediterranean. D.Cebrian

A demographic model for the Mediterranean population of loggerhead turtles showed that adult survival was the main factor affecting population growth rates, fecundity being less significant (Laurent et al., 1992). Turkey is a key country regarding the total number of nesting females for the three mentioned species breeding in the Mediterranean, though fishing practices around the entire basin affect their populations.

The loggerhead turtle (**Caretta caretta**), green turtle (**Chelonia mydas**) and leatherback turtle (**Dermochelys coriacea**) are the most common species of marine turtle in the Mediterranean, though only the former two are known to nest on Mediterranean beaches. All three are endangered species (UNEP/IUCN, 1990). In the case of the loggerhead, an additional contingent of individuals of Atlantic origin is known to migrate into the western Mediterranean via the Gibraltar Strait during the first half of the year (Camiñas, 1997a, b). A third nesting species, not strictly marine, the Nile soft-shelled turtle (**Trionix triunguis**), is found in a few coastal wetlands in the eastern Mediterranean.

Adopt and complete the last international initiatives

International concern about the general decline of the marine turtle population in the Mediterranean led the Parties to the Barcelona Convention to adopt an Action Plan for the Conservation of Mediterranean Marine Turtles in 1989, acknowledging that catches by fishermen were the most serious threat to the turtles at sea, and that the conservation of the green turtle deserved special priority.

The 1991 Bern Convention on the Conservation of European Wildlife and Natural Habitats recommended to the Council of Europe that this sub-tropical species be given better protection.

The Standing Committee of this Convention recommended that the Turkish Government strictly control fisheries in the three main green turtle nesting beaches (document T-PVS (98) 62). The Turkish authorities have repeatedly been asked (from as early as 1994) to completely ban fishing in the Kazanlı area during the nesting period, though with little success to date.

Actions needed

- Importance of limiting fishing **by-catch** of these species.
- Fishing in the Mediterranean basin is clearly a major threat to marine turtle populations. The especial vulnerability of these species to high mortality rates of adults and sub-adults makes maximising the survival of individuals at sea a priority; this could be achieved by **reducing the mortality caused by fishing gear**.
- In surface longline fisheries, the **hook should be removed** whenever possible and the **individuals immediately released**; fishermen's collaboration is essential. Specimens caught and released alive with hooks in their oesophagi or stomachs do not necessarily survive.
- Delay in the total elimination of drift-nets in European waters, particularly Greek and Italian, and the continued and growing use of drift-nets in key turtle conservation areas in waters off the North African coast and Turkey, are further matters for concern.
- Special restrictive fishing measures that concern large pelagic fisheries could be applied in areas described in recent years as having big populations of immature and adult loggerheads.
- More specific measures should be taken in the vicinity of nesting beaches to prevent the capture of adults. This is particularly urgent for the green turtle because of its small breeding stock. Various fishing practices - even traditional fleets - in these areas cause turtle mortality, and restrictions on fishing are frequently violated in most coastal waters.
- **Reducing trawl times** is effective in reducing turtle mortality; trawls that do not exceed 60 minutes give a rate of turtle mortality in the gear of close to 0%, but this rises to 50% if the fishing time increases to 200 minutes (Henwood and Stuntz, 1987). Kasperev (1999) recommends stopping all kinds of fishing around Dalaman (including nets, lines, guns and dynamite) to protect the small local population of the soft-shelled Nile turtle. In addition, methods for experimental tagging should be improved so as to reduce potentially harmful effects such as turtles being entangled in nets.
- **Improving trawling gear** by means of turtle excluding devices (TED), in use in several tropical regions (Villaseñor, 1997), could be an effective measure in some cases where the impact of trawling on turtles is high (i.e. the Gulf of Gabès).

Finally, **campaigns** designed to raise the **awareness** of stakeholders, primarily fishermen, should be undertaken along all the Mediterranean coasts to promote turtle-friendly fishing practices.

3.2.4. On Mediterranean monk seals

Improve and accept the conclusions of the assessment

The Mediterranean monk seal (***Monachus monachus***) is a **highly endangered species** whose distribution has shrunk considerably over the last decades. The bulk of the world population (about **300-500** individuals) is currently limited to only two nuclei, one in the eastern Mediterranean and the other in the north-east Atlantic, off the coast of north-west Africa. The Mediterranean monk seal population, consisting of only a few scattered groups of individuals breeding in the last isolated, undisturbed caves, is suffering a rapid decline. **Two thirds** of the world's largest surviving population, located on the Côte des Phoques in the western Sahara, died off in 1997, victims of an epidemic. The remaining seals are extremely vulnerable and all evidence points to fishing as one of the main agents that are pushing the species to the brink of extinction, especially in the case of the eastern Mediterranean population (Johnson and Lavigne, 1998).

