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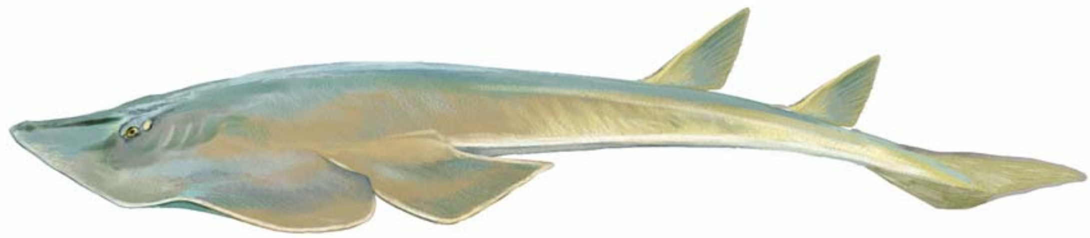
Mediterranean Action Plan
Regional Activity Centre For Specially Protected Areas

GUIDELINES FOR REDUCING THE PRESENCE OF SENSITIVE CHONDRICHTHYAN SPECIES WITHIN BY-CATCH



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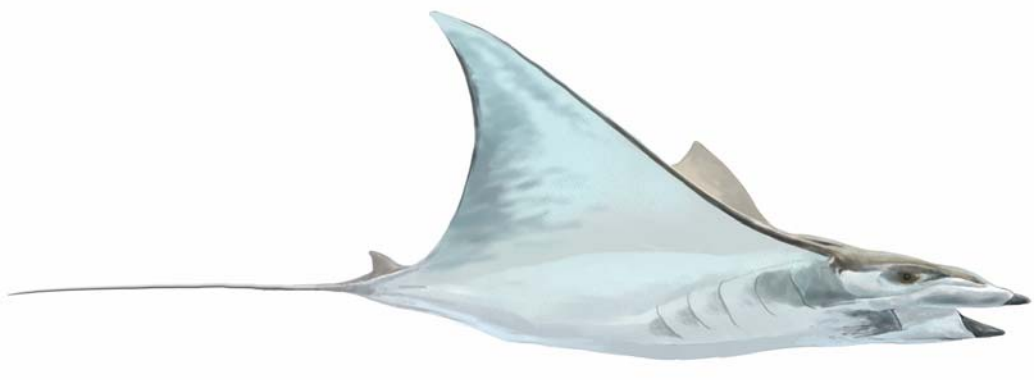

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Introduction

Fisheries impacting populations of chondrichthyan animals (sharks, rays and chimaeras) require careful management. Where excess fishing capacity occurs, mechanisms need to be established to reduce capacity to levels commensurate with the biological productivities of the species taken to ensure sustainable and rational use of the resources. Similarly, where bycatch species are depleted or threatened, then steps need to be taken to manage and, if necessary, provide special protection to those species for biodiversity conservation. Critical habitats need to be protected and, where affected by fishing or other human activities, restored.

The harvest of animals for products from shark and other chondrichthyan species pre-dates recorded history. Every part of these animals has been used for some purpose. Depending on region of the world, shark meat is important food consumed fresh, dried, salted or smoked. The demand for fins of sharks has grown rapidly in recent years such that they are now among the world's most expensive fishery products. Similarly, the demand is rising for shark cartilage and other products for medicinal purposes. In some fisheries, only the meat is retained, while the rest of the animal is discarded. In other fisheries, only the fins, or liver or skin is retained; few fisheries utilize all parts of the animals.

The main problem that appears when we focus the assessment on shark fisheries is the lack of information to link all those products to the species where they come from. Most of the shark catch is taken by fishers targeting teleost species, which results in most of the catch reported as unidentified shark or mixed fish or not reported at all. In addition, sharks can be difficult to identify down to species level, particularly given the need to behead and eviscerate sharks at sea to reduce spoilage rates of the meat and the fishers' preference to remove fins at sea. This lack of species identification for catches and lack of information on fishing effort means basic data for fishery stock assessment are currently available for only a few species (Walker, 1998).

Populations of shark and other chondrichthyan species tend to have lower reproductive rates and lower natural-mortality rates than populations of teleost and invertebrate species. Consequently, for many chondrichthyan species, only a small proportion of the population can be removed annually if the catches and populations are to remain sustainable. Such populations are said to have low biological productivity. These animals therefore require careful management and monitoring. Managers need to take a somewhat more precautionary approach to the management of fisheries staking sharks than they might to the management of fisheries based on teleost or invertebrate species.

