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Fishing in the Mediterranean, Past and Present: History and Technical Changes

The historical context of the maritime sector can present certain difficulties for historians and fishery specialists. Seas and oceans are mostly worlds without archives, often mistakenly thought of as immutable. Most often glossed over by biologists, more than ever does it seem necessary to ask questions about the past of the underwater world. It must today be at the heart of all reflections that condition the defining of policies for the management of fisheries. While the challenges faced by Mediterranean fishing, climate change, acidification and the need for a rigorous management of stock, are no different from those found in all seas of the world, they are all the more applicable in this closed basin and must engage the responsibilities of all the surrounding states in the 21st Century. Dedicated for millennia to fishing and the movement of men and goods, this "liquid continent with a solid border", as it was called in the 1930s by the poet Gabriel Audisio and his friends from the *Cahiers du Sud*, has witnessed the rise of new uses in the last 50 years, which present important problems for fisheries. The rise of leisure fishing, harm to coastal fishing caused by the damaging of marine ecosystems and the need to provide for urban and tourist markets increasingly demand of sea products today, influence the maintenance

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or the survival of professional fishing in all of the basin. However, the long history of Mediterranean fishing, far from unmoving, shows that the men and women who formed it over centuries were able to adapt their methods to the fluctuating conditions of access and exploitation of fishing resources. The future of fishing in the Mediterranean requires mastering the effects of industrialization and urbanization on ecosystems, also must take into account the cultural aspects, including traditional expertise, for a better management of this medium. Compiling a comprehensive history of fishing would appear unfeasible in the confines of this chapter. A choice has therefore been made first to present a reflection on historical methods of fishing. A table of traditional techniques, the organization of communities and their plurality is envisaged here (section 1.1). Second, the successive changes that have transformed this activity sector since the modern era are analyzed (sections 1.2 and 1.3). The third component of this approach proposes some reflection on the characteristic of Mediterranean fishing at the start of the 21st Century. This last part will be a description of the current flotillas in operation, while looking at the challenges faced by this sector of activity: environmental changes, changes in how people consume, the redefining of the fishing boss, between collective needs for the protection of the habitat and the need to fulfill the demands of the market (section 1.4).

1.1. Mediterranean fishing of the past (18th Century)

Structured by religious brotherhoods and communal efforts, fishing communities efficiently control the exploitation of the natural medium in the modern era. The large variety of fishing techniques used, as well as the characteristics of an "Ancient Regime" style of consumption, marked by a chronic lack of protein, explains the extreme diversity of the products offered at the fishmonger's stall.

1.1.1. *Brotherhoods and prud'homies: old forms of regulation of the fishing world*

Being present as early as the 15th Century on the north coast of the Mediterranean, the brotherhoods, Italian *confraternite*, Catalan *gremis*

or the Spanish *cofradias*, appeared as the dominating form of organization in the fishing community. Placed under the protection of the Virgin Mary or a patron saint, Saint Peter, Saint Elme or Saint Roch, the brotherhoods were first of all religious structures that not only guaranteed their members' collective solidarity in the case of an accident (loss of ships or fishing materials), but also looked after the souls of the dead through prayers and processions. They were also professional regulatory structures. Made up of all the fishing bosses, i.e. the boat owners, they enacted precise fishing regulations, most often passed on orally. The distribution of fishing zones (the Provençale "postes"), the mesh size of the nets, the size of the hooks, the quality of the baits and a strict calendar fixed by the community [FAG 11], thus precisely defined the modes of exploitation of a "fishing ground" [FER 01] whose spatial limits are strictly delimited. The names used by the fishing communities of the past clearly illustrate this distribution of the marine space, which was split into microterritories: for example the two seas of *Amoun* and *Avau*, which split the organization of fishing in Marseilles in the 17th Century [FAG 11]. Exceptionally, the organization of the community would depend on two structures: the *prud'hommes*, a tribunal made up of representatives of the profession, are clearly distinguished from the brotherhood, which would in this case be reduced to a spiritual function and a function of assistance. The only jurisdiction in all of the ports of the Mediterranean, the corporation of *prud'hommes* of Marseilles would appear today as the most accomplished form of self-regulatory organism for fishing activities [BER 98]. It benefits from its age, since the municipal authorities allow the community as early as the 14th Century to choose its own *probi homines*, its wise men, to sort out any conflicts related to fishing. There are four of them, renewed each year and elected by a simple vote by show of hands. These Marseilles *prud'hommes* provide public justice, orally, freely and without the possibility of appeal. A tribunal of experts and recognized as such, the Marseilles *prud'hommes* thus avoid the suppression of corporations put in place by the revolutionary laws of the 2nd and 17th March [FAG 11]. A model of professional organization, as early as the last decade of the 18th Century, it became the dominating form of justice within the fishing communities of the French Mediterranean coast.

Figure 1.1. *Provençale fishing prud'hommes (source: Musée Ciotaden)*

COMMENTS ON FIGURE 1.1.– As Mediterranean fishing boss communities, the *prud-hommes* appeared for the first time in Marseilles in 1481, officially recognized by Louis XI's royal charter. Extended to all fishing communities after the French Revolution, the *prud'homme* form of organization found its definitive form in a decree from 1859. The function of the *prud'hommes* is to sort out conflicts between fishermen and regulate the access to fishing zones depending on their jurisdiction. Long neglected by the legal authorities, especially during attempts to develop industrial fishing, they have been, since 1994 by decree of the *Affaires Maritimes*, systematically consulted before any regulation is made in maritime affairs. As a decentralized power of management and authority, the *prud'hommes* constitute a model of management and governance of fisheries ensured by the polyvalence of the activities and making the fishers aware of their responsibility, which are the optimal conditions for the proper exploitation of the resources. "The five *prud'hommes* wore hose, a doublet and a black coat with a white band. On their heads they wore a hat with large edges. Their faces were tanned, and they represented the elite of the maritime population of the town and of the gulf" [SUE 45].

1.1.2. *Plural communities*

Present over the entire Mediterranean coast, traditional fishing communities offer much diversity. The differences first concern the

forms of habitat and insertion in the coastal space. From the simple Languedoc or Moroccan rosewood hut [FER 01, PAY 07] to the specific urban quarter, the fisherman's habitat appears as the result of natural conditions (dirtiness of the coast), and also depends on historical processes that can reflect the age of a community (Saint-Jean quarter in Marseilles, Jonquières quarter in Martigues, etc.), or reflect political decisions, often made later (Barceloneta quarter in Barcelona, created from scratch in 1753, La Bordigue quarter in Sète, after the 17th Century) [CAB 95]. On top of these differences in accommodation, a plurality of the activities that are not entirely dedicated to fishing can be added. Better than the classes system etablished by the French Royal administration, the study parish registers also frequently highlights the professional instability of the people of the sea, successively recorded professionally as "brassiers"[1] rather than fisher[2].

Like for the Atlantic coast, the presence of a cultivatable inland explains the coexistence in the Mediterranean, within fishing families, of time dedicated to the cultivation of wine grapes or wheat and periods dedicated to fishing. The availability of agricultural resources, which sometimes transforms income taken from the sea into significant revenue, explains the choice of one type of fishing over another by communities. In the Languedoc and Roussillon, the fisher-winemakers of Leucate, Banyuls or Collioure, masters of the *sardinal*[3] or of small fishing in lagoons, thus opposed the fishing owners of Gruissan or Sète in the 18th Century, who were converted to the *pêche au boeuf*[4] very early on (section 1.2) [LAR 97]. For the most part an opportunist, able to make the most of any positive variations offered by the resource, the traditional fisherman adapts his trade according to the season. He knows how to use the *boguière* or the *thonaire*[5] with the same dexterity as the

1 Labourers.

2 In 1668, Jean-Baptiste Colbert, the minister of Louis XIV, created the class system, which enrolls and identifies all seamen to provide regular service to the Royal Navy.

