

# MODULE 3

## “THE EXPLOITATION OF THE SEAFOOD RESOURCES: FISHERY AND AQUACULTURE”

### TEACHER’S GUIDE

#### Module map

Topics		
Fishery techniques, fishing gear, coastal and pelagic fishery.		
Fishing management measures, sustainable seafood resources management.		
Aquaculture activity.		
Aims and rationale		
Learning the main fishing methods, distinguish industrial and artisanal fishery.		
Highlight the importance of a correct management of marine resources to avoid overfishing.		
Learning about aquaculture activity.		
To let the students investigate on the potential impacts of fishery and aquaculture activities on marine environments.		
Inserts		
1. Fishing techniques.		
2. Management of the seafood resources through the protection of the species .		
3. Aquaculture.		
Subjects		
Ecology, law, nature conservation.		
Fact sheets		
Type	Title	Activities
S - Survey	1. “About seafood resources”	Survey in class.
R - Research	2. “About fishery”	Research in class.
	5. “About aquaculture”	
E - Experience/ elaboration	3. “The voice of fishermen”	Visit to a fishing port and interview to fishermen.
	4. “Fishery rules & laws”	Visit to the Harbour Master’s Office and interview to the Master Officer.
	6. “How to rear seafood”	Visit to an aquaculture plant.
T - Test	7. “How do you fish it?”	Survey in class.
	8. “Tell me what you think!”	
Link to Mr.Goodfish Campaign issues		
Introducing different fishing techniques and the issue on environmental impact of fishery.		

## Didactic instructions

After having examined the marine ecosystem and defined how and how much the fish resources represent an important source of food for Mankind, in this form we take into consideration the various ways by which these resources are exploited and managed.

Therefore the central themes of this task are:

- fishing activity;
- fish resources management;
- aquaculture activity;

The purpose is to train the young students not only to the knowledge, but most of all to the awareness of the importance of a correct management of the natural heritage, our main source of life.

The following field activities are recommended for the execution of this form:

- interview with a fisherman;
- interview at the Harbour Master's Office;
- visit to an aquaculture plant.

For this form it is advisable to do the research fact sheets (R) in the classroom or at home, and to use the experience/elaboration ones (E) within the field activities.

The work, as usual, starts with the fact sheet dedicated to the youngsters foreknowledge (**fact sheet S 1**), in this case regarding the fish resources, fishing and aquaculture.

**Fact sheet R 2** suggests a research work, in preparation for the following field activities; the students are asked to get acquainted with the fishing theme, by getting information about the different techniques used to catch the various species, also in relation to the different environments where these are fished.

**Fact sheet E 3** consists of a practical activity, aimed at expanding on the knowledge of the local area fishing techniques and tools. By interviewing the fishermen, one will be able to fully understand the fishing reality of the territorial study; furthermore, one will be able to understand the difficulties and the harshness of the work at sea, by observing the equipment and discovering the needs dictated by their utilization and maintenance. The voice and the passion of the direct protagonists will be undoubtedly the best leaders in getting the young ones interested in expanding on the knowledge of these aspects; these are fundamental for the survival of the small local cultural and economic realities.

Furthermore, by suggesting the knowledge elaboration on the different types of fishing, both artisanal and industrial, the students will be able to understand how the technological development depletes the resources and will be able to contribute to the discussion about the necessary measures to control and manage the inevitable progress within the field (topic discussed in insert 2).

For the execution of the fishing fact sheets, the reading of the **insert 1** is recommended; it provides a brief overview of the most commonly used fishing systems, and invites you to encourage your students to investigate the local seafaring peculiarities, with the possible adjustments and artisanal versions of the several systems mentioned herewith. It is always best to remember the great importance of the local economic realities as fundamental engines of the global market. In this way, one of the founding

principles of the various Local Agendas 21 will be applied;

The programmatic documents of the actions to be taken in the twenty-first century, to safeguard the environments and the natural resources: **“act locally to manage globally”**.

**Fact sheet E 4** offers a research and analysis activity (in the form of an interview) on the existing fishing management measures, suggesting a meeting with the operators of these important Government Bodies, such as the Harbour Master’s Offices. The topics tackled in this fact sheet refer to many of those initiatives taken to guarantee the economic result to the operators, and the continuity in contributing the fish product to the market. **Insert 2** is dedicated to the fishing management measures, from which one will understand how every rule has its precise reason, to safeguard the resource preservation; it is generally founded on the biological characteristics of the target species.

At the end of the activity regarding fishing and fish resources management, one proceeds with the verification (**fact sheet T 7**) which, in a quiz format, reintroduces some key concepts, such as the different fishing tools and the relevant target species, the selectivity concept and the respect of the catches minimum sizes.

**Fact sheet R 5** offers a research task, in preparation for the next on field activity. The students are invited to find out information regarding the origins of the aquaculture, species that can be raised, various types of equipments, the possible environmental impacts of such activity, etc.

**Fact sheet E 6** offers, consequently, the visit

to an aquaculture plant. For this purpose, a trace for the gathering of the main information is provided, with regard to the technologies, as well as the management and environmental problems linked to the running of these business activities.

The visit to a plant will rouse the students’ curiosity on this type of activity, leading them to ponder on the related limitations and potentials.