Fishing mortality rate for a harvested population is usually expressed as the product of the two quantities: fishing effort and catchability. **Catchability** is the proportion of the exploited population taken by one unit of fishing effort and has a value in the range 0–1 It is the product of three parameters, each of which also has a value 0–1. The three parameters comprising catchability are availability, encounterability, and selectivity.

The concept of catchability is usually applied to target and byproduct species where most of the animals captured are retained. So as to broaden the concept to include bycatch, the term "**catch susceptibility**" (Stobutzki et al., 2002) and the term "**post-capture mortality**" are adopted here to allow for survival of part of the catch released.

Post-capture mortality is the proportion of the animals that die as a result of being caught in or of encountering the fishing gear. Animals of target and by product species that are mostly retained have a post-capture mortality value approaching one. This can be less if some are discarded because of their size or breeding condition. Post-capture mortality for discarded species can vary markedly. In addition to handling by fishers, the fishing gear and biological characteristics can contribute to various kinds of mortality referred to as unaccounted fishing mortality or as collateral mortality.

A rapid assessment approach for evaluating risk to chondrichthyan species was applied to species caught as bycatch in a tropical prawn fishery in northern Australia (Stobutzki et al., 2002). This method ranks the relative sustainability of each species on the basis of its "susceptibility" and "recovery" (Stobutzki et al., 2001; Stobutzki et al., 2002), which are assessed on the basis of the biological attributes of the species. Because of their comparatively low biological productivity and, for many species, because of their high catch susceptibility, most chondrichthyan species require management action long before sufficient data are available to undertake full stock assessment. It is therefore necessary to apply rapid assessment techniques for evaluation of risk from the effects of fishing ((Punt and Walker, 1998; Punt et al., 2000; Walker, 1994; Walker, 1998).

There is also growing emphasis on by-catch reduction and on ethical issues associated with full utilization of dead sharks and the handling and processing of these animals (Anonymous, 2000).

In summary, taken into account the susceptibility of the chondrichthyes species to harvesting and their low biological productivity rates, management measures to assure the reduction of by-catch of this species and releasing alive to the sea if caught must be developed.

1. Management tools

Fisheries management presupposes a minimum set of institutional arrangements and recurrent activities at local, sub-national, national, sub-regional, regional and global levels. Entities engaged in fisheries management require appropriate policy, and legal and institutional frameworks to adopt measures for the long-term conservation and sustainable use of shark fishery resources. Conservation and management measures need to be based on the best scientific evidence available. Effective coordination of implementation of fisheries management at a national level through development of shark plans and ongoing shark assessments requires a structure, a definition of roles, agreed processes, and mobilization of resources. Many fishing communities informally regulate their fishing effort, based on their observations of fish abundance and their interpretation of their indicators of abundance over time (Charles, 2002).

The competent administration to manage a fishery has several tools and parameters in order to regulate rights for harvesting fish from a fishing ground. In the paragraphs below we expose the most useful and frequent tools that lead to a correct fishery management.

Limited entry is a common management tool whereby the management agency issues a limited number of licenses to take fish. This creates a use right to participate in a particular fishery. License limitation is the restriction of fishing rights to those fishers, fishing units, or fishing vessels licensed in a fishery.
Limited entry caps the number of operators in a fishery, but is rarely sufficient to manage a fishery. It is difficult to reduce the number of licenses once there is overcapacity in the fleet. Whereas limited entry is a reasonable mechanism for assigning use rights, it must be implemented as part of a management portfolio.

Input controls designed to limit or reduce fishing mortality requires some form of restrictive licensing, which limits the number of fishing vessels engaged in a particular fishery, and some measure for limiting the fishing effort of the licensed vessels. Where license limitation is established, incremental technological advances in vessel and fishing gear design and improvements in fish-finding equipment and navigation aids are likely to cause the effective fishing capacity of a fleet to increase with time.
Overcapacity of a fleet can be reduced in several ways: removing vessels, reducing fishing time of the vessels, limiting the amount or size of gear that a vessel can carry, or reducing efficiency of fishing effort.