3 The sardinal is a drifting gillnet on the surface for catching sardines.

4 The "pêche au boeuf" is a pair-trawling technique that consists of towing a trawl simultaneously with two vessels.

5 The *boguière* targets the bogues (*Boops boops*) and the *thonaire* aims to capture bluefin tuna. They are like the drifting sardinal surface gillnets or are set on the seabed.

girelier[6] or the *eissaugue*[7], due to ancestral knowledge passed down from father to son. The use of all types of traditional fishing, more than the limits of his expertise, only depends on the financial capabilities that condition the buying of certain materials, whose cost is often greater than the value of the vessel itself.

1.1.3. *Diversity of traditional techniques in the Mediterranean*

Under the watchful eye of brotherhoods or *prud'hommes*, Mediterranean fishermen use in the modern era techniques that were already known in Antiquity, and often represented in mosaics of the Greco-Roman civilization, an example being the one found in the Villa del Casale in Sicily, dating back to the 3rd Century AD. Passed on through the vernacular, the expertise attached to these techniques is rarely the object of treaties or professional manuals. They are part of an oral culture of apprenticeship, provided on a vessel, aimed at sailors. The materials used can be classified into two categories. The first category is that of static gear, traps, coastal fishing lines, longlines and nets – whose extreme variety reflects the species that are being caught. Among these, we can distinguish bottom gillnets with a single *aumée*[8], the trammel nets superimposing three *aumées* or net panels, aimed at catching benthic fish, gillnets floating on the surface, aimed at catching pelagic or semi-pelagic species (tuna, sardines, anchovies, etc.). This first group of static gears, opposed to all the mobile gear, is essentially composed of towed nets [MAR 05]. Whether manipulated from the coast by hand (Provençale *eissaugue* and Languedoc *boulier*), or from a vessel (*gangui*, Languedoc "*peche a vache*", Albufera or Valence *gànguil*)[9], these nets have the particularity of sweeping the posidonia prairies, the beds of silt or

6 The *girelier* is a fish trap of wicker or iron wire designed for capturing wrasse (*Coris julis*).

7 The *eissaugues* or *issaugues* referred to a type of towed net similar to beach seines and that were dragged from land by several men to catch various pelagic and demersal species mainly living in coastal sea herb beds [GOU 97].

8 An *aumée* is a layer of netting made up of meshes of different sizes according to the type of fishing being practiced.

9 Ancestor to our modern trawlers, in order to maintain its horizontal opening the *gangui* needed to be towed by two vessels (pair-trawling) or to be held up by two yards fixed to the bow and stern of the vessel (*pêche à la vache*).

of coral sands, to find flat fish and elasmobranchii fish. Whether static or mobile, these different fishing gears are made up of fragile materials and are characterized by rapid wear. Their manufacture is supplied by a highly active artisan industry, mostly gone today, and their maintenance calls upon practices found on most of the Mediterranean coast. Nets made of hemp, which retain humidity, are subject to alteration, the damage caused by which delays the process of dying. This is carried out with the help of the bark from the Alep pine tree (*Pinus halepensis*), from which a decoction is obtained by boiling it in the community cauldron. The fish traps and crab traps (*gireliers*, Provençale *emborniers* and Spanish *nansas*) are most often made from myrtle sticks (*Myrtus communis*), their imputrescibility ensuring the longevity of the materials. If, for the most part, the manufacture of almadraba nets uses the same materials as those used in the elaboration of other fishing gear, the dimensions of these fixed fisheries and their maintenance costs are enough to put them in a class apart from that of small-scale artisanal fishing.

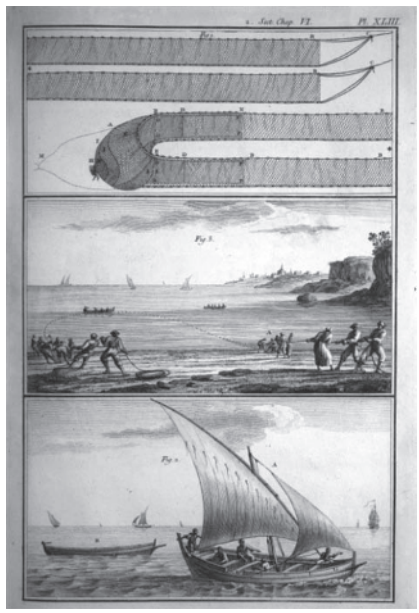

Figure 1.2. *Eissaugue (source: etching taken from Duhamel Du Monceau Henri Louis, Traité général des pêches, Guillaume de Bure, Paris, 1782)*

COMMENTS ON FIGURE 1.2.– A dragged net manipulated from land, the beach seine is a piece of fishing gear whose history goes back to Antiquity. Called *eissaugue* in the French Provence, this net required a consistent coastal line, against a shallow infracoastal space free of rocks. This technique, maintained throughout the Middle Ages, preceded the growth from the 17th Century of open sea trawling. It was, however, still in use in the first half of the 20th Century.

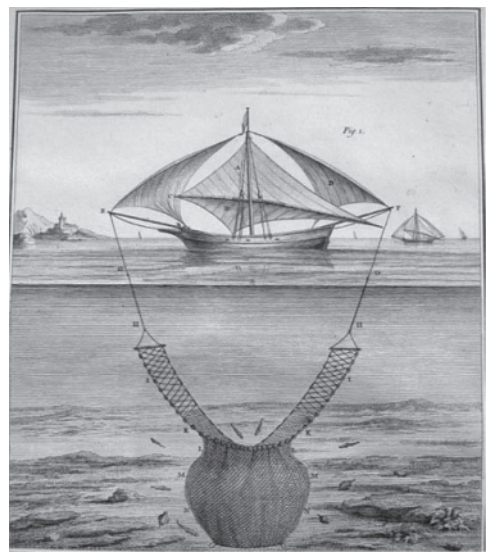

Figure 1.3. *Tartane (source: etching taken from Duhamel Du Monceau Henri Louis, Traité général des pêches, Guillaume de Bure, Paris, 1782)*

COMMENTS ON FIGURE 1.3.– At the end of the 17th Century, a new, powerful, polyvalent vessel appeared in the Mediterranean world. This new vessel was armed with a Latin sail. It was equipped with special nets with high sea fishing. With an important tonnage (between 30 and 50 tons, 1 ton = 2.83m^3), this vessel was first built in Martigues (called *tartana* or *martingana* in 17th Century Italy). Parallel to the distribution of the sardinal, the development of the vessel was at the origin of the development of new activity, dragged fishing techniques at sea.