For the development of the activities regarding the aquaculture, we recommend reading the **insert 3**, which offers a brief overview of the breeding activity and introduces some interesting data on which to meditate.

At the end of this subject, and of the whole form the students are invited to write a text (**fact sheet T 8**) where to express their impressions and considerations on the fishing and aquaculture activities.

In this way, in the light of the “lived” experiences, the pupils will be able to freely express themselves; therefore many different subjective aspects will come up, about “objective” themes such as fishing, fish resources management and aquaculture. It will also be interesting to expand on these aspects through discussions in the classroom.

*Before coming to the end, we cannot leave aside the fact that, like with all human activities, fishing and aquaculture generate forms of environmental pollution, which go beyond the fish resources impoverishment problem. This subject, even though is not contemplated herewith, could make an interesting elaboration.*

## INSERT 1

### “FISHING TECHNIQUES”

Since antiquity, man has built different tools that allow him to take sea products from the sea beds, in their vicinity and in the whole water column. Fishing history is written in the evolution of the tools and different jobs. The catch methods are, on one hand, the outcome of a deep knowledge of the animals' biological characteristics, and on the other hand, of the technological creeping.

*There are different fishing methods:*

- **passive and active** , according to the catch procedure;
- **pelagic and coastal**, according to the type of environment where it takes place and consequently to the type of domain (planktonic or benthic) the targeted species belongs to;
- **industrial or artisanal**, in relation to the take amounts and the size of the tools used (artisanal fishing employes boats with a gross tonnage not greater than 10 tonnes).

Accordingly to the catch procedure we will present hereunder the main fishing methods, illustrating their respective gears, environments were they take place, target species and curiosities.

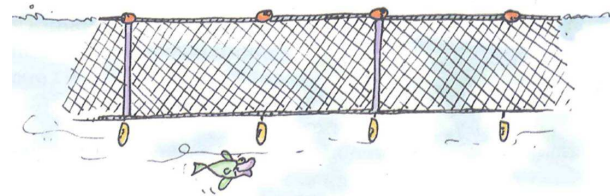
#### Passive methods

Among the different fishing techniques, the one of the great pelagic fish (Scombridae and swordfish in particular), represents one of the

main activities of industrial fishing at world level.

Up to 2001, fishing of these species took place mainly through the use of **pelagic drifting nets**, whose origins are very old. Oppian already mentions the existence of the driftnets for the catch of the swordfish in 177 B.C.

The length of these nets varied according to the type of fishing, which in the case of swordfish nets and "palamitare" (fishing nets for bonitos, tuna species and other big fish), reached up to 40 linear kilometres (medium length 12 to 15 km) and a height of 35 m (medium height 28 to 32 m).



*Driftnetting is a fishing technique where nets, called driftnets, drift free. Usually a driftnet is a gill net with floats attached to a rope along the top of the net, and weights attached to another rope along the foot of the net. Controversy around the use of driftnets stems not from their impact on fished populations, which, due to the selectivity parameters of the nets, are well understood, but from their impact on non-target species, particularly dolphins and turtles.*

From the end of the Eighties, this fishing technique has endured a series of legal and administrative vicissitudes, which have led to the subsequent activity openings and closures and an elevated unrest between the fishermen in charge and the environmental

associations.



An industrial fishing vessel picking up a big pelagic drifting net, nowadays forbidden. On the top of the vessel is visible an helicopter employed for the big pelagics aggregates sighting.

Among the drift nets, the swordfish driftnets are the most studied in the Italian seas, both because of their spreading and because of the problems caused to cetaceans and sailing. From a strictly quantitative point of view, the small dolphins are the ones that mostly endure the impact of these nets; the number of deaths can only be estimated.

Furthermore, inestimable damages are caused by the huge quantity of nets, or parts of them, which in time have gone missing in the sea, inevitably continuing their fishing activity on fish, cetaceans, turtles and other species, outside any possible control or remedy.

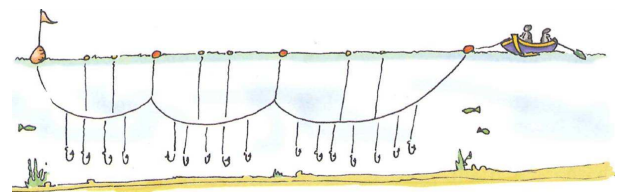
For these reasons, fishing with swordfish driftnets was forbidden first by the United Nations (Resolution 44/225 of December 1989), and then by the European Union, which in 1991 declared illegal the use of drift nets bigger than 2,5 km (EC Regulation No 345/92), and in 1997 outlawed it completely as from 1<sup>st</sup> January 2002, "to ensure the protection of the marine biological resources,

as well as a balanced exploitation of the fishing resources, consistent with fishermen and consumers interests" (EC Regulation 894, 29<sup>th</sup> April 1997).

Unfortunately, in spite of the ban, this fishing method is still illegally practiced, even though in a more limited manner.

The "**ferrettare**" nets are drifting nets which the Italian Government has declared legally valid for fishing small pelagic fish and various demersal species. As a matter of fact, the 18 cm mesh side and the 10-mile distance from the coast authorized by the Italian Government, might imply the catch of species forbidden by the EC with driftnets, such as tuna fish and swordfish and the accidental catch of protected species, i.e. cetaceans and turtles.