Impact of fishing practices on the monk seal population

The impact of fishing practices on the monk seal population has a largely **twofold** origin:

- **direct mortality**, caused by seals becoming incidentally entangled in fishing gear, and deliberate killing by fishermen, and

- **food scarcity**, related to over-fishing and the subsequent depletion of fish populations.

A third related factor is the trophic limitation triggered by over-fishing that encourages seals to prey more heavily on fish caught in nets, thus increasing the interaction between seals and gear (and fishermen).

Adopt and complete the last international initiatives

The seal is listed as critically endangered by the International Union for the Conservation of Nature and Natural Resources (IUCN) and is also included in Appendix I to the Convention on International Trade in Endangered Species (CITES). It is also covered by the UNEP Bonn Convention on Migratory Species and the Bern Convention on the Conservation of European Wildlife and Natural Habitats. An Action Plan for the Management of the Mediterranean Monk Seal was adopted in 1987, launched under the Barcelona Convention.

SAD-AFA's Central Aegean Programme started in 1992 as the Foça Pilot Project, operating in association with the local community and the Turkish Ministry of the Environment, and covers the north-west corner of the Bay of Izmir. Commercial fishing is prohibited there and the data suggests that the project is succeeding in its goal of helping fish stocks recover (Johnson and Karamanlidis, 2000).

Actions needed

Given the critical status of the Mediterranean monk seal remnant population, the only acceptable **level of fishing-related mortality** in the region is **0**. Action must be taken to **prevent the deliberate killing** by fishermen and seals becoming **incidentally entangled in nets** and to **manage fisheries** so as to prevent overfishing and rebuild depleted food resources (Johnson and Karamanlidis, 2000). The participation of small-scale fishermen appears to be essential.

An integrated approach, involving protecting ecosystems through marine protected areas and involving local traditional fishermen, is likely to be most effective; this includes increasing traditional **fishermen's awareness** that they themselves, as well as the seals, are the victims of over-fishing by commercial fisheries, mostly by medium-sized fleets.

The immediate **financial compensation** of fishermen affected by seal attacks and **information** campaigns to destroy negative myths about seals appear necessary.

Implementing more restrictive measures such as **the banning of small fry fishing** for aquaculture seed or the seasonal **prohibition** of the lampara fishery in the Bay of Izmir is still a priority. In the context of the Cilician Basin Project, the Turkish Ministry of Agriculture has banned all types of trawl and purse seine fishing in 15 square miles that cover seal habitats. Small areas surrounding breeding caves have special protection as no-fishing zones.

Other technical measures, such as **improving fishing nets** and **developing techniques** to keep seals away from fishing equipment, are envisaged by the Action Plan for the Management of the Mediterranean Monk Seal.

To conclude: whereas some specific measures, such as enforcing the current regulations that **ban dynamite fishing** and other highly damaging fishing practices known to affect monk seals, should clearly be undertaken, the overall problem of monk seal conservation in the Mediterranean is clearly related to the sustainable management of entire marine ecosystems, in which monk seals are apex predators. Marine Reserves, no-fishing zones and the involvement of traditional fishermen - including educational programmes - are basic tools for ecosystem-based fisheries management.

3.2.5. On cetaceans

Improve and accept the conclusions of the assessment

About 17 different cetacean species have been reported in Mediterranean waters, some of them being only occasional visitors from the Atlantic (Duguy et al., 1983a). They range in size from the small common (Delphinus delphis) and striped (Stenella coeruleoalba) dolphins to large whales such as the sperm whale (Physeter catodon) and the fin whale (Balaenoptera physalus). In general, both the diversity and the abundance of cetaceans are higher in the western basin.