- Removing vessels from the fleet requires rescinding licenses.
- Reducing vessels' fishing time can be implemented by imposing limits on the number of days or times of the day vessels can operate.
- Fishing capacity of a fleet can be restricted by limiting the size of vessel and engine power and thereby restrict the ability of vessels to tow fishing gear such as demersal trawls.
- Fishing gear can be limited in type, size and number.

In any case, to limit the effort produce an effect all over the fishing product: By-catch and target species . This limitation reduce the by-catch in the same proportion to the effort reduction. Meeting the biological objective of reducing fishing mortality by reducing vessel efficiency is incompatible with the economic objective of improving economic efficiency of the fleet. Similarly, meeting the biological objective by reducing vessel numbers is incompatible with the social objective of providing employment for fishing communities.

Gear regulations tend to restrict the efficiency and cost of catching fish for each operator. Some of the benefits of limits on the quantity of fixed gear used, such as gillnets, can be offset by the gear being in the water for extended periods. Legislating for vessels not to leave the gear unattended discourages the practice of returning to port while the gear remains set at sea. This practice leads to cryptic fishing mortality from predation mortality and ghost fishing mortality if the netsare lost. Improve the selectivity of the fishing gear has proven to be the better method to reduce the by-catch (Ferretti and Myers; 2005).

Limitation of catch can take the form of a global catch quota, individual quotas as non-transferable individual quotas or individual transferable quotas (ITQs) with a total allowable catch (TAC), bag limits or trip limits. A global catch quota, alternatively referred to as a competitive TAC, is the maximum catch allowed from a resource by the entire fleet for a year or season. Under this system, individual fishers compete for catch until the fleet reaches the overall limit and the fishery is then closed. Such a system requires rapid collation of catch statistics to be effective. Individual fishers feel compelled to operate under hazardous weather conditions and to capitalize in vessels and gear to attain a competitive edge. This can result in progressively shorter seasons, which disrupt employment patterns and market supplies. This method reduce the by-catch limiting the fishing season.

2. Technical procedures for the conservation of fisheries. Forms, its applications and effects.

2.1. Size limits

Size limits can be legal minimum sizes or legal maximum sizes. They can be an effective management measure where the animals are landed from the fishing gear live and in condition where the survival rate of released animals is high. Conversely, size limits are ineffective measures where the animals are landed dead or in poor condition and the survival rate of released animals is low. Hence, they are effective for many species that survive release from hooks, seine nets, and fish traps, but are not effective for many species released after capture by gillnets and trawls where survival rates are low.

Legal maximum sizes can be used to avoid recruitment overfishing. This is potentially useful for those many species of sharks where the proportion of the females in breeding condition each year increases with size and fecundity increases with maternal size. Where reproductive rates increase with size, the contribution to recruitment is likely to be much higher for large animals than for small animals. Hence, there can be stock benefits in releasing large animals live. A legal maximum size is likely to be of higher value for females than for males.

Fishers recognize the benefit of releasing undersized animals and usually endorse legal minimum sizes. They are prepared to release undersized animals on the understanding that they can be recaptured at a later time and benefit from a mass gain. On the other hand, they are less likely to support legal maximum sizes.

In Australia, a legal maximum length was applied for school shark (*Galeorhinus galeus*) in Victoria, during 1972–85 as a way of reducing the average mercury concentration in shark meat reaching the consumer (Walker, 1999). Similarly, a maximum weight of 18 kg for trimmed carcass applies to all sharks in Western Australia (Simpfendorfer, 1999).

Legal minimum lengths for sharks have been applied in southeastern Australia for school shark (*Galeorhinus galeus*) and gummy shark (*Mustelus antarcticus*) since 1949 (Walker, 1999).

2.2. Threatened species

Naturally rare species and species with poor conservation status may require special protection or management through such measures as a prohibition on catch, injury and interference. Where such species are inevitably killed, injured or disturbed accidentally, consideration should be given to establishing sanctuaries through fishing area closures or MPAs (Marine Protected Areas).

There are no internationally agreed definitions of “threatened” or “endangered with extinction”, but some countries have adopted classifications such as “endangered”, “threatened” and “depleted”, which have legal status in their jurisdictions. The most widely accepted classification for the conservation status of chondrichthyan species is the IUCN Red List, which classifies species as “critically endangered”, “endangered”, “vulnerable”, “lower risk”, and “data deficient”. The first three of these are grouped as “threatened” species (Anonymous, 1994; Hilton–Taylor, 2000). Chondrichthyan species first appeared on the IUCN Red List in 1996 (Dulvy et al*.*, 2003; Hudson and Mace, 1996).