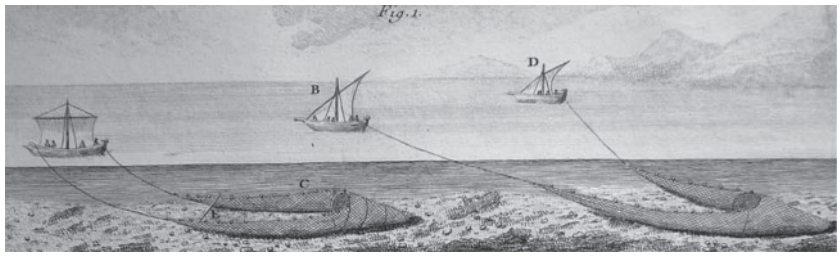

Figure 1.4. *Gangui "à la vache or plow" fishing (source: etching taken from Duhamel Du Monceau Henri Louis, Traité général des pêches, Guillaume de Bure, Paris, 1782)*

COMMENTS ON FIGURE 1.4.– The dragging technique originating in the Spanish Levantine coast, the *pêche au boeuf* spread from the end of the 17th Century over all of the north-occidental coasts of the Mediterranean. Quickly accused of destroying resources, *pêche au boeuf* was a reply to the increasing demands of urban markets. As they only required modest boats powered by the wind, the practice of *pêche au boeuf* progressively imposed itself over *pêche à la vache* and "tartanon fishing" (on the left of the etching).

Figure 1.5. *Fixed artisanal Mediterranean fisheries: the Tunisian charfia (source: Daniel Faget)*

COMMENTS ON FIGURE 1.5.– An ancient technique, *charfia* fishing relies on the use of traditional materials (palm trees and palm fiber fish traps) and the existence of strong community practices. The future

of these artisanal fixed fisheries, which are nowadays threatened, illustrates the coexistence of traditional fishing and industrial fishing in the Mediterranean. The Tunisian *charfia* gives an example of sustainable fishing, with respect to the resource, orientated toward satisfying close alimentary markets.

1.1.4. *Speculative fishing: the madrague*

In use since Antiquity, the *madrague* is an immersed fixed post used to catch tuna. The fishing gear is presented as a large net divided into a succession of chambers, called "*le corps de la madrague*". The walls of this device are kept afloat by pieces of cork, their lower extremities reaching the bottom due to weights made of large stones (the Provençale *baudes*). This underwater trap, sometimes set at a depth of 45 m, is linked to the coast by a net that acts as a barrage: "the tail of the *madrague*", which guides the fish toward the entrance of the successive chambers. Set out in the months of February or March, for a fishing season that goes on to the start of autumn, the *madrague* is directed by a *rais* or *ray*, which organizes its exploitation. Highly developed in the modern era, the *brassier* are present all along the coast from Sicily to Gibraltar and from the Gulf of Gabes to Tangier. The Provençale coasts had no fewer than 19 of these fixed fisheries on the eve of the French Revolution. The big investments necessary for their exploitation (sailor's wages, net mending, conditioning and sale of fish, transport and *esparto*)[10] meant that they mostly evaded the fishing communities. They were headed by powerful landowners, such as the lords of Bandol or the Prince of Rohan in Provence [BUT 98] or the dukes of Medina Sidonia in Andalusia in the 18th Century [RAV 03]. These landowners, whose fishing rights came from royal privilege, did not look after their *madragues* themselves. They delegated their exploitation, by leases of three or six years, before a lawyer, to rich representatives of the world of negotiation and banking, who themselves worked for urban clients on behalf of their companies. In terms of price, the cost of a single *madrague* in the mid-18th Century was around 20,000 *livres-tournois*,

10 Originating in the arid regions of the occidental basin of the Mediterranean, *esparto* or *alfa*, also called *auffe* in Provence, was used to make ropes and baskets.

which is the price of a 40-ton tartanon [BUT 00]. The management of these fisheries is, therefore, beyond the communities, who do not consider the world of *madrague* to be true fishing. Calling the *madrague* societies "companies" and "firms", the members of the brotherhoods were well aware of what differentiated the world of the boat from these speculative and precapitalist activities.

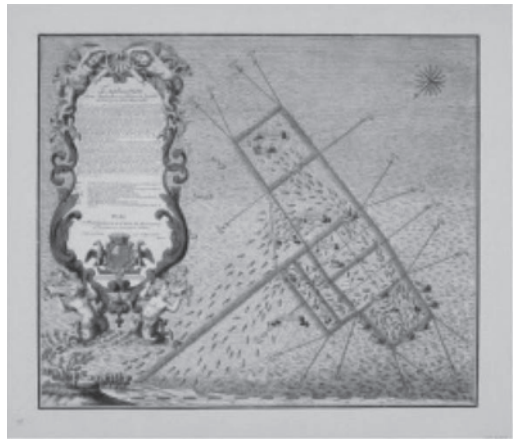

Figure 1.6. *Madrague etching (source: Archives départementales des Bouches-du-Rhône, 1Fi3398)*

COMMENTS ON FIGURE 1.6.– Very common in the Mediterranean in the 18th Century, the *madrague* were fixed fisheries aimed at catching tuna. Due to the amount of investment required, they were most often beyond the control of fishing communities, whose members had to work for them as employees. With high tonnages, they supplied a very prosperous activity of fish conditioning. Eight of these *madragues* are actually still in use in the Mediterranean.

1.1.5. *A highly varied consumption, reflective of relative shortages*

Coming from small-scale fishing, or from these large companies that are the fixed fisheries, the products offered at the fishmonger's stall in the modern era are extremely varied. Few species manage to evade capture according to the testimonies of naturalists of the 18th

Century. While compiling his inventory of Marseilles fishmongers in 1768, the German philosopher Martine Brunnich referred to no fewer than nine species of shark and catshark, including porbeagle, despite its reputation at the time as a man-eater [FAG 11]. Duhamel du Monceau revealed that in Provence "highly rated sausages" are made with the flesh of bottlenose dolphin, i.e. a large dolphin (*Tursiops truncatus*). In this diverse palate, the south coast of the Mediterranean is no exception. As in Sardinia, the consumption of sea turtles seems to be the norm on the Tunisian coasts, and we can find on these coasts, as on the coasts of Provence or Cataluña, the use of sea anemones (*Actinia viridis*) in cooking. However, all the available products are not equal. Michel Darluc, author of *Natural History of Provence* (published in 1786) made the distinction within marine animals between those species aimed at the people and those targeted at wealthy amateurs. On the fishmonger's stalls, the sardine, the bogue and the goldline porgy thus join the category of lower foods with the likes of the octopus, cuttlefish and squids, mollusks reduced by the author to the hardly appetizing rank of "cartilages", while more sophisticated buyers can share the more delectable sea dates and marinated tuna, with a special place for the whiting, king of the tables of Provence in the modern era. Behind this apparent health of the fish market in the 18th Century, there is the reality of relative shortages. The necessity of a certain level of protein in diets governs all here. Coastal populations also make the most of coastal fishing to complete their daily rations, by gathering limpets, periwinkle and green crabs – easy prey for the amateur fisherman. While most of the products of the sea used for food seem to be identical over the entire Mediterranean, detailed analysis shows that there are certain cultural differences in the art of using fish, mollusks and shells. Grilling is the most prevalent in the east of the Mediterranean, while boiling seems to be the rule in the septentrional coasts of the occidental basin.

1.2. Evolving practices (18–19th Centuries)

The complex world of Mediterranean fishing was not an unmoving universe over the centuries that preceded the birth of mechanized vessels. The product of migrations and an ever-increasing demand from the markets, the techniques spread over the entire basin,

changing the faces and practices of fishing communities. While some of the techniques date back to the Middle Ages, their progressive use from the first decades of the 18th Century allowed a more intensive exploitation of the environment. Combined with an increase of marine pollution made worse by the first by-products of the industrial revolution, the acceleration of the exploitation of the resources was felt very early on. The fear of a depopulation of the seas and its corollary, the belief in a past golden age, appeared in intellectual writings from the end of the "Age of Enlightenment". These two themes became certainties in the 19th Century, when public powers and populations saw a confirmation in the rise of the price of fish and a rapid impoverishment of coastal marine fauna. The search for alternative solutions is explained by this context of worry. Mostly unnoticed by those involved in traditional fishing, aquaculture companies did flourish under the Second French Empire, but ended in failure, largely explained by the scientific limitations of those initiating it. As they multiplied at the end of the 19th Century, the research carried out in marine biology centers did, however, afford a better understanding of the dynamics of species, while the world of Mediterranean fishing was being transformed by the applications of mechanical power.