The tools used today for catching pelagic species at industrial level are the **longlines**: hooks and lines systems, whose brackets are linked to a horizontal "beam", on which there are also the floats. The length of the beam is correlated to the number of hooks used and to the distance between the brackets; it can reach a length of many kilometres, variable in relation to the target species.



Longline fishing technique uses a long line, called the main line, with baited hooks attached at intervals by means of branch lines called "snoods". A snood is a short length of line, attached to the main line, with the hook at the other end. Longlines are classified mainly by where they are placed in the water column: in the water column (pelagic) or at the bottom. Hundreds or even thousands of baited hooks can hang from a single

line. Longliners commonly target swordfish, tuna, halibut, sablefish and many other species.

The **fixed nets** are lowered and anchored to the seabed and are divided into trammel nets and gillnets; **trammels** have three layers; the two outer ones are made of thicker meshes, and the inner one of finer meshes, whereas **gillnets** have a single mesh.



Fishermen stocking the species captured with small artisanal fixed nets.

**Trap nets** fishing uses a system of walls or compounds of netting that are set out in a particular way and anchored to the seabed so that fish, once they have entered, are no more able to leave the trap. In some cases long leader nets are arranged from the shore to intercept migrating fish and guide them

into the trap system. This kind of fishing technique is targeted usually to tuna, bass, herring and salmon species.

The selectivity of the trap nets is determined by the mesh size. This technique allow non target species (or undersized target specimens) captured to be returned to the sea alive.

**Pot fishing** are tools typical of artisanal fishing, spread worldwide. Basically, they are traps inside of which baits are put, in order to attract the preys; they are made of different materials, such as wicker, rush or nets, mounted on fixed wooden or iron frames; there are also plastic or synthetic ones.

Pots are used to catch demersal fish, crustaceans and shellfish. In the lagoon areas, they can be replaced by other kinds of traps, called "bertovelli".



*Pots, are gears in which the fish are retained or enter voluntarily and will be hampered from escaping. This method of fishing results in fish staying alive until the time they are hauled into the boat, as against being entangled and killed in a gill net. This method also allows for non-target species and other protected species to be released without harm.*

Beside the main fishing techniques illustrated before, we lastly mention some passive techniques to gather many different seafood resources with minimal equipment such as: pole and line, handline and jigging fishing.

**Pole and line** fishing (also known as bait boat fishing) is used to catch naturally schooling fish which can be attracted to the surface. The method almost always involves the use of live bait which is thrown over board to attract the target species near the boat (chumming).

**Handline** fishing uses a single fishing line which is held in the hands. One or more lures or baited hooks are attached the line. Usually a weight and maybe a float are also attached. This technique is possible from a stationary or moving boat as well; it is used to catch demersal species and pelagic species such as mackerel, squid and tuna. Handlining is one of the oldest forms of fishing and it is still common.

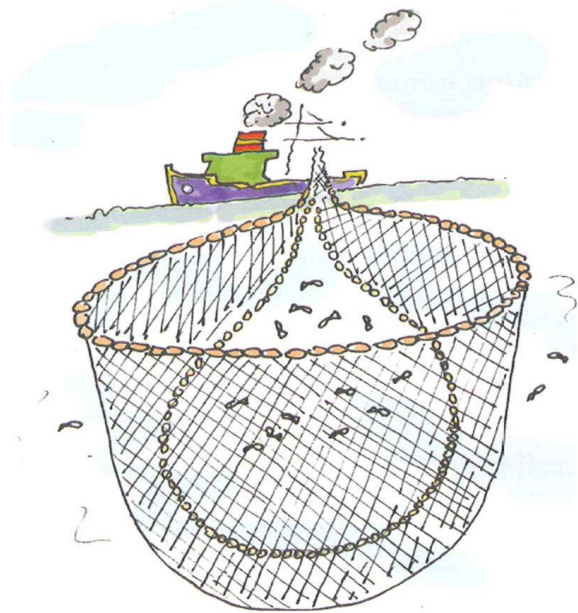
**Jigging fishing uses jigs**, a type of fishing lures consisting of a lead sinker with a hook molded into it and usually covered by a soft body to attract fish. Jigging is widely used to capture squid, normally at night with the aid of light attraction.

### Active methods

**Purse seiners** or "ciancioli" are used for the catch of anchovies, sardines and mackerels and most recently (since the '60s) also for bluefin tuna fishing. These nets can reach a length of more than 1 km and a height of more than 300 m and are managed by vessels (boat encircling nets) with a tonnage of over 30 tonnes.

The net is kept afloat by the floats' file and is lowered so as to surround the bank of fish; then a cable linked to the sinkers' file is quickly pulled; this action creates a sort of sack which stops the fish from escaping.

Fishing by seine nets can be aided by using fishing lights or other sources of light, placed on small support boats.



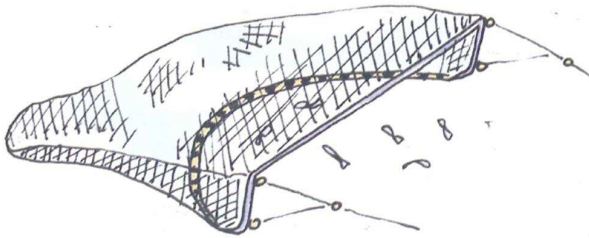
*Purse seine is named such because along the bottom are a number of rings. A rope passes through all the rings, and when pulled, draws the rings close to one another, preventing the fish from "sounding", or swimming down to escape the net. This operation is similar to a traditional style purse, which has a drawstring.*

*The purse seine is a preferred technique for capturing fish species which school, or aggregate, close to the surface: such as sardines, mackerel, anchovies, herrings and tunas.*

For anchovies, sardines, mackerels and garfish fishing, "**pelagic trawlers**" are also used, pulled at mid-water or just above the seabed by one or two vessels.