Some species are classed as threatened on the basis of extreme rarity. Other species are classified as threatened because their populations have been depleted by the effects of fishing. These include several species of angel shark (*Squatina* spp.) and batoid species severely impacted by trawl fisheries. Species that have naturally small populations and have been depleted, include the basking shark (*Cetorhinus maximus*), grey nurse shark (*Carcharias taurus*), and white shark (*Carcharodon carcharias*) (Camhi et al*.*, 1998).

Various initiatives to protect endangered species have been taken in various parts of the world. Fishing for whale sharks is banned in the Maldives. White shark is now protected in South Africa, Namibia, Australia, USA, Maldives and Malta. In addition to declaring full protection for this species, Australia has developed species recovery plans for the white shark and grey nurse shark. Several additional steps have been taken to reduce the accidental kill, injury or disturbance of these animals. Ten grey nurse shark sanctuaries were recently declared in New South Wales waters, and there is a total ban on the use of shark fishing gear and the use of mammal blood or oils for attracting sharks in all Victorian waters. There are legislative requirements to report all interactions with white sharks and codes of practice are being developed for ecotourist activities.
In the Mediterranean, at the moment any protected area have been established on the basis of Shark protection. A Mediterranean critical areas map for condrichties must be developed in order to create a marine protected areas net for chondrichthyes.

2.3. Regulation of fishing gear

The overall number of species harvested is relatively small, sharks are captured with a wide variety of types of fishing gear and vessels. Sharks are mostly taken by gillnet, hook or trawl in industrial and artisanal fisheries. Small amounts are taken in traditional and recreational fisheries (including game fishers and divers) and bather protection programs by beach gillnet and drumline fishing. There are several fisheries directed at one or a small number of species of sharks, but most sharks are taken in multi-species fisheries where the fishers tend to target more highly valued teleosts. In some fisheries, part or the entire shark catch is discarded. Shark fisheries can be classified as “coastal hook and gillnet fisheries”, “demersal trawl bycatch fisheries”, “deepwater bycatch fisheries”, “pelagic bycatch fisheries” (primarily bycatch in tuna longline and purse seine fisheries), and “freshwater fisheries” (Anonymous, 2000).

Coastal hook and gillnet fisheries operate in regions of the continental shelf. Construction of the fishing gear depends on topography of the fishing grounds and on the available species mix of shark, chimaerid and teleost species. Much of the artisanal catch is taken by bottom-set longlines and by bottom-set gillnets, mostly constructed of monofilament webbing with some constructed of multifilament webbing. These gears take a variety of shark species and teleost species. In regions of narrow continental shelves, where deep waters off the continental shelf are readily accessible, or, in regions of broader continental shelves, the artisanal fleet uses surface-set longlines and driftnets to target pelagic sharks (Anonymous, 2000).

In demersal trawl bycatch fisheries, demersal trawl fisheries are impacting stocks of dogfishes (*Squaliformes*), angel sharks (*Squatiniformes*), rays (batoids), and chimaeras (holocephalans). As in the high seas fisheries, much of the trawl bycatch of sharks and rays is discarded dead and often not reported. Fishery-independent surveys in several parts of the world show that many species of these groups have exhibited marked declines in abundance.

In deepwater bycatch fisheries, like many of the teleost species studied from the deeper and colder waters of the continental slopes, the deepwater dogfishes (notably genera *Centrophorus*, *Centroscymnus*, *Etmopterus*, *Dalatias*, and *Deania*) have particularly low productivity. Expansion of demersal trawl fisheries into progressively deeper water to target dogfish and high valued teleosts on the continental slopes in some regions of the world is placing several species at high risk of severe depletion. Already demersal trawling occurs on the continental slopes at depths exceeding 1000 m. Part of the catch is targeted or is bycatch taken by gillnets and hooks (Walker, 1998).

In pelagic shark bycatch fisheries, longline, purse seine and driftnet fisheries targeting tunas and tuna-like species on the high seas and in the Exclusive Economic Zones through bilateral access agreements take significant bycatch of sharks. Blue shark (*Prionace glauca*) is the main species caught and other species caught widely in lower quantities include *Isurus oxyrinchus*, *Alopias supercilious*, *Carcharhinus falciformis*, *Carcharhinus longimanus*, and *Lamna nasus* (Bonfil, 1994; Anonymous, 2000).