1.2.1. *The evolving world of fishing: human migration and technical changes*

Even more porous than national boundaries (themselves established rather later), the maritime zones are areas of active movement of men and knowledge in the modern era. Certain fishing communities played an important role in these transfers in the 18th Century. Among these vectors of technical evolutions, the fishermen of Provence or Cataluña appear to have played an important role in this period. Following the rapid spread of the sardinal in the 16th Century, the massive increase in dragged nets appeared, on the coasts of the Levantine seas, as the great event of the end of the 17th Century. This technique was essentially practiced from the coast up to this era. In Provence, it was the process of eissaugue, and in Languedoc it was the process of the *boulier*. The use of dragging nets in the sea from a vessel was still unknown at this

time, since a royal decree from 1584 banned the use of the *dreige*[11] in the Atlantic. Regularly practiced in the 17th Century despite the ban, sea dragging was developed at the end of the century from Andalusia to the Adriatic, linked with the spread of the tartan, this new boat of roughly 50 tons, developed at the start of this century in the naval building yards of Martigues. This type of fishing, whose provisions were invaluable for the urban markets, was finally authorized under certain conditions by the decree on fishing of 1681. Its variants in Provence and Languedoc, *gangui, tartanon* or moulinet, presented a common aspect of being carried out by a single vessel, anchored (for the moulinet), drifting (for the gangue and tartanon). The spread of the *pêche au boeuf* (the Catalan *bou*), known from the Middle Ages in Valence, radically changed the characteristics of trawling. Now practiced by a couple of vessels, using the sail to tow a particularly large net, this technique considerably increased the efficiency of fishing. Only requiring small vessels, they democratized the access to the trawling art, freeing fishing owners from the obligation of possessing a costly tartan. It also allowed an extension of the fishing season; the *pêche au boeuf* was practiced with wind coming from the rear, as opposed to the *tartanon*, which placed the vessel across the wind.

As soon as it appeared in the Occidental ports of the Mediterranean, the *pêche au boeuf* was immediately adopted, resulting in a rapid expansion over less than 3 years from the north of the Valencian country to the Adriatic. Carried by Catalan or Provençale fishermen, then locally relayed in Italy by heads of the kingdom of Naples and Chiogga (Venice laguna), the diffusion of this technique illustrates the flexibility of Mediterranean fishing methods in the past. Present on the coasts of the Roussillon as soon as 1725, “pair trawling” reached the coasts of Languedoc in 1726. The following year it reached the Rhône, then appeared in Gênes and Livourne, where it developed in the direction of the coasts of Latium and Campania under the impulse of the fishers of Gaète, despite a ban issued by all the states concerned.

The initial pole of the diffusion of the *pêche au boeuf*, the Catalan coast provided an example of fishing communities powerfully

11 Dragged net.

transformed by new economical and social conditions which were those of this part of the Iberian peninsula from the end of the 17th Century. While its population doubled between 1713 and 1787 [HUR 02], Cataluña experienced a form of preindustrialization that led to an increase in the demand of food. The diffusion of *pêche au boeuf* can, therefore, be considered to be an answer to the growing needs of new urban centers in animal-based protein [ALE 03].

1.2.2. *Between the thought of decline and fragility of the environment*

As early as the end of the 18th Century, the rise of towing gears deeply destabilized coastal communities. In its very region of origin, the affirmation of the *pêche au boeuf* caused the emigration of part of the fishermen using fixed material, such as the Catalan longliners, who at the same time left the ports of Selva or Maresm to cast their lines in the waters of the gulf of Marseilles. The use of the *pêche au boeuf*, progressively adapted by the most enterprising of fishing owners, contributed to the division of communities already affected by the arrival of foreign bosses in their waters. In Marseilles, the divorce seemed confirmed by the end of the French Revolution between those practicing polyvalent fixed fishing and the fishermen converted to the practice of the "great art", who went as far as no longer recognizing the authority of the *prud'hommes* in the gulf [FAG 11]. This crisis in the communities favored the emergence of talk of decreasing populations, encouraged the recriminations of fishermen now marginalized by the trawlers. Scientific literature provides substance to this discourse, with the example of the work by the Dominican priest Antoine Menc on the origins of the decreasing populations of the Provençale waters [MEN 69]. This theme of decline was gladly taken up by the popular press and by some of the political elite during the 19th Century. It found a semblance of confirmations in the sudden increase of the price of fresh fish in urban markets, which progressively convinced the coastal populations of the reality of an impoverishment of the coastal ecosystems. It also explained the birth, in art and literature, of the figure of the poor fisherman, who is treated with the same compassion usually reserved for those on the brink of extinction. This idea of the end of a golden age is not new – the poems of Hesiod as early as the 8th Century BC, as well as the Old

Testament writs, have testified, since Antiquity, to the certainty of a cycle of decline in the West .

In the absence of reliable statistical series for the 19th Century, it is difficult to measure the reality of this impoverishment of the marine resources in the Mediterranean. The best that can be done is to note the disappearance of certain species from certain uses. In the Gulf of Marseilles, victim of excessive land-based fishing, the date mussels (*Lithophaga lithophaga*) disappeared was as early as the 1830s, at a time when most of the natural oyster fields were ruined on the Languedoc and Provençale coasts by the use of dredges [FAG 07]. Half a century later, the oceanologist A.F. Marion noted the progressive reduction of the size of the fish sent to Marseilles from the gulf of Algiers, a reduction that he attributed to the unchecked development of the dragging arts in the maritime space [FAG 11]. The techniques of fisheries in use adapted to these changes of the available resources. The use of the longline, therefore, became a rarity from 1850 in the gulf of Marseilles, while at the same time the municipalities of Sète or of Collioure denied the extreme rarity of the whiting in their fish auctions. The establishment of this very exact approach reflects the sense of urgency that there would be in the current research to orient the efforts of historians toward the establishment of databases on fisheries in the past. Still indicative (but are the tonnages carried out officially today by the fishing sector on a global level not themselves indicative?), these reference statistics could eventually avoid a number of biologists and fishery experts over using the *shifting base-line*[12], which does not allow a correct evaluation of the real evolution of the stocks available over the average length of time. The example of bluefin tuna, which has exceptional archives, such as the work carried out by the team led by Daniel Pauly, is a demonstration of the real possibilities that are available to biologists and sea historians, if the specialists allow themselves a certain level of interdisciplinarity [RAV 03].

As much as the words of political authorities, the lamentations of the fishermen also deserve to be examined. The recurrence, starting

12 Considering a decrease in population levels compared to a reference situation that is already damaged and not pristine.

halfway through the century, of complaints made by the *prud-hommes* against marine mammals, which are direct competitors of fishing, is indicative of the social and economic difficulties that affect the communities during this period.