**Bottom trawling** takes place by using towing nets and is very common in coastal and offshore areas. The great net "ploughs" on the sea bottom, towed by the trawler; the mouth is kept open by the corks file and by two specific structures (trawl beams), which tend to expand according to the straight movement of the boat's net. At the bottom of

the net there is the “sack”, where the take is gathered; it is usually made of demersal fish, but also various crustaceans and shellfish.

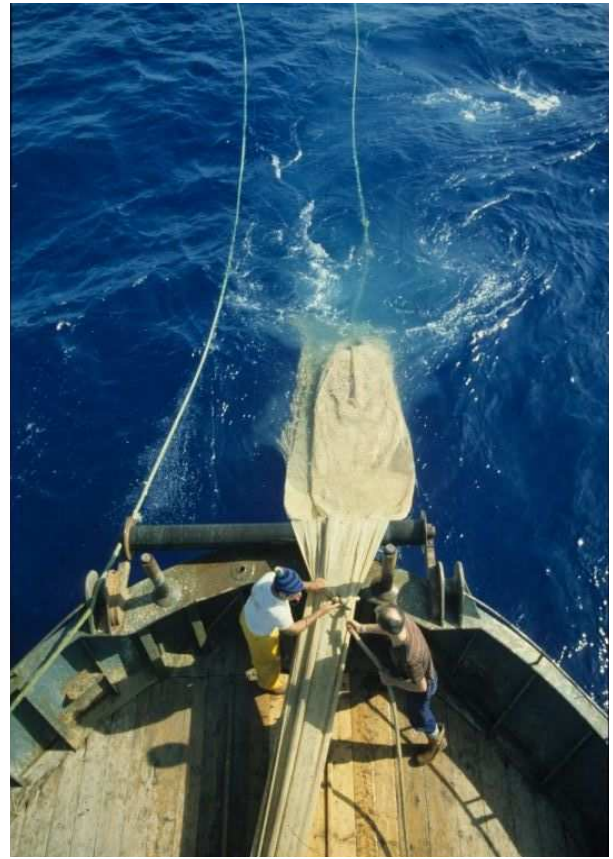


Trawling is a method of fishing that involves pulling a large fishing net (called trawl) through the water behind one or more boats. The boats that are used for trawling are called trawlers. Trawlers vary in size; from small open to large factory trawlers.

Trawling can be divided into bottom trawling and midwater trawling, depending on how high the trawl is in the water column. Bottom trawling is towing the trawl along or close to the sea floor. Midwater trawling is towing the trawl through free water away from the bottom of the ocean. Midwater trawling catches pelagic fish such as anchovies, shrimp, tuna and mackerel, whereas bottom trawling targets both bottom living fish (groundfish) and semi-pelagic fish such as cod, squid, halibut and rockfish.

Trawling necessarily takes place on sandy or muddy seabeds (rocky seabeds would damage the nets irreparably); this type of fishing is still very harmful in the coastal areas of the Mediterranean Sea, because of the *Posidonia oceanica* meadows, which during the second half of the 20th century have been seriously damaged by the senseless use of these tools.

The posidonia meadows have consequently suffered a strong decrease. In order to safeguard these ecosystems, which are fundamental for the natural, coastal balances, strict rules are in place today, which severely regulate the trawling practice in coastal areas, fully prohibiting it over posidonia meadows .



Fishermen retrieving the trawl net on a bottom trawler fishing vessel.

The very recent EC regulation No. 23/2010 in particular, establishes for trawling in the Mediterranean Sea, nets with looser meshes (40 mm for the square nets, or 50 mm for the lozenge ones) and the fishing ban within three miles from the coast.

Also, as a further prevention measure against any possible damages caused by trawling, in the recent past artificial underwater barriers have been created in some areas; they consist of structures created by the sinking of solid bodies on the sea beds to be protected, in order to achieve at least two objectives: preventing mechanical fishing and illegal trawling and increasing the presence of species, particularly those mostly related to fishing.

The **seine netting** is a method using a net that is pulled and put out generally by hand; it can either be a beach one, or a boat one. The first one is lowered from a boat, leaving one end on land and by covering a semicircle, brings the second end ashore; it is then pulled by two rows of fishermen directly onto the beach. The boat seine net is used in presence of high coasts or shoals far from the shore; the boat is anchored and the fishermen pull the net.

Lastly, it is worth mentioning bivalve molluscs fishing, which utilizes specific tools, such as **hydraulic dredges, drag nets** and different small **trolling tools** (active methods).