Striped and common dolphin: some data on distribution in the Mediterranean Sea

The state of conservation and the size of the different populations vary greatly, depending on species and region. The striped dolphin is the most abundant cetacean species in the western Mediterranean, with an estimated population of **117,880 individuals** in 1991 (Forcada et al., 1994). A study of the distribution of this population, however, reveals important geographic heterogeneities, often related to specific oceanographic conditions resulting in higher food availability (Forcada and Hammond, 1998). The biggest population is found in the north-west Mediterranean, in the Ligurian Sea and Provençal Basin (n: 42,604). The other outstanding area for the species, in terms of population density, is the Alboran Sea, especially its western part near the Strait of Gibraltar. The common dolphin, in contrast, has become increasingly rare in north-western Mediterranean waters since the early 70's; its population in the western Mediterranean is concentrated in the Alboran Sea (with a population estimated at **14,736 individuals** in 1991-92). The coastal strip of Morocco and Algeria seem to be a particularly important area for the species (Bayet and Beaubrun, 1987). Maximum concentrations of fin whales in the Mediterranean are again recorded in the Ligurian-Provençal Basin, where the summer population was estimated at **1,012 specimens** in 1992 (Notarbartolo di Sciarà, 1994). There are probably only a **few hundred sperm whales** in the Mediterranean (Di Natale, 1995). Other less abundant species include the harbour porpoise (*Phocoena phocoena*), whose population outside the Black Sea has declined to the verge of extinction, though some sightings point to its presence off the North African coast.

This variety of species of different sizes, with different life histories, together with the equally high diversity of gear and fishing practice found in the Mediterranean, lead to complex interactions between cetacean populations and fisheries.

Adopt and complete the last international initiatives

A specific Action Plan for the Conservation of Cetaceans in the Mediterranean Sea was adopted under the auspices of the Barcelona Convention in 1991. The reduction or depletion of food resources, incidental catch in fishing gear and deliberate killing are recognised as some of the most serious threats to cetaceans in the Mediterranean. The Action Plan called on all parties to adopt and implement legislation to prohibit the deliberate taking of cetaceans, the prohibition of drift-nets longer than 2.5 km and the discarding of fishing gear at sea, and required the safe release of cetaceans caught accidentally. Contracting parties also agreed to promote the creation of a network of Protected Areas and marine sanctuaries in cooperation with RAC/SPA .

The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) has been signed by 14 states, though it is not yet in force since the ratification of a minimum number of parties is still pending. Among other measures, its conservation plan (Annex 2) envisages the implementation of measures to minimise the adverse effects of fisheries, with explicit emphasis on drift-nets.

The United Nations, the European Union and the General Fisheries Commission for the Mediterranean call for the restriction or even eradication of drift-nets.

Actions needed

Cetacean populations suffer principally from the **direct mortality** caused by fishing gear, whilst small cetaceans also compete for the fish taken in nets; furthermore, fishermen **deliberately kill** dolphins to reduce the damage these inflict on their gear. The most significant issue (in terms of both quantitative incidence and potential effect on cetacean populations), however, is the mortality derived from fishing **by-catch**, which is largely due to **drift-netting practices**. Information on the different interactions between cetaceans and fisheries is given below, with emphasis on the specific features of different fishing practices related to cetacean mortality.

Drift-net fisheries and, to a much lesser extent, small-scale fisheries using fixed nets and purse seine fisheries appear to account for the highest impact and are also responsible for the highest rates of direct human-induced marine mammal mortality. **Drift-net fisheries are clearly inherently harmful** to cetacean populations, and a **major factor of direct mortality** in Mediterranean waters.

The disappearance of drift-net fleets from the Mediterranean is the most desirable option, but even immediate short-term measures to restrict this practice in the most sensitive areas would be a useful interim measure.

In 1999 the governments of France, Italy, and Monaco jointly declared the creation of a 100,000-sq. km whale sanctuary in the Ligurian Sea. The Alboran Sea and the waters off the North African coasts urgently need and would benefit from similar measures.

Striped dolphin by-catch by Italian drift-nets in Balearic waters, where the population appears to be low, is also a matter of concern, as is the current fishing-induced sperm whale mortality rate; this species particularly would benefit greatly from **measures restricting drift-net fishing**.

Fishermen in small-scale fisheries need to be encouraged and motivated not to kill dolphins.

More systemic approaches focusing on **rebuilding degraded ecosystems** could benefit both fishermen and cetacean populations directly.

Among other management measures, the effective enforcing of a **ban on dynamite fishing**, once more appears to be necessary for the conservation of cetaceans (mostly dolphins) in some Mediterranean areas. Solutions to local conflicts, such as the **putting an end to the illegal use of dolphin meat as bait** in two Spanish ports, need immediate attention.