Regularly mentioned in the texts of the modern period, the disturbances to fishing caused by marine mammals became a central theme in Mediterranean fisherman from the start of the 1850s. The affirmation of this near-obsessive hate provides an abundance of correspondence between bosses and representatives of the State or of local collectivities over most of the coasts of the Occidental basin. Claiming that the multiplication of small cetaceans was ruining fishing, the fishermen received concrete measures from the public powers. These were added to the rewards offered by the *prud'hommes* to fishermen able to prove the destruction of a porpoise or a dolphin. With the help of the Navy, anti-cetacean systems were also trialed after 1890 over the entire Provençale and Languedoc coast, whether with trapping baits, exploding nets or cannons, whose effectiveness is very hypothetical. This hostility toward marine mammals did not stop with the start of the 20th Century, since in 1920 it was even reflected by aerial bombings carried out on the Algerian coast. In Sète, if we do not consider the individuals killed by bullets or cannons, nor those victims of the deadly baits, 254 small cetaceans were eliminated between 1904 and 1910. Moreover, the port of Sète is not the one in which the elimination campaigns were carried out with the most vigor. Thousands of dolphins were undoubtedly killed in the Mediterranean coasts before World War I. These massacres are surprising for the contemporary readers, for whom the new sanctification of the dolphin is a familiar reality; they provide us with a double lesson on the fishing communities of the 19th Century. On the one hand, it draws our attention to the increased sense of vulnerability felt by the fishermen during the century of industrialization. This can be explained first by changes in the methods of fishing. The use of the roe by sardine fishers, extremely rare in the 18th Century, is noted by certain *prud'homies*, such as Martigues from the 1830s onward. This usage certainly increased attacks of dolphins against quickly damaged fishing material. The increasing competition from Atlantic fishing, which arrived massively on the Mediterranean coast with the opening

of the Paris-Lyon-Mediterranean line after 1850, only increased the worry of communities that felt left aside by the social changes caused by industrialization. The reduction of the acceptability of the constraints caused by marine mammals finally marked the birth of a new way of looking at the animal world, with the distinction between those that are useful and those that are a nuisance. It is through this that the maritime authorities and the oceanologists at the beginning of the 20th Century sought to establish an industrial branch of dolphin fishing which, by commercializing oils and fats, would make the massacres profitable. Taking inspiration from porpoise fishing in the Black Sea, very active throughout the 20th Century, the idea developed by the Marseilles biologist Paul Gourret fitted into this process. The mastering of processes of refining petrol, by allowing the production of low-cost mineral oils, would, however, make these projects of industrial fishing obsolete after World War I.

In this context of worry and increased competition in the exploitation of the maritime medium, Mediterranean fishermen also had to confront the first effects of industrial and urban pollution. It is often wrongly assumed that maritime pollution in the Mediterranean started in the first half of the 20th Century, when the industrial release of chemical molecules started to become massive. However, locally, we can observe real changes in the ecosystems of the infracoastal layer caused by factory waste as early as the end of the 18th Century. In Marseilles, over 12,000 tons in total of polluting residue were released annually into the seas in rocky inlets close to the port by soap production from the 1780s. Their effect on the maritime environment was catastrophic, as shown by the inquests carried out by officers of maritime affairs from 1820. The development of the chemical industry and non-iron metal industries worsened the situation in the gulf throughout the 19th Century. The case of the factory belonging to the exploitation Company of Rio Tinto, established on the Estaque coast in 1882, is emblematic of this, since it is reflected in the near total ruin of professional fishing in the north of the commercial port of Marseilles. On top of this chemical pollution can be added millions of tons of organic waste that dangerously damaged the quality of the waters of the biggest ports of the Mediterranean, such as Marseilles,

Geneva, Barcelona or Algiers, to the point of making the consumption of shellfish caught close to certain urban centers dangerous [FAG 05].

Faced with the difficulties of coastal fishing deemed incapable of properly handling the resource, entrepreneurs and scientific institutions tried throughout the 19th Century to restore the medium's ability to deal with the food requirements of coastal populations.

1.2.3. *Aquaculture, or the dream of a domesticated sea (1850–1900)*

From their origins, aquacultural companies escaped the control of *prud'homies* and brotherhoods. They appeared as an application to the maritime space of the desire of free enterprise developed by liberal thinking. Its protagonists, first of all motivated by the hope of solid profit, provided an activity that was of interest to the public. For this reason, they therefore benefited from constant support from the State, with the Second Empire of France representing a real golden age for aquaculture experimentation. Coming from various horizons, since this group was made up of "sea industrialists", as they liked to call themselves, real scientists, such as the professor of compared embryogeny at the College de France, Victor Coste, powerful industrialists, Léon Vidal, for example, or true adventurers, like the representative of the Imperial acclimation Society Eugène Lamiral, the aquaculturers expressed a common faith in the thoughts of Saint Simon. Without doubting man's capability to cultivate the sea, they sought to transform traditional fishermen into gardeners of the marine space, for the greater good of the consumers. Their initiatives, of various forms, are a testimonial to the fascination felt by these men for the shell farms of Lake Fusaro and of the little sea of Tarente in Italy, where most of them traveled as part of their studies during the 1850s. Designed as an answer to the ruin of the oyster benches in the Languedoc, the trials in oyster cultivation and reproduction conducted by Victor Coste from 1860 onward in the Thau laguna had massive potential in the eyes of these entrepreneurs. Inspired by this, Léon Vidal started experimenting with the culture of mullet and sea bass from 1864. He conducted trials of castration or artificial insemination, without hesitating to call his activities "stalls or courtyard cultivation". Although the trials conducted by Léon Vidal, like those of Victor

Coste, ended in failure, largely attributable to gaps in scientific knowledge at that time, they are of much interest for the history of fishing. By proposing to employ the fishermen of the Martigues as simple providers of feed to be used to fatten the fish in his farms, Léon Vidal was designing the outline of a new organization of fishing, marked by an increased dependence of the communities faced with private interests external to the world of traditional fishing. By planning to sacrifice part of the marine resources taken from the Berre laguna to his cultures, Léon Vidal announced the development of the current milling fleets, entirely dedicated to the service of aquaculture farming. The example of Coste and Vidal finally planted the seeds of future developments in Mediterranean aquaculture, which would finally be successful in mastering the cycle and production of oysters in the Thau lagoon at the beginning of the 20th Century [GIO 95].

1.2.4. *Rationalizing the fishing industry in the Mediterranean: the rise of "applied zoology" (1880–1914)*

From the beginning of the 1880s, coastal Mediterranean fishing became the object of the studies of oceanologists. From the Balearic Isles to Sicily, laboratories of marine biology looked into the best way to help communities to better manage the resource. In France, the rise of the station of Banyuls-sur-Mer, Marseilles or Villefranche-sur-Mer, to only mention the most important ones, happened in parallel to the reconstitution in 1887 of the technical service for maritime fishing, which was first of all an answer of the public powers to the worry expressed in several French ports as a result of a reduction in the tonnages carried out. Created by the decree of 17th May 1887, this service was made up, as of 1862, of a general inspection and an advisory council, forming the advisory committee of maritime fishermen, answering to the minister of the Marine and the colonies. From its creation, this organism was perceived by some of the oceanologists as an efficient one, likely to provide a method of immediate action to reform fishing in the Mediterranean. The Endoume laboratory in Marseilles appeared in the sense as the main place for reflection on this subject, under the watch of Professors Antoine-Fortuné Marion and Paul Gourret. By starting in 1888 works of

"applied zoology", these two men began a phase of fruitful cooperation between fishermen, public powers and scientific environments. This can be essentially separated into three axes [FAG 11]. Partisans of a reconstitution of the resource by preservation of part of the maritime, the Marseilles scientists obtained in 1864, with support from the *prud'homie* of fishermen, the creation of a cantonment zone, which we can consider to be the ancestor of the marine parks in the Mediterranean. A site of observation favored by oceanologists, the cantonment area of Endoume provides the proof of the capabilities of rapid reconstitution of the resource in the absence of fishing.