*All of the methods we have just mentioned are characterized by a certain degree of "**selectiveness**", i.e. the ability to catch only individuals within a certain size. This quality mainly depends on the meshes opening, in case of fishing techniques which entail the employment of nets, and by the hooks size, in case of boulders.*

*It is intuitive to think that a wider opening of the meshes of the net will allow the smaller individuals to escape. However, other factors can determine the selectiveness of a tool, such as the design of the net used or the fishing speed.*

*Apart from harpoon fishing, no method can be truly 100% selective.*

*The importance of the definition of the level of selectiveness is therefore evident; particularly with regard to management goals, aimed at limiting the catch of the younger individuals, and averting the catch of non targeted, protected species, such as cetaceans, various species of sharks and turtles.*

## INSERT 2

### “MANAGEMENT OF THE SEAFOOD RESOURCES THROUGH THE PROTECTION OF THE SPECIES”

The human pressure, the climate changes and the environmental phenomena linked to pollution, have prompted in the last century a quick habitats transformation, particularly of the coastal ones.

An increase of the activities linked to fishing have also contributed to this process, through the increase of the fishing fleet and the application of state-of-the-art technologies.

**The excessive exploitation of the marine resources of the world seas, has however led to their drastic impoverishment.**

With regard to the Mediterranean Sea, the variety and wealth of species which populate it, is made unique by the fact that this sea is basically a closed basin; the quasi-isolation from the other seas has encouraged the evolution of other species, which have therefore remained geographically restricted to this area of the planet.

It is a peculiar situation that, together with resources abundance, has encouraged the development of the human settlements, turning the Mediterranean coast into one of the most populated areas and as a consequence, the Mediterranean Sea one of the most exploited seas.

**Not only one has fished too much, but for a long time one has unfortunately fished the species before they became adults.** This has

meant, using terms borrowed by the economy field, **dipping into the capital at our disposal.**

*Basically, one has taken more than the different fish populations were able to guarantee, without realizing the importance of giving the single individuals the chance to reproduce.*

*To guarantee the sustainable exploitation of the resources, it is therefore fundamental to schedule the withdrawal activity based upon the biological cycles of the target species, in order to guarantee the maintenance of the stock in the different fishing areas.*

*In order to try to realistically solve this problem, rules necessary for the maintenance of the balances between the catch and the reproduction capabilities of the species have been studied.*

*Among the most relevant regulations, it is worth remembering those that stimulate the use of **selective fishing methods**; for example, the use of nets with a looser mesh, the ones which limit the number and power of their boats and their working period: for example, the **biological shutdown** (suspension of the activity during the reproductive period of the target species) and those that establish the **minimum catch sizes**.*

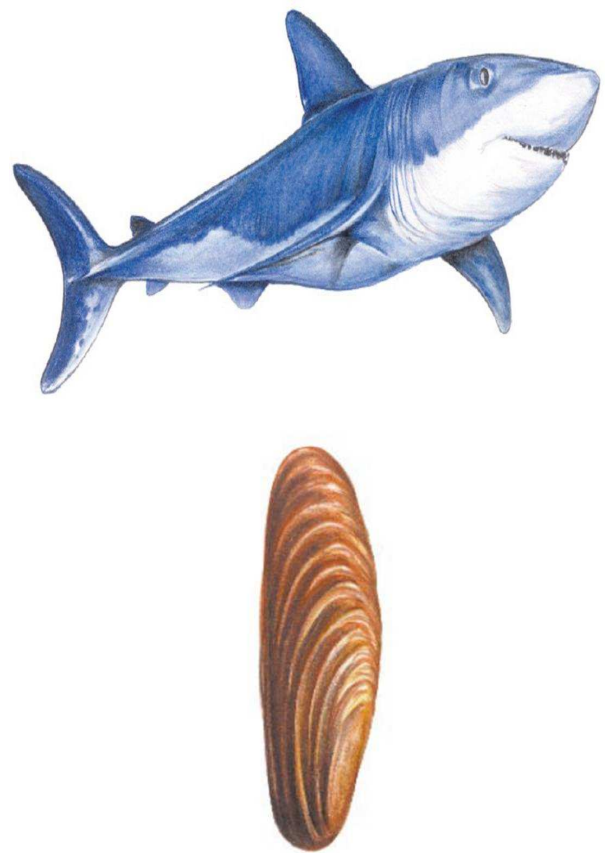
Also, for some stocks like the ones of the North-Western Atlantic Ocean, North Sea, Baltic Sea, or for some species, it has been established the **Total Allowed Catch (TAC)**, i.e. the maximum possible withdrawal that a stock (or the species) can bear.

Areas of particular natural interest, reproduction and nursery areas have been identified, meant for **marine protected areas**, where fishing is strictly regulated or even banned. Also, **areas banned from certain types of fishing** are pinpointed, such as the coastal strip (within 3 miles from the coast), where trawling is usually forbidden. For the latter, the use of nets with meshes under 40 mm/50 mm (according to the shape of the trawl) opening has been banned, as it can cause serious damage to the environment. The most detrimental aspect concerns particularly the fry and the breeders' destruction, as well as the destruction of the Posidonia meadows and of the other coastal biocoenosis. Under this point of view, also edible, Bivalve molluscs' mechanical fishing can take certain significance, in some coastal areas.

Still in favour of the coastal environment, **strict protection measures for the date mussel** have been taken, forbidding the catch of this bivalve mollusc. It is considered one of the finest seafoods, it lives inside cavities that it digs itself into the rocks and its extraction entails the total destruction of the rocky seabed, with a serious damage not only for the survival of this species, but also for the whole benthic community, which populates the same environment.