Ideal fishing gear achieves many things simultaneously. It is efficient at capturing target species while avoiding small animals to minimize growth overfishing and avoiding large breeding animals to minimize recruitment overfishing of the species. It has negligible direct or indirect impact on bycatch species, habitats, and substrates, and it causes minimal damage to animals captured and in no way diminishes the food quality of the animals caught.

Regulation of fishing gear can be used for control of fishing mortality, of impacts on habitats and ecosystems, and of the food quality of fish retained. Regulation of fishing gear should be used as a way of controlling the catch susceptibility component of fishing mortality. This can be achieved by variously controlling one or more of the four components of catch susceptibility—availability, encounterability, selectivity, and post-capture mortality. Availability can be controlled through the fishing area closure to the use of specific gears, whereas encounterability, selectivity and post-capture mortality can be controlled or influenced through regulation of the construction of the gear or the way it is used.

Table V.2.3 provides an evaluation of different fishing gears for selectivity and ecosystem effects of fishing. The values presented are from evaluation across many fisheries, but specific values for a particular fishery, particularly as it might relate to chondrichthyan species, can be altered depending on regulation of the fishing gear (Bjordal, 2002).

Table V. 2.3 Estimates of ecosystem effects of fishing for different fishing gears. Ranking is a scale from 1 (non-favorable) to 10 (highly favorable) for different ecosystem-related factors; ecosystem effect index is the mean of the other seven factors (reproduced from Bjordal, 2002).

Fishing gear	Size selection	Species selection	Bycatch mortality	Ghost fishing	Habitat effects	Energy efficiency	Catch quality	Ecosystem effect index
Gillnets	8	4	5	1	7	8	5	5.4
Trammel nets	2	3	5	3	7	8	5	4.7
Handlining	4	4	6	10	9	9	9	7.3
Longlining	6	5	6	9	8	8	8	7.1
Pots	7	7	9	3	8	8	9	7.3
Traps	5	5	8	8	9	9	9	7.6
Spear, harpoon	8	9	5	10	10	8	9	8.4
Pelagic trawl	4	7	3	9	9	4	8	6.3
Demersal trawl	4	4	6	9	2	2	6	4.7
Beam trawl	4	4	6	9	2	1	6	4.6
Shrimp trawl	1	1	7	9	4	2	6	4.3
Seine net	5	5	6	9	4	5	8	6.0
Purse seine	-	7	5	9	9	8	8	7.7
Beach seine	2	2	5	9	6	9	9	6.1

The type of fishing gear used and the species of shark taken as bycatch determines which techniques and equipment are appropriate for minimizing bycatch.

For trawl nets, there is evidence that catches of sharks have been reduced when fitted with turtle exclusion devices, suggesting there might be advantages investigating alternative devices designed specifically to exclude sharks.

Also, there is scope to reduce bycatch of sharks in gillnets by regulating mesh size and possibly the breaking strain of the webbing filaments.

Many species of sharks remain alive on hooks for extended periods and can be released alive. There might be scope to improve survival of sharks by prohibiting the use of wire traces used to attach hooks to the snoods on a longline and by regulating for reduced breaking strains of the snoods. Wire traces reduce the probability of hooks being bitten off the snoods by sharks. Regulation of hook size may provide a means of eliminating or reducing the catch of smaller, younger individuals in a shark populations (Dowd, 2003).

Minimum mesh sizes or square mesh panels in codends of trawl nets are applied widely, but are not selected specifically for chondrichthyan species. Regulation of mesh size is a highly effective measure for shark management (Kirkwood and Walker, 1986; Simpfendorfer, 1999; Walker, 1998).

2.4. Area and time restrictions

Closures involve restricting all or particular methods of fishing in selected areas, and the closures can be permanent, temporary, seasonal, daily or part of the day.
Spatial and temporal closures are frequently applied to meet specific fishery-management objectives, but they are also used to meet other community objectives. Other objectives for closures include protecting marine, estuarine, and freshwater biota, items of special cultural value, or geologic interest. In addition, areas might be set aside for specific purposes such as navigation, aquaculture, or mining. The fishery manager needs the flexibility of prescribing management boundaries and varying rules between zones. At the simplest level, this might be prohibiting angling from a jetty to avoid injury to bathers. At a more complex level, this might be zoning a broad region of thousands of square kilometres to meet a range of fishery and ecological objectives through a complex system of licensing use rights, gear restrictions, and area closures across several fisheries. For example, gear restrictions across a complex of zones might be designed to provide high sustainable yields from target species of high biological productivity, while simultaneously minimizing impacts on bycatch species of low biological productivity.