Adequate **monitoring of the fleets** in the Mediterranean tuna purse seine fishery is advisable to ensure that their activity does not unduly affect dolphin populations.

Monitoring the activity of other Mediterranean purse seine fleets that target small pelagic fish, especially in areas with big common dolphin populations, the species potentially more vulnerable to this fishery, (i.e. those operating along the North African coast) is necessary.

The **potential impact** of mid-water pelagic trawling for small pelagics on cetacean populations by fleets in the Gulf of Lions and in other Mediterranean areas (i.e. Italy) should be assessed.

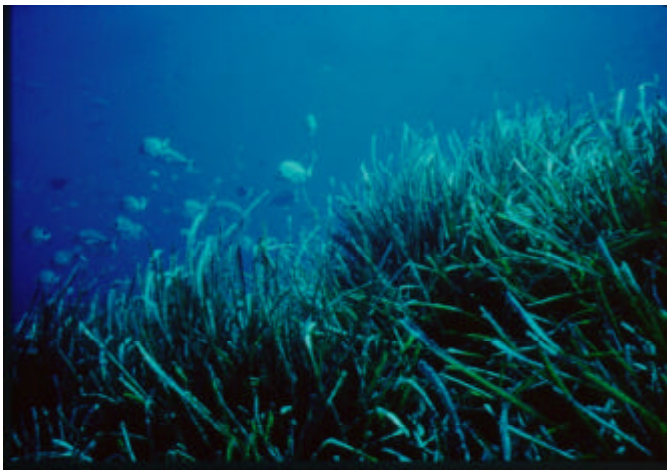
Conservation policies focusing on the recovery of cetacean populations should probably take into account the potential fishing interactions that might eventually emerge, thus simultaneously tackling the issue of responsible fisheries.

Educational programmes for fishermen, focusing on building an awareness of cetacean conservation and providing them with basic guidelines on how to reduce both cetacean by-catch and mortality, are essential.

3.2.6. On seagrass beds

Improve and accept the conclusions of the assessment

Mediterranean seagrass beds are mostly constituted by the endemic angiosperm species **Posidonia oceanica**. This species inhabits large areas of the coastal seabed down to depths of 40 m in optimal conditions and covers a total surface area of about 20,000 square nautical miles, i.e. 2% of the surface area of the littoral sea (Ardizzone et al., 2000; Bethoux and Copin-Montegut, 1986). Seagrass beds are spatially complex and biologically **productive ecosystems** that provide habitats and food resources for a diversified fish fauna and act as an important nursery area for many species (Harmelin-Vivien, 1982).



Seagrass bed: main habitat and trophic resource for a diversified fishfauna. © CAR/ASP

Meadows regress significantly for two main reasons:

- anthropogenic changes in sediment structure and composition, and
- the direct mechanical impact of fishing (Ardizzone et al., 2000).

Bottom trawling has the most dramatic consequences on Posidonia, though other fishing practices such as dynamite fishing may also be destructive at a more local level.

Trawling has an impact on seagrass beds by both suspending sediments and directly damaging vegetal mass. Sediment suspension affects macrophyte photosynthesis by decreasing light intensity. This is believed to have contributed to the disappearance of seagrass meadows, and to affect fish recruitment and the quality of juvenile feeding areas along the Mediterranean Spanish coast (Sánchez-Jerez and Ramos-Espla, 1996).

The negative effects of trawling on seagrasses have been confirmed by studies. Dynamite fishing still occurs in some Mediterranean waters and is not good news for seagrass beds. Poacher fishermen target salema (*Sarpa salpa*) shoals and cause extensive damage to rocky bottoms and coastal seagrass beds.

Apart from the negative physical impact of the above reported fishing practices, the fishing of seagrass communities significantly affects trophic webs and, therefore, ecosystem structure and function.

Adopt and complete the last international initiatives

International concern about the conservation of this particular habitat led to the banning of trawling on seagrasses in EC waters (Regulation No 1626/94), and the listing and designation of Posidonia beds in Annex 1 of the EC Habitats Directive as special conservation areas.

Actions needed

- Seagrasses must therefore be protected from bottom trawling and other destructive practices, and fishing pressure reduced as much as possible.
- Current regulations **banning trawling** on Posidonia beds in most Mediterranean coastal areas need to be enforced and greater areas of seagrasses **included** in Marine Protected Areas **totally closed** to fishing.
- **Campaigns to build awareness** together with effective monitoring and surveillance are other useful tools.
- Additional technical measures such as the **deployment of artificial reefs** (if justified) could offer further protection.