Also fishing for the great pelagic species is regulated, and in some cases banned, for the

**safeguard of protected species**, such as turtles, cetaceans and large fish like sharks. The latter in fact, for their biological characteristics, are in some cases seriously threatened by extinction: opposite to bony fish, cartilage ones do not have an elevated reproduction rate; they have few offspring, which are born completely formed and independent and this requires a long period of embryonic development.



Two examples of protected species: the Great White Shark (*Charcarodon charcarias*) and Date Mussel (*Litophaga litophaga*).

Once again we care to insist on the fact that **each person's effort is fundamental for the environmental conservation**, as we all have a decisive role in the exploitation of the natural resources.



Obviously, law rules are essential for a correct regulation of the withdrawal activities, but it is just as important to guarantee the rules' observance, to be able to ensure the effectiveness of the measures taken; at sea, this task lies mainly with the Harbour Master's Office and the "Guardia di Finanza" (Italian Finance Police).

However, for the defence of the protected marine species, fishing control is not enough, although very important. It is necessary that consumers do not nourish their market by buying them and eating them.

## INSERT 3

### "AQUACULTURE"

FAO'S Fisheries Circular 815 establishes that "**Aquaculture** is the rearing of water organisms (fish, molluscs, shellfish and water plants). This entails forms of human intervention, through rearing within the growth processes, sowing and control, feeding, protection or control of the predators systems. Rearing also implies the single or associated ownership of the breeding stock. For statistical purposes, it is considered as aquaculture the production of all water organisms reared by subjects who have retained their single or associated ownership during the growth period, whereas the water organisms which form an accessible, common property, with or without a specific permission, form the fishing product".

The aquaculture contribution to the fulfilment of the continuous food request increase is growing constantly; since the early Eighties, the production has more than doubled, reaching about **52 million tonnes** at world level, according to FAO data, representing roughly **47%** of the global fish production.

Water species rearing can also have different aims apart from the dietary ones. Therefore there is aquaculture for human consumption, repopulation, aquariology, sport fishing. However, here we will only deal with the one meant for human consumption.

Today at the world level, the reproductive cycle of over two hundred species is controlled, through a continuous

technological development, which allows constant improvements of the productive return.

Climate and water temperature are a determining factor in the breedable species assessment.

The classification traditionally done in the water productions takes into consideration the:

- environments,
- reared species,
- level of intervention/control of the system by man.

For example, according to the type of breeding environment, a **marine aquaculture** and a continental one (or freshwater) can be distinguished.

From the reared species point of view, different classifications can be made. Shellfish rearing is called **mollusc breeding**, among which can be distinguished **mussel farming**, **oyster farming**, and **clam farming**. Within **fish species farming**, it is possible to cite **eel**, **cyprinid**, **salmon**, **tuna**, **tilapia**, **catfish**, **seabream**, **seabass**, **drum** as the most common fish **farming**. Seaweeds breeding is called **algae farming**, and shellfish breeding is called **crustacean farming**. The breeding of more species within the same environment is called **polyculture**, whereas the rearing of a single species is called **monoculture**.



Two examples of aquaculture activity: fish farming (top) and molluscs mariculture (bottom).

According to the control capability of some environmental parameters and based also on man's role towards the reared species, it is possible to distinguish the following productive practices: **extensive farming**, **semi-extensive farming** and **intensive farming**, where density and surfaces are the relevant discriminating factors

**Extensive aquaculture** means any kind of

breeding which does not require high contribution of supplementary energy in order to obtain the product's growth.

In other words, the trophic energy needed relies completely on the environment. This type of activity normally takes place on great stretches, in natural or semi-natural environments. Human intervention is only finalized to the realization of hydraulic works (canalization, embankments, locks, etc). The productions are expressed in kilos per hectare.

**Semi-extensive aquaculture** represents the development of the extensive system and requires the provision of supplementary food, compared to the already existing one within the system (it is called supplementary diet). This productive practice can include the waters fertilization, which allows phytoplankton blossoms, facilitating zooplankton and benthic species production, increasing availability of natural food for the reared species. The surfaces used for this type of breeding are smaller than the extensive system ones and are usually formed by land basins or restricted coastal areas. The productions are measured in tonnes per hectare.

Finally, the **intensive aquaculture** is characterized by elevated density of biomass reared per surface and volume unit. All the food is supplied from the outside.

This type of activity entails environmental control, in order to operate at high density storages.

Such rearing needs elevated water supplies and proper ventilation and oxygenation mechanisms. The equipments of this system

take up lesser space compared to the extensive and semi-extensive ones. The tanks or basins cover relatively small areas, which vary between a few tens and some thousands square metres. Within the sea breeding, the typical structure of the intensive farming is characterized by cages, both floating and underwater. The productions are measured from a few to over 100 kilograms per square (or cubic) metre.