Open to the necessity of high-level training for fishermen, Paul Gourret proposed furthermore in 1893 the creation of an institution for the professional training of future fishermen. The world of Provençale fishing therefore anticipated, quite early on, the foundation in February 1895 of the *Société d'enseignement professionnel et technique des pêches maritimes* (SEPTEM) (Society for the Professional and Technical Training of Maritime Fishing), whose first director was Emile Cacheux. Officially opened in 1896, the professional school of maritime fishing of Marseilles provided for its students (aged 11–20) technical knowledge, the handling of materials, elementary principle of navigation, as well as basic knowledge concerning marine ecosystems and a better understanding of their vulnerability, which was completely new. Going further than just the Marseille region, Paul Gourret compiled a manual in 1898 for use by primary school students along the French coast, called "The sailor and the fisherman. Lessons relevant to the marine profession and to the fisherman", which showed his desire to improve the practices carried out by the fishing industry through education.

Eager to associate the population, which they considered to be a vital partner for the proper management of maritime media, Marion and Gourret finally opened a fishing museum in 1897, in which not only material and fishing vessels were exhibited, but important displays dedicated to living species were also presented, as were their uses by human societies. Even more innovative, as it is linked to the first steps of ethnological science, the fishing museum of Marseilles

finally presented elements that constituted the traditional culture of the fishermen of the Mediterranean, idioms, beliefs and traditions.

If the example from Marseille appears representative of this new path of Mediterranean fishing, now followed and advised by scientists, it is not alone in the entire basin. At the same time, the works of Raphaël Dubois on sponge fishing and Mediterranean pearl oyster fishing in Tunisia, of Armand Sabatier on oyster farming in Thau laguna or those by Odón de Buen on the management of the management of fishing resources on the Spanish Levantine coast showed that the world of the boat was entering a new age on the eve of World War I. The mechanization of vessels, the rise of deep fishing, the dilation of active zones to the colonial domain and the revolution of refrigerated transportation at this date opened up new horizons for most of the fishermen.

1.3. Industrial power at the service of fisheries (end of 19th–20th Century)

The industrial revolution that animated Europe and North America from the end of the 19th Century triggered a chain reaction that dragged along all the sectors of economic activity.

First, the use of steam, then of new energies, such as electricity[13] and petrol, would stimulate the development of the textile industry and the steel and metal industries, with notably the mechanization of the methods of production and motorization of conveying. Steam-based navigation and railroads would close the continents, reduce the distance from the coast and the duration of travel. The development of methods of communication with neighboring cities would favor the development of seaside tourism and coastal economic activity [AMO 60]. The application of the work of Charles Tellier on the conservation by artificial cooling (1867) would ensure the transport of perishable goods to further away places, thus contributing, with the

13 "[…] steam, electricity will have allowed human ingenuity to make, in less than half a century, a huge step in the direction of progress, that up to then, would only have been followed step by step" [LED 35].

improvement of methods of transport, to the increase in the amount of consumables available.

This demand for foodstuffs, and notably marine products, becoming increasingly pressing under the effect of expanding demographics and the improvement of feeding habits, would incite politicians to support any innovation in favor of the development of the most productive segments of the fishing sector.

These innovations toward greater productivity always met resistance from the traditional knowledge of the fishermen, forged through often empirical experience of the sea built over several generations. The tradition opposed itself to any risk of the change to the social and economical balance of their community, favoring the knowledge of the "man of art" over that of the "engineer". Up to then, the transmission of knowledge was essentially the fruit of the migration of the fishing communities around the Mediterranean basin [BAS 05, MER 63].

Most of the resistance, however, would cease faced with unequal competition with more efficient methods and the hope of greater productivity promised by the perspective of exploring greater areas of sea [FER 01].

The transfer of these innovations to fishing would be made unequally. Alone, regions that already benefited from a level of industry, established communication networks and a workforce were the first to benefit from this. The fisheries of maritime regions of countries with no industry would encounter a lesser and later economic growth, essentially resting upon the organization of the traditional societies of fishermen (*prud'homies* and brotherhoods).

With the industrial revolution, two types of organization of fishing determined themselves, one being not very territorial and more orientated toward maximizing fishing quantities, the other, established on traditional knowledge and developing a more patrimonial economy [CEN 01, FER 01].

1.3.1. *The industrialization of Mediterranean fishing*

In the Mediterranean, industrializing would mainly affect mass-production fishing, aimed at preservation and export, i.e. first *madragues*, and then other fishing of pelagic species and finally trawler fishing. However, with the exception of some shipping companies operating in the Atlantic during the 1950s and the 1980s [BAR 61, FOL 93], this industrialization is not total and justifies the denomination of semi-industrial fisheries [LLE 98]. While the copropriety between several fishermen of production methods, or the financial participation of fish traders, does exist, Mediterranean fishing is in most cases carried out within artisanal- or familial-type structures, the industrial character being based mainly on the marketing of the productions.

The other jobs commonly called the *petits métiers*, or also incorrectly "artisanal fishing", are very poorly taken into account by policies of development. Their modes of production are more orientated toward self-consumption, exchange and direct local sales, and, through modest profits and high diversity, correspond badly to the criteria of quantity, monospecificity and regularity of the industrial markets. Until the 1950s, the simple and rudimentary character of their catching techniques meant that their fisheries benefited very little from the technological progress brought by industrial development. It was only later in the second half of the 20th Century that nylon, outboard engines, composite flat hulls and geo-positioning system (satellite-based GPS) ended up giving an extra boost to these small fishing jobs, by allowing them to move away from the coast to look for higher value fish [BOU 87].

The technological progress that benefited semi-industrial fishing touched all of the functional components of the fishing industry, from the fish production to cannery, passing by the textile industry and naval construction. Unlike agriculture perhaps, few innovations were specifically dedicated from their origin to fishing. Most of them came from the adaptation of systems, tools and materials created for other sectors of the economy, such as marine or train transport, or the industries of weapons, clothing or food. Applied to fishing, they have

provided constant improvement to four main domains: energy and vessels, communication and information, fishing gear and its handling, and the conservation and the valorization of the catch. These technological changes would follow different paths over time depending on the fishing methods and the evolution of economic strategies. The evolution of Mediterranean pelagic purse seining, as well as the evolution of trawling, illustrated this over the last two centuries.

Figure 1.7. *Catalan Lamparos (source: Jacques Sacchi, 1973)*

COMMENTS ON FIGURE 1.7.– The technique of fishing sardines with light is one of the most widespread in the Mediterranean since Antiquity. The word "lamparo" refers to both the technique and the lighting devices, the vessel and the encircling net used to catch the fish. By replacing the sardinal fishing technique, this method of fishing strongly contributed to the sardine industry of the Mediterranean.