3.2.7. On the seabed (soft and hard bottoms) and its associated benthic communities

Improve and accept the conclusions of the assessment

Seagrasses are exceptional seabed bottoms. The vast majority of Mediterranean seabed surfaces lack such a massive vegetal cover and are muddy, sandy or, in some places, rocky. These apparently modest habitats, far from being lifeless, are inhabited by complex biological communities, often part of fragile ecosystems.

Current fishing practices, notably trawling on seabed sediments, profoundly disturb the physical support system and undermine the structure and functioning of the benthic ecosystem.

Soft and hard bottom habitats are fished differently; the effects of fishing on them are different and the information available distinguishes between them.

Heavy fishing disturbs muddy and sandy bottoms, causing dramatic changes in the structure of both the physical support system and the related biological assemblages.

The short-term impact of hydraulic dredges on the sea bottom reveals that they cause extensive damage, digging and furrowing the sediment to a depth of 6 cm. Negative effects on the structure of the macrobenthos community were recorded: these included an increase in the abundance and biomass of taxa a week after the perturbation because of the increase in the trophic availability, benefiting a few opportunistic scavenger species.

Commercial exploitation appears to result in cumulative disturbance, as shown by the higher biomass of scavenger Crustacea and Echinodermata at the expense of Porifera, Mollusca and Annelida. Commercial fishing may therefore be selecting the epibenthic species most able to cope with physical disturbance by gear and endure the discard process.

Bottom fishing has deeply affected some Mediterranean invertebrate species, such as the endemic sponge **Axinella cannabina** or the bryozoan **Hornera lichenoides** (De Ambrosio, 1998).

Otter trawling fisheries on muddy bottoms targeting shrimp *Parapenaeus longirostris* destroy the benthic community associated with the seapen (*Funiculina quadrangularis*, Anthozoa) (A. Nouar, pers. comm.).

Hydraulic dredges plough the sediment to a depth of 20-30 cm and are particularly destructive.

Other destructive fishing practices are also locally important in some areas: illegal dynamite fishing affects rocky bottoms down to a depth of 10 m (A. Nouar, pers. comm.); an iron bar hung with chains, used for harvesting coral (*Corallium rubrum*), is a well-known and highly destructive gear deployed on Mediterranean rocky bottoms.

Impact of trawling on seagrass beds

There is no information on the effects of deep sea trawling on muddy bottoms in the Mediterranean (or anywhere else in the world); the few authors who touch on the subject warn of the extreme vulnerability of such seabeds to physical disturbance. It appears that recovery rates are much slower and the impacts of trawling may be very long lasting (many years or even decades) in deep water, where the fauna is less adaptable to change in sediment regimes and external disturbance (Jones, 1992; Ball et al., 2000).

Otter trawling in red shrimp grounds is injurious to the *Isidella elongata* facies of the bathyal mud biocenosis. This octocorallian species is very much affected by fishing (A. Nouar, pers. comm.; Sardà, 1997).

The ecosystem effects related to the use of bottom gear may extend far beyond the direct, straightforward impacts discussed above.

Trawling and dredging can also affect the intensity and duration of naturally occurring seasonal hypoxic crises in some places. These fishing practices, carried out in hypoxic conditions in the Adriatic, can exacerbate the summer killing of young shellfish. Trawling can also remove large-bodied, long-lived macrobenthic species and subsequently reduce the bioturbation zone (Ball et al., 2000). This could increase the danger of eutrophication and result in longer recovery rates (Rumohr et al., 1996).

Otter trawling operations produce short-term changes in the biomass of taxa within the trawled area. Fishing disturbance may cause shifts in the benthic community structure that particularly affect mobile scavenging species, probably the most food-limited group in muddy seabed environments.

Actions needed

The impact of fishing on the seabed concerns mostly the use of bottom trawling gear, namely **otter trawls**, **beam trawls** and **dredges**, together with some aggressive practices affecting rocky bottoms such as **dynamite fishing** and **fishing for coral and date mussels**. Although it is clear that the latter should be minimised, given the documented damage they cause to seabed bottoms and benthic communities, an ecosystem-based management of the former is difficult, since their harmful effects are inherent in their use.

The **creation of networks of marine reserves** totally closed to bottom trawling could help to rebuild degraded benthic communities in adjacent fished areas in the future.