*On the one hand, aquaculture represents a feasible way to satisfy the population growing food request. On the other hand, it is a controversial activity, in terms of its possible repercussions on the environment and fishery economy.*

Aquaculture equipments are often challenged because of the **environmental pollution risk that can result from feed, supplements and drugs leakage, the possible spreading of pathogens.** There is also the **biological and environmental risk caused by the accidental introduction of alloctonous species in the natural environments, i.e. coming from different geographical areas.**

Another aspect not to be overlooked is the one linked to the **sustainability of the breeding of carnivore species,** for whose growth substantial quantities of food are needed, represented by fished wild species. **Cod, gilthead, skate, sturgeon, salmon, trout and red tuna are among the reared carnivore species that cause the most serious problems;** these species are widely consumed in Western Europe and in Asia. In these cases, in order to produce 1 kilo of

reared carnivore fish, it is necessary to provide it with food for about 2, 5 kg of wild fish in the most “performing” breedings, often increasing to 4 kg up to 20 kg, in order to rear a red tuna.

The problem becomes more serious if one takes into account the fact that the available wild fish quantities are very limited.

On these aspects, the scientific community is still debating and trying to understand what could be the effects of these activities on the natural balances, even if the ethic factor of consuming good seafood resources to create luxury consumption is to be seriously taken into account.

*In parallel, from an economical point of view, the major risk of this activity is represented by the production's growth fastness, which can disconcert the economic system linked to it, because of a supply excess. This in turn can imply the risk of a decrease of the product quality on the market.*

*From these considerations, emerges how important it is to include a constant check, so that this activity is carried out with the utmost safety for mankind and natural environments health, ensuring at the same time the guarantee of a quality product.*

Among the initiatives taken for this purpose, the **FAO Code of Conduct for responsible Fisheries** is worth mentioning; its section 9 is specifically dedicated to the responsible development of the aquaculture sector.



# Fact Sheet S 1 "ABOUT SEAFOOD RESOURCES"

Answer the following questions.

 Do you know what is a "natural resource"?

Yes       No

If so, how would you define it?.....

.....

 Have you ever fished? If so, where? What did you catch and how?

.....

.....

.....

.....

 Do you know any marine protected species?

.....

.....

 Do you know what is an "environmental impact"?

.....

.....

 Do you think it is possible to rear fish? How?

.....

.....

.....



# Fact Sheet R 2 "ABOUT FISHERY"

Look for the following requested information about fishing activity.

 What are the main fishing techniques?

.....  
.....  
.....

 What is the difference between industrial and artisanal fishery?

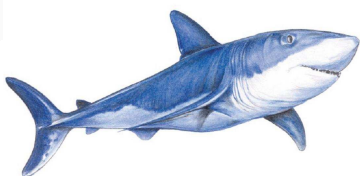
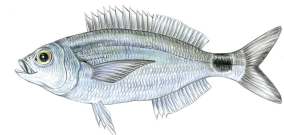
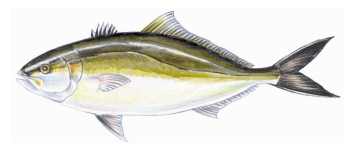
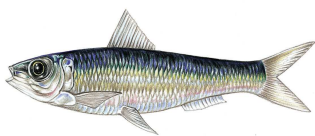
.....  
.....

 How do fishing techniques have evolved through time?

.....  
.....

 Among these organisms which ones are:

Captured in open sea?    Captured in coastal waters?    Protected?



 Open sea

 Coastal waters

 Protected



## Fact Sheet E 3 "THE VOICE OF FISHERMEN"

Before interviewing fishermen, look around and identify the two different kinds of following fishing vessels.

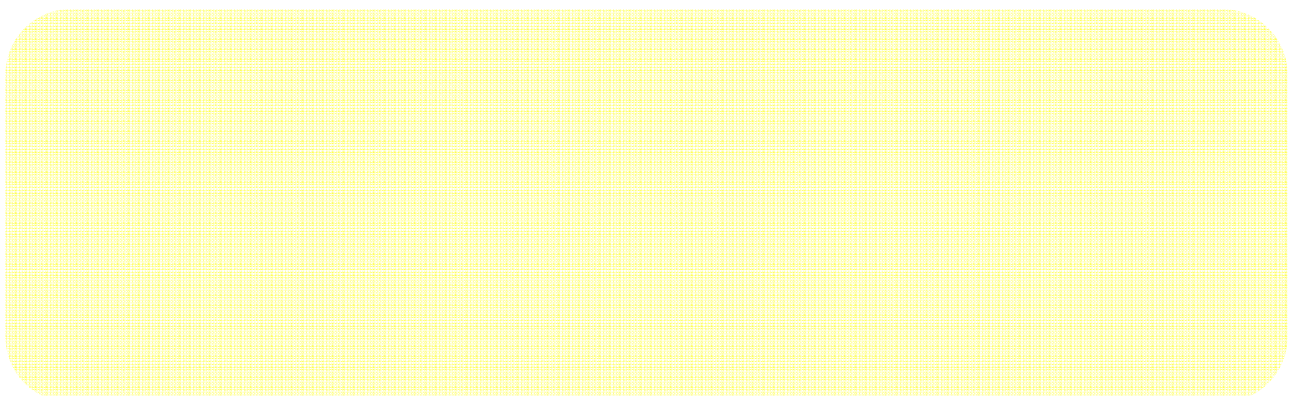
Number of: industrial fishing vessels ..... artisanal fishing vessels .....

Which ones are predominant? .....

 Now, following the suggested questions, interview some fishermen:

- 1) How long have you been fishing?
- 2) Do you fish as a work or as a hobby?
- 3) What do you fish?
- 4) What kind of fishing gear do you use?
- 5) What is the most common fish of this season?
- 6) What are the most common fish of this area?
- 7) Has the way you fish changed though time?
- 8) How does your typical working day go?