1.3.2. *Seine fishing*

Whether bluefin tuna (*Thunnus thynnus*) or sardines (*Sardina pilchardus*), investors and politicians quickly saw the profit they could draw from these species, excellent products of commercial exchange

through their abundance and nutritional value. The birth and the history of the preservation industry in the Mediterranean are strongly linked to those of the fishing of these species. Previously preserved and sent off in a wooden barrel, sardines and tuna would be the first to benefit from the invention by Appert [APP 13] and from the use of tin cans ("tinplate") to the benefit, first of all, of armies and the French navy. In its beginning, this industry that only required a large, non-qualified workforce required no particular technology at the beginning of the 20th Century, except for the soldering and setting of the boxes. The rapid success of this industry quickly made the vessels dependent on the preservation market, which contributed to the variations in the fishing landings. From its industrialization onward, pelagic fishing in the Mediterranean went through a series of crises linked to irregularities in stock availability, exploitation costs, drops in consumption or to competition with Atlantic products [BER 87, MET 63, RIO 05]. During each period of recession, the companies and the public converted to the new technology available, without being able to resolve the chronic instability present in this sector.

Drifting nets (i.e. "*sardinal*", "*courantille*" and "*thonaille*") have progressively disappeared and been replaced by encircling techniques (thys and traina) [GOU 97] and turning seines (*lampara* and *lamparo*). The *lampara*, appearing at the end of the 19th Century in Italy, most likely originated from the ancient big coastal seines, as noted by their "spoon" shape, the central pocket and the wings that characterize them. "Lampara" fishing consists of encircling at night the shoals of blue fish grouped together by the light, and to manually hauling the hemp or cotton net, of 150–300 m in length. Much more efficient than the drifting nets, the "lampara" developed around the Mediterranean due to migrations of Italian fishermen, leading to an important increase in production and opposition and worry from traditional fishermen, fearing that more productive fishing would cause a sudden decrease in the value of their produce [BAR 61, SIM 61]. Sardine fisheries are often confronted with a drop in their values and a decrease in catches. Under the threat of the closing of the canneries and dramatic social crises [MAR 97], these can only be compensated for by imports of fish or by an increase in the fishing effort. After

World War I, and under pressure from factory workers, the public powers then favored the introduction of the *ring net*. This evolution from the Italian "lampara", imported from California at the same period, presented on its lower part a series of rings in which ran a closing cable. First introduced in Italy (1925), and then in Spain (1936) [BER 87], the ring net became, by the end of the 1950s, after several modifications including the shifting of the bag to one of the extremities and the use of nylon instead of cotton, the main piece of fishing gear for fisheries of small pelagic species in the occidental Mediterranean [DIE 53]. Due to the introduction of the *power-block* "puretic", a sort of mechanized wheel for the raising of the net, the mechanical capstan and the generalization of the use of ultrasonic sounders, sardine purseiners could now haul in 9 min with five men a net of 200 m that required over 10 men with the *lamparo* [MAU 61].

Tuna fishing was also revolutionized by the arrival of this new method of capture. The *madragues*, remaining for centuries the main method of capturing red tuna, progressively gave way to mobile techniques such as the "seinche", a collective technique that remained in Provence and in the Languedoc until the arrival of the turning and sliding tuna net at the beginning of the 1960s [RAV 11]. The development of the purse seine in the Gulf of Lions is largely linked to the arrival of displaced fishermen from North Africa using their knowledge of the *ring net* and its variants for small pelagic species to adapt it to tuna fishing.

The "catalanes" vessels and the "pointus" were, little-by-little, replaced by bigger units of 18–20 m, capable of using the turning sardine net or the tuna "seinchole" depending on the circumstances. From the beginning of the 1970s, due to the difficulties felt by the sardine market, part of the French purse seine fleet became specialized in the fishing of bluefin tuna, which was more promising. Under the impulse of plans of restarting and modernizing fishing started by the initiative of regions and governments, and then by the European Union (EU) beginning in the 1980s, construction was developed and became standardized. The vessels adopted in 1973 the "clipper" shape, with a wheelhouse at the front and a *flying-bridge* to ease

detection. They were extended, reaching roughly 4 m in 1990. With the customizing of hulls for the preservation of catches, their capacity increased sixfold in 40 years. The replacement of wood by composite materials in 1975 lightened the hulls, while greatly decreasing maintenance costs. With propulsions three times greater than those of the 1960s, they reached a maximum speed of more than 17 knots in the 1990s. Starting from then, their design started to largely resemble those of ocean tuna vessels, with the first constructions carried out in 1990 in the Atlantic shipyards and the installation in 1997 of a ramp on the stern for hauling the skiff (working boat). The equipment of the bridge also increased ergonomically, the capstan of the 1960s being replaced with a purse line winch due to changes in hydraulics, capable of closing the purse seine in less than 15 min.

In the meantime, the conception of tuna purse seines continued to progress notably due to improvement in hydrodynamic calculation in the 1990s. At 600 m in length in the 1960s, tuna purse seines reached 2,000 m 40 years later, increasing their deployed surface eightfold.

It is in the domain of communication and detection that pelagic fisheries obtained the most benefits. Initially used as a link with the mainland or for security reasons, the information and communication technologies were adapted to various functional ends by the Mediterranean fishing industry at the beginning of the 1960s.

As for all pelagic fishing, bluefin tuna fishing required long hours of often unfruitful prospecting (70% of the fishing time for purse seiners), which naturally involved cooperative work. Communication between associated vessels and the protection of the transmitted information from competing vessels appeared, therefore, from the start of this technique as a vital factor for success. This legitimate aspect of the use of single-sideband modulation (SSB) and very high frequency (VHF)[14] radios from the 1960s onward was followed by the satellite facsimile at the end of the 1990s.

14 Single-sideband modulation (SSB) is a type of radio transmission used on boats for long-distance communication, unlike very high frequency (VHF) whose reach is limited to about 30 nautical miles.

Bluefin tuna being first of all a surface fish, its detection by sight is primordial and any technology will look to give the greatest field of vision. Thus came aerial prospecting in 1975, which goes from the simple detective aerial flyover to a way of helping the purse seine shot that is so efficient that it ended up being banned by the International Commission for the Conservation of Atlantic Tuna (ICCAT) in 2006. The use of highly discriminating radar to detect the flights of birds flying over tuna shoals (S-band radar or "bird radar") and the extension of the use of sonar from the 1990s onward provided the vessels with a considerable amount of effectiveness in the detection of fish shoals. The democratization of GPS in 1994 finally ensured greater precision in fishing operations and navigation. All the while improving the effectiveness of the fishing and commercialization operations, this technology has, therefore, contributed to producing a greater fishing effort.

Up until the mid-1970s, bluefin tuna was destined mainly for the Mediterranean fresh fish or cannery markets; its storing onboard required only icing or brine for long trips. From the mid-1980s, due to the Japanese "sashimi" market, this fish acquired a high market value, requiring more sophisticated preservation methods, such as immersion in refrigerated water (1994) and deep freezing, and larger vessels as a result .

The exponential size of the demand quickly resulted, from the 1990s, in a radical transformation of the system of catching and preservation. The near-totality of catches are thus no longer brought aboard, but rather transferred directly to floating catches that are dragged to coastal fattening zones. The extension of this so-called "opening up" technique to the whole of the Mediterranean led to an excessive development of fleets such that, out of fear of a collapse of this resource, the ICCAT and the EU imposed reduction in the quotas for catches in 1998 and reduction in the sizes of fleets [CIC 06]. These increasingly drastic measures have led to a subsidized removal of the least profitable tuna seine boats, too specialized to be reconverted into another job.