Seasonal rotation of fishing grounds through **establishing temporal closures** could benefit bottoms too, since the likelihood of permanent change in bottom communities is proportional to the frequency of gear disturbance, as pointed out by Jones (1992).

3.3 Regulating the use of gear and fleets to limit negative fishing impacts

3.3.1. Bottom trawling

Improve and accept the conclusions of the assessment

Bottom trawling fleets predominate in many Mediterranean fisheries, being responsible for a high share of total catch and, in many cases, yielding the highest earnings among all the fishing sub-sectors. The high profitability of this fishing practice is largely due to its low selectivity with respect to size and species caught, and to the high harvests generated.



Trawl fishing: Trawlers have dramatic effects on the ecosystem including physical damage to the seabed and the degradation of associated communities.
M. Relini © CAR/ASP

Over-fishing of demersal resources causes changes in the structure and functioning of marine ecosystems derived from the depletion of populations and the huge amount of by-catch and associated discard.

The high marketability of small fish encourages the targeting of the juvenile fraction of some species, often in violation of laws regarding: minimum size, shallow areas (illegally trawled) and mesh size (small, illegally used).

Discard by Mediterranean unselective trawling fleets is significant. The effect on marine communities is twofold:

- ✂✂ **at single-species level**, the population dynamics of a species is altered, and
- ✂✂ **at ecosystem level**, profound changes occur because of the disruption of food webs.

Ecosystem modifications are triggered by a change in the biomass and demographic structure of the different species as well as by an increasing food supply for scavenger and opportunistic species. It is worth noting that the latter can result in the trophic connection of separate sub-systems (i.e. pelagic and benthic), making ecosystem consequences even more dramatic.

Information on discard in Mediterranean trawl fisheries confirms the size of the problem, though varying considerably in amount and composition (depending on region, boat size, season,

bottom type and depth of the exploited ground). Discarding can also involve important commercial species, especially smallest size classes.

Actions needed

- Trawling gear could be made more selective by using higher mesh sizes or incorporating special excluding devices, such as those based on rigid grids. The development and compulsory use of excluding devices that increase selectivity (such as those in use in some North Atlantic waters) deserves attention. The use of a square mesh can also improve selectivity.
- Most impacting scenarios could be avoided by restricting trawling both spatially and temporally. Current provisions banning trawling in coastal waters less than 50 m deep or 3 miles offshore should be enforced effectively.
- The banning of bottom trawling in large Marine Protected Areas throughout the Mediterranean basin appears to be the only way of maintaining a sample set of demersal ecosystems free from the damage caused by this widespread fishing practice. These areas would moreover be very useful as a basic reference guide to healthy bottom communities in the context of a future ecosystem-based management of Mediterranean fisheries.

3.3.2. Longlining on large pelagic populations

A variety of medium-scale and industrial pelagic longlining fleets operate in Mediterranean waters, ranging from local coastal state fleets to large commercial foreign fleets, whether Japanese, flag of convenience (FoC), or even unflagged 'pirate' fleets. FoC and pirate fleets are estimated at about 100 units (GFCM, 1997). Surface longline gear, including that used by local Mediterranean fleets, are deployed over large areas, since line lengths of 50-60 km (bearing several thousand hooks) are not rare. Longline fleets in quest of their highly migratory target fish species, even local ones, are highly mobile, covering virtually the whole Mediterranean basin. A significant share of catch is taken in international waters, more than 12 miles offshore.

The selectivity of longline fishing in the Mediterranean with respect to ICCAT's minimum legal size for swordfish and bluefin tuna are a matter of concern.

Apart from harming important groups taken as by-catch, pelagic longlining in Mediterranean waters is clearly unselective with respect to non-target undersized fractions of the populations that are the object of the fishery.

Small specimens are caught because of the intrinsic action of the gear or merely reflect over-fishing of populations, known to be at low levels.

Actions needed

Improve control and assess non-compliance with the international and EU legal obligations (catch of immature, small-sized individuals, absolute catch).

Action could be undertaken to **minimise** the negative impact of present longline practices.

The creation of **no-fishing zones** in strategic areas and seasons, for example spawning and nursery grounds or coastal areas in autumn, could be considered as recommended.

Enforce EU Regulations (derived from ICCAT Recommendations) and implement other new measures in the former international waters.

3.3.3. The ecosystem impact of traditional gear

The high diversity of traditional gear (and species targeted) and the importance of small-scale fisheries in many Mediterranean coastal waters add considerably to the complexity of the overall issue of the ecosystem-based management of Mediterranean fisheries.