 Make a drawing of a fishing gear used by the interviewed fishermen.



What about you? Would you like to be a fisherman? Why?



## Fact Sheet E 4 "FISHERY RULES & LAWS"

Make a research on the main fishery rules at both local and national levels. Then, make an interview to the Harbour Master Officer.

 Follow the suggested questions:

- 1) What are the main rules regarding the fishing gear use?
- 2) Are there limits on the total catch amount?
- 3) Are there rules on the sizes of the fish?
- 4) Is there a period when fishing activity is forbidden or limited?
- 5) Are there areas where fishing activity is forbidden or limited?
- 6) Are there protected species that can not be caught by law?
- 7) .....
- 8) .....

 What are the main reasons and effects of these rules?

.....  
.....

 Who guarantees for their respect?

.....  
.....

 If you could invent a law, what would you establish? Why?

.....  
.....  
.....



# Fact sheet R 5 "ABOUT AQUACULTURE"

Look for the following information on the aquaculture activity.

 What are the main aquaculture activities?

.....  
.....  
.....

 What organisms can be reared with alimentary purposes?

.....  
.....

 Who has invented aquaculture? When?

.....  
.....

 What kind of impacts can aquaculture have on the environment?

.....  
.....  
.....

 How do they feed the reared organisms?

.....  
.....

 Is it easier to rear herbivorous or carnivorous organisms? Why?

.....  
.....  
.....

Check the data with your classmates.



## Fact sheet E 6 "HOW TO REAR SEAFOOD"

Collect the following information.

 What are the reared species? What kind of food do they eat? Are they herbivorous or carnivorous?


.....  
.....

 How much time do they take to complete their life cycles?

.....  
.....

 How many tanks do they need to be reared? .....

Draw a simple scheme illustrating the main parts of the  
aquaculture plant.

 How is the water treated? Are there some preventive measures in order to avoid environmental pollution?

.....  
.....

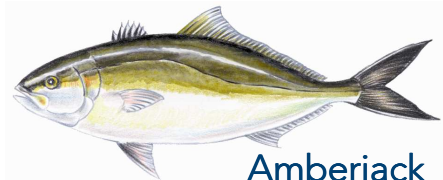
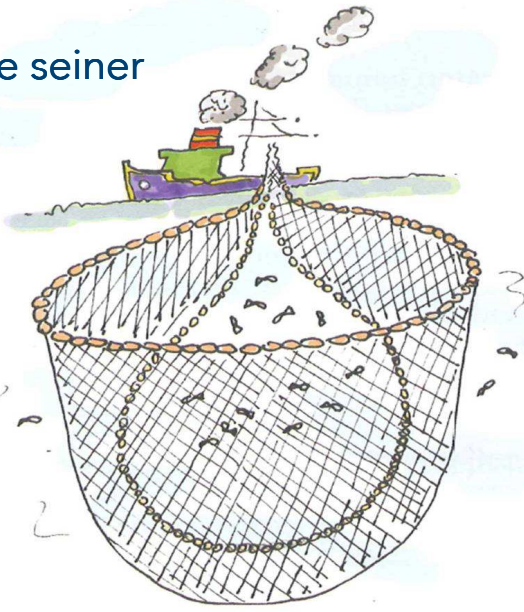


# Fact sheet T 7

## "HOW DO YOU FISH IT?"

What do you fish with the following fishing gears?  
Connect these fishing methods to their target organisms.

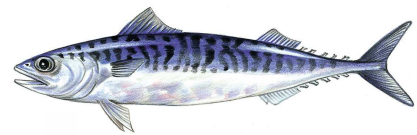
Purse seiner



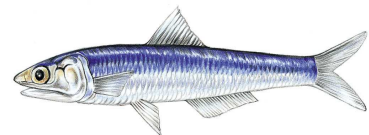
Amberjack



Crab



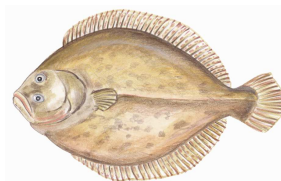
Mackerel



Anchovy

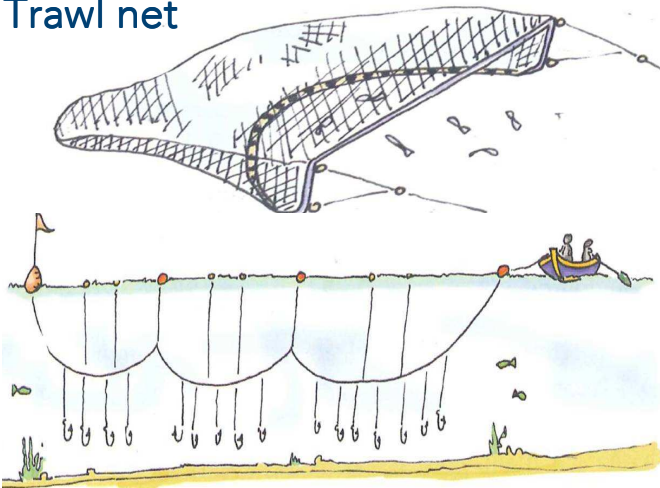


Octopus



Turbot

Trawl net



Longline



Pot