2.4.1. Marine Protected Areas

A Marine Protected Area (MPA) is defined by the World Conservation Union (IUCN) as “any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (Anonymous, 1988). An MPA can be a large or small area and the overall objectives for an MPA can be specific or broad. Large MPAs with broad objectives are often divided into geographically smaller zones and designated for multiple use (Plummer et al., 2003).

MPAs are highly suitable for management of chondrichthyan species known to aggregate, where they are vulnerable to capture or disturbance by human activities (Bonfil, 1999). There are several examples from various parts of the world where these have been applied for sharks and rays. In New South Wales, Australia, the grey nurse shark (*Carcharias taurus*) is fully protected, but, to avoid unintentional kill in the coastal waters from longline fishing, a system of 10 sanctuary areas was established during December 2002. Each sanctuary extends 200 meters out from an island or a section of coast with buffer zones extending a further 800 meters. Fishing is prohibited, and new controls on scuba diving include bans on night diving, feeding, touching, harassing or chasing sharks, and on use of electronic shark repelling devices and electric scooters in these areas. In the Florida Keys National Marine Sanctuary, nurse shark (*Ginglymostoma cirratum*) mating aggregations at the Dry Tortuga Island group were recently given added protection by implementing a seasonal closure to boat traffic (Bonfil, 1999; Stevens 2002). The Ningaloo Reef Marine Park in northern Western Australia on the edge of the Indian Ocean provides protection to whale shark (*Rhincodon typus*) when these animals aggregate in this region from late March to early May. The number of divers and hours that divers and boats can approach these animals

is restricted. Touching the animals or use of camera-flash lights is prohibited (Tricas et al., 1997). The Kinabatangan wildlife sanctuary in Sabah, East Malaysia, includes about 27,000 hectares of tropical forest and the lower reaches of the Kinabatangan River and provides some protection (although some artisanal fishers operate there) to several rare freshwater elasmobranch species. These include the river speartooth shark (*Glyphis sp.*), giant freshwater stingray (*Himantura chaophraya*), and greattooth sawfish (*Pristis microdon*) (Payne and Andau, 2002).
At the moment, any protected area have been established in the Mediterranean on the basis of Shark protection.

2.4.2. Fishing area closure

Fishing area closure is defined here as closing an area to all or selected fishing gears for continuous or selected time periods to limit fishing mortality on all or particular length or age classes of one or more fish species, or to reduce gear impacts on habitats or other uses. Fishing area closures can be applied to target, byproduct, or bycatch species. MPAs can also limit fishing mortality, but areas closed to meet fisheries management objectives are not normally referred to as MPAs, marine parks, reserves or sanctuaries. In MPAs, more than fishing mortality and impact of fishing gear are controlled.

Fishing area closure as a fisheries management tool is applied to meet specific fisheries objectives. One important objective is to protect aggregations of small (pre-recruit) animals to allow these animals to grow and thereby improve yield per recruit and avoid growth overfishing. Another important objective is to protect aggregations of breeding or mature animals to enhance survival of the largest animals, which produce the highest number of offspring, and thereby avoid recruitment overfishing.

Closures are a more essential management tool for managing less abundant species with low biological productivity like chondrichthyan species.
In addition, three important technological developments in recent years make fishing area closures a more practicable fisheries management tool: Geoglobal Positioning Systems (GPS), Geographic Information Systems, and the development of Vessel Monitoring Systems (VMS), which overcomes the need for deployment of high-cost vessels at sea for surveillance purposes. e

Two types of fishing area closures have been implemented in the shark fishery of southern Australia since the 1950s. Closure to shark longline fishing in nursery areas of school shark (*Galeorhinus galeus*) in the inshore waters of northern and south-eastern Tasmania. These closures were designed to prevent targeting pregnant females entering shallow waters for parturition, as well as to reduce the incidental kill of neonate and small juvenile animals (Williams and Schaap,1992). In addition, closed seasons during October or November (months immediately prior to parturition) were adopted across the entire fishery. These rolling closures were designed to protect pregnant animals as they migrated from the western region of the fishery to the nursery areas in the eastern region for parturition (Walker, 1999).