Management strategies based on single species calculations will be of limited value, and management systems based on marine harvest refuges can be a promising alternative approach.

Static nets are usually highly selective, catching larger fish than - in most cases - dragged nets. Different types of nets can, in turn, also differ deeply as to intra- and inter-specific selectivity. Gillnets are always the most positive selective gear for size of individual caught. Beach seines, deployed over very shallow grounds to catch small fish, are common in some Mediterranean waters and are relatively unselective.

Game fishing is a growing leisure activity in many Mediterranean waters, and probably has a significant impact on some species, for example bluefin tuna and swordfish, whose low age classes suffer particularly.

The massive use of fixed nets (and other traditional gear such as traps) in many small-scale Mediterranean fisheries, makes ghost fishing by abandoned or discarded gear a potentially important problem in Mediterranean waters. Ghost fishing is disturbing demersal food-webs in a similar way to that reported for trawl discard.

Actions needed

- There is a sufficient scientific consensus to support a total **ban on some traditional gear** in Mediterranean waters.
- **Beach seines** should be eradicated from EU Mediterranean waters from January 2002. Where fishing with coastal seines exists, this will also be prohibited.
- In general terms, and leaving managerial issues aside, many traditional fisheries (such as static or bottom longlines) are probably more selective than trawling, and therefore a preferable, much less ecosystem-impacting alternative, provided that the discarding of gear at sea can be stopped.

3.3.4. The case of Mediterranean driftnet fisheries

Driftnet fleets continue their activities despite successive international initiatives to ban or limit this low-selective fishing practice.

Some fleets indeed did restrict driftnet fishing in Mediterranean waters during this long political process, but others grew rapidly. After 1994, boats stopped using large-scale driftnets and changed target species. Other fleets, on the contrary, have continued to expand, in some cases taking advantage of gear supplied by reconverted fleets.

Actions needed

Legal instruments exist to tackle the issue of driftnet fishing in the Mediterranean. Money is also available to convert the EU's affected fleets. It is a matter of political will. Resolutions 44/225 and 46/215 adopted in 1989 and 1991 by the General Assembly of the United Nations recommended the imposition of a moratorium on all large-scale pelagic driftnet fishing from 30 June 1992. European Regulation (EC) No 345/92 prohibited driftnet fishing in the Mediterranean with nets more than 2.5 km in length, as did the General Fisheries Commission for the Mediterranean (GFCM) in 1997 under Resolution 97/1, a binding recommendation. Effective moves to restructure the Italian driftnet fleet have been made since the adoption of European Regulation (EC) No 1239/98 and later regulations totally banning the use of driftnets by Community fishing vessels within and outside Community waters from 1 January 2002.

Bibliography

- Ardizzone, G. D., Tucci, P., Somaschini, A. and Belluscio, A. (2000).** Is bottom trawling partly responsible for the regression of *Posidonia oceanica* meadows in the Mediterranean Sea? In: Kaiser, M. J. and de Groot, S. J. (eds) Effects of Fishing on Non-target Species and Habitats. Blackwell Science, London. pp 37-46.
- Ball, B., Munday, B. And Tuck, I. (2000)** Effects of otther trawling on the benthos and environment in muddy sediments. In: Kaiser, M. J. and de Groot, S. J. (eds) Effects of Fishing on Non-target Species and Habitats. Blackwell Science, London. pp 69-79.
- Bayet, A. and Beaubrun, P. (1987)** Les mammifères marins du Maroc: inventaire préliminaire. Mammalia 51: 437-446
- Bethoux, J.P. and Copin-Montegut, G. (1986)** Biological fixation of atmospheric nitrogen in the Mediterranean Sea. Limnology and Oceanography 31: 1353-1358
- Brander, K. (1981).** Disappearance of common skate *Raia batis* from Irish Sea. Nature 290: 48-49
- Camiñas, J.A. (1997a)** Relación entre las poblaciones de la tortuga boba (*Caretta caretta* Linnaeus 1758) procedentes del Atlántico y del Mediterráneo en la región del Estrecho de Gibraltar y áreas adyacentes. Revista Española de Herpetología 11: 91-98
- De Ambrosio, L. (1998)** Estrategia del Programa Marino de ADENA/WWF-España. Informe sobre Especies y Ecosistemas. Adena/WWF, Madrid. 23p
- Di Natale, A. (1995)** Driftnet impact on protected species: observers data from the Italian fleet and proposal for a model to assess the number of cetaceans in the by-catch. ICCAT Collective Volume of Scientific Papers 44: 255-263
- Duguy, R., Casinos, A., Di Natale, A., Filella, S., Ktari-Chakroun, F., Lloze, R. and Marchessaux, D. (1983a)** Répartition et fréquence des mammifères marins en Méditerranée. Rapp. Comm. Int. Mer Médit. 28: 223-230
- Forcada, J. and Hammond, Ph. (1998)** Geographical variation in abundance of striped and common dolphins of the western Mediterranean. Journal of Sea Research 39: 313-325
- Forcada, J., Aguilar, A., Hammond, P., Pastor, X., Aguilar, R. (1994)** Distribution and numbers of striped dolphins in the western Mediterranean after the 1990 epizootic out break. Mar. Mamm. Sci. 10: 137-150
- Hall, S. (1998)** Closed areas for fisheries management - the case consolidates. Trends in Ecology and Evolution 13: 297-298
- Harmelin-Vivien, M. (1982).** Ichthyofaune des herbiers de posidonies du Parc national de Port Cros: I. Composition et variations spatio-temporelles. Travaux scientifiques Parc naturel Port Cros 8: 69-92
- Hastings, A. and Botsford, L.W. (1999)** Equivalence in Yield from Marine Reserves and Traditional Fisheries Management. Science 284: 1537-1538
- Irazola, M., Lucchetti, A., Lleonart, J., Ocaña, A., Tapia, J.M. and Tudela, S. (1996)** La pesca en el siglo XXI. Propuestas para una gestión pesquera racional en Catalunya. CCOO, Ceprom and Forcem. Barcelona. 167p
- Jiménez, S., Bayle, J. T., Ramos Esplá, A. A. and Sánchez Lizaso, J. L. (1997)** Ictiofauna de dos praderas de *Posidonia oceanica* (L.) Delile, 1813 con distinto grado de conservación. Publicaciones Especiales del Instituto Español de Oceanografía 23: 255-264
- Johnson, W.M. and Karamanlidis, A.A. (2000)** When Fishermen Save Seals. Monachus Guardian 3. Internet edition: <http://www.monachus.org/mguard05/05covsto.htm>
- Johnson, W.M. and Lavigne, D.M. (1998).** The Mediterranean monk seal. Conservation Guidelines. Multilingual Edition. IMMA Inc. Ghelph, Canada. 152p. Internet edition: <http://www.monachus.org/library.htm>
- Jones, J. B. (1992)** Environmental impact of trawling on the seabed: a review. New Zealand Journal of Marine and Freshwater Research 26: 59-67

- Lauck, T., Clark, C.W., Mangel, M. and Munro, G.R. (1998)** Implementing the precautionary principle in fisheries management through marine reserves. *Ecological Applications* 8 (Supplement): 72-78
- Laurent, L., Clobert, J. and Lescure, J. (1992)** The demographic modelling of the Mediterranean Loggerhead Sea Turtle Population: First Results. *Rapp. Comm. int. Mer Médit.* 33: 300
- Lebreton, J.D. (2000).** Dinámica de poblaciones y conservación de aves marinas: el papel de los modelos matemáticos. 6th Mediterranean Symposium on Seabirds. Conference on Fisheries, Marine Productivity and Conservation of
- Lleonart, J. (1990)** (co-ord.) La pesquería de Cataluña y Valencia: descripción global y planteamiento de bases para su seguimiento. Final Report to EC DG XIV
- Roberts, C.M. (1997)** Ecological advice for the global fishery crisis. *Trends in Ecology and Evolution* 12: 35-38
- Rumohr, H., Bonsdorff, E. and Pearson, T.H. (1996)** Zoobenthic succession in Baltic sedimentary habitats. *Archives of Fisheries and Marine Research* 44: 179-214
- Sánchez Jerez, P. and Ramos Esplá, A.A. (1996).** Detection of environmental impacts by bottom trawling on *Posidonia oceanica* (L.) Delile meadows: sensitivity of fish and macroinvertebrate communities. *Journal of Ecosystem Health* 5: 239-253
- Sardà, F. (co-ord.) (1997)** Concerted Action for the Biological and Fisheries Study of the Mediterranean and Adjacent Sea Deep Shrimps. Final Report. EC Concerted Action FAIR CT95-0208