Other examples of fishing area closures for sharks, include large areas being closed to gillnet and longline fishing for sharks in Western Australia to protect breeding animals of *Carcharhinus obscurus* and *C. plumbeus* (Simpfendorfer, 1999).

At the moment, any protected area have been established in the Mediterranean on the basis of Shark protection.

A regional approach to fisheries management through the judicial use of fishing area closures is required to avoid depletion of the populations of species with low biological productivity impacted by the fishing gear used to target species of high biological productivity. Maximum benefits from fishing area closures can be attained by aligning refuge areas for species of high catch susceptibility and low biological productivity (low reproductive rates and low natural mortality rates) with areas containing critical habitats, and pre-recruit and breeding animals of the target species.

2.4.3. Artificial Reefs.

Installation of artificial reefs is a procedure frequently adopted by many governments and regional administrations, and that has been demonstrated to be a very useful tool to protect special areas and to recover damaged ecosystems. The reef is composed by many basic units (modules) disposed in a characteristic spatial distribution.

Modules can be made of different materials such as wood, steel, fibreglass or concrete. Recycled structures are also used in many cases (e.g. old ships, tyres, oil platforms). Depending on the modules used and the spatial distribution adopted, there are two concepts of artificial reefs:

- attraction-concentration reefs, which produce a concentration of several species with high mobility around them. They are also called production reefs because of the increase on capture rates observed in their influence area;
- dissuasive reefs, designed to protect special habitats from the impact of specific fishing gears. The installation of this kind of reef has been shown very useful in the Mediterranean Sea, specially to protect the *Posidonia oceanica* fields from the destructive impact of the bottom trawl nets.

As most of shark species harvested are pelagic with a high mobility, we might consider the attraction-concentration reefs to have a major influence and positive effects on harvested elasmobranches populations.

2.5. Product form

Products from sharks and other chondrichthyans when landed by fishers, transported, sold, or exported occur in many forms. These forms include whole animal, carcass, tissue or processed product. The carcass form can be beheaded and eviscerated carcass with skin on and fins on, beheaded and eviscerated carcass with skin on and fins off, or beheaded and eviscerated carcass with skin off and fins off. Tissues, body parts, or product can be in the form of filleted meat only, heads only, jaws only, head cartilage, vertebral column, powdered cartilage, skin only, fins only, whole livers only, or liver oil.

This wide range of product forms creates difficulties identifying the species or measuring these animals when they are brought ashore. This creates ambiguity in the official catch statistics. Monitoring sex composition of the catch is not possible if the pelvic fines and claspers of males are removed. Monitoring length-frequency composition and enforcing size limits usually involves measuring partial length, which can be uncertain if all fins and the tail are removed.

To standardize the statistics for chondrichthyan species, Australia has adopted the following wording in its National Plan of Action for the Conservation and Management of Sharks (Anonymous, 2002).

• Fishers should be required to report shark weights for the form in which they are landed and, where practical, all sharks be landed in the carcass form where a carcass is defined as a beheaded and gutted shark with all fins and, for males, the claspers attached. Leaving the claspers intact enables monitoring the sex of sharks after landing ashore.

• Fishers should be required to report chimaera weights for the form in which they are landed. Where practical, all chimaeras should be landed in the carcass form where a carcass is defined as a beheaded and gutted chimaera with all fins and, for males, the claspers attached, except for the pectoral fins and belly flaps which are removed.

• The issue of standard reporting of rays needs to be addressed. There is a growing practice of retaining the outer margins of the discs (pectoral fins) of the animal and discarding the rest of the animal for several large-sized species. This involves removing a relatively small proportion of the animal and might be regarded as wasteful and analogous to finning.

• Official statistics of catch weights should be published as standard carcass weights and, where reported by fishers in a different form, the weights are converted to the standard carcass form.

2.6.Special protection of threatened species

Product certification and ecolabelling can be applied in support of fisheries management. Product certification is a measure mandated by governments to ensure that only legally harvested and reported fish landings can be traded and sold on domestic and international markets. Ecolabelling programs can create market-based incentives for better management of fisheries by creating consumer demand for seafood products from well-managed stocks (Wessells et al., 2001).

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