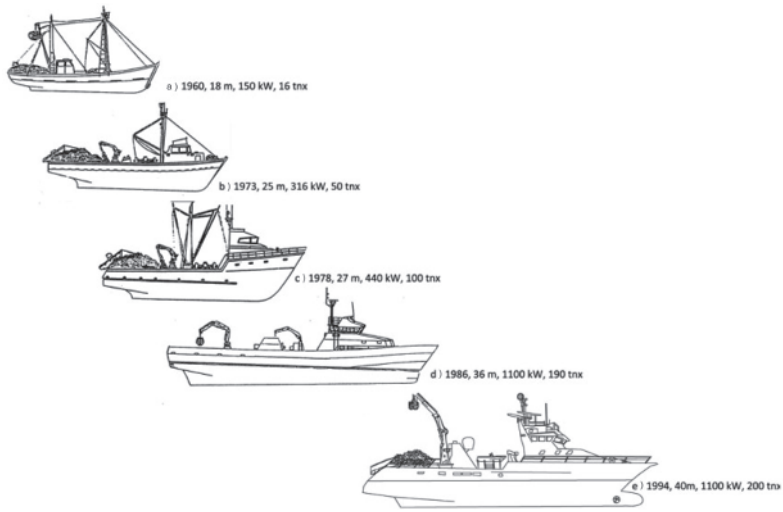

Figure 1.8. *Evolution of French tuna purse seiners in the Mediterranean (source: a)–c) Henri Farrugio and d)–e) Jacques Sacchi)*

COMMENTS ON FIGURE 1.8.– Since the 1960s, the length, tonnage and engine power of tuna purse seiners have not stopped increasing, contributing to an overall increase in the fishing capacity of the fleet, beyond the limits of sustainable exploitation of the bluefin tuna resource.

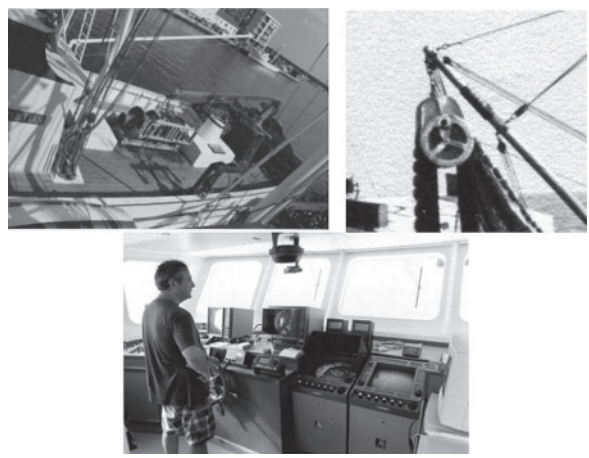

Figure 1.9. *Modernization of vessels and equipment (source: Jacques Sacchi, 1973)*

COMMENTS ON FIGURE 1.9.– The specialization that took place from the 1960s in the practice of "métiers" calls for a more ergonomic reorganizing of the fishing bridges, mechanization, the use of hydraulics for hauling gears (winches and *power-block*) and electronics in navigation and the spotting of shoals. This modernization contributed toward the improvement of the conditions of navigation and work at sea, as well as greatly increasing the effectiveness of the fishing power of the vessels.

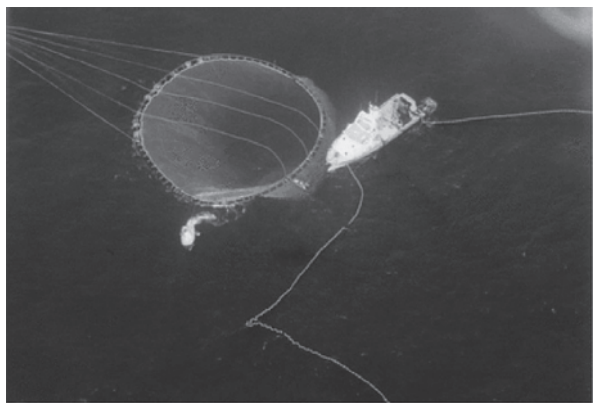

Figure 1.10. *Bluefin tuna purse seining in the Mediterranean. Transfer of a catch to towed floating cage (source: Henri Farrugio, 2008)*

COMMENTS ON FIGURE 1.10.– The tuna captured by the tuna purse seiner are transferred alive directly from the purse seine to a floating cage, which is then towed to the coastal fattening zones for the Asian raw tuna market; this technique, imported from Australia, has reanimated the Mediterranean bluefin tuna market by optimizing the effectiveness of this branch and the quality of the catches.

1.3.3. *Trawl fishing*

Over the last two decades, the development of the Mediterranean trawling fishing was essentially conducted as a unique response to the ever-increasing demand from neighboring countries for fresh and refrigerated products. With a few rare exceptions, these fisheries were

concerned very little by the industrial valorization of their productions in the form of transformed products. They mainly focused on extending their field of action further and deeper by gradually improving their capturing efficiency and the quality of these catches. In a constant quest for unexploited, far away resources, the evolution of propulsion has been a determining factor in trawling and the vessel's ability to pull its fishing gear. Steam, therefore, appeared from the end of the 19th Century as the opportune answer to this demand for most of the fisheries of the North Atlantic. The Mediterranean was, however, less attracted by this mode of propulsion, the amount of coal necessary to fuel the machines weighing the vessels down considerably. Until 1920, the Mediterranean trawler fleets were, therefore, mainly composed of sailboats working in pairs [GOU 91]; only ports benefiting from sufficient infrastructure (Marseilles, Algiers, Bougie and Ancôna) could receive steam trawlers. After World War I, the Mediterranean trawler fleets quickly adopted the internal combustion engine[15] [BAS 55]. This technology appeared to be more adapted to coastal fishing carried out with vessels of low-to-medium tonnage. The serial release of the "diesel" engine (Ets Baudouin) with integrated reduction gearbox in 1929 was a decisive step. With an energetic yield far greater than the steam engine, the use of diesel, therefore, left more hull space for the cargo, by carrying less fuel. Due to the reducer, it also allowed for the use of less cumbersome, lighter and more powerful propulsive groups. The four-stroke engine, with turbo compressor, the variable step propeller (1994), the nozzle around the propeller would thus lead to an increase in the effective power of trawlers by 5–8 from the 1950s to the present day [EVO 11].

The development of the use of the diesel motor favored the development of the mechanization of winches. From the 1950s onward, the use of hydraulics brought more flexibility and security to maneuvers as well as greater traction power. With the stern trawling which started at the beginning of the 1960s and the replacement of the

15 By directly transforming inside the engine the thermal energy produced by a fuel into mechanical energy, internal combustion motoring allowed for the removal inside trawlers of the cumbersome boilers that were needed in steam propulsion.

cargo boom with a stern gantry, the hydraulically controlled net reel drum of the trawler, introduced at the beginning of the 1970s, marked a cornerstone for the trawler, by reducing the danger and difficulty of the maneuvers.

The hulls of Mediterranean trawlers evolved more slowly. At the beginning of the 20th Century, the large majority were made of wood in artisan yards. The creation of "deep water" ports from 1918 [MUS 21] allowed the receiving of vessels with higher tonnages. The hulls then took on a "V" shape, without a lateral keel, the vessels no longer needing to be brought to ground. As for pelagic fisheries, trawling in the Gulf of Lions greatly benefited from the repatriation of large units of North Africa at the beginning of the 1960s. It also benefited from regional, national and European plans for the modernization of fisheries. The vessels benefited, as did tuna purse seiners, from technological advances in the use of composite material and aluminium for their construction.

After navigation by estimation and manual probing, the functions of detection and navigation called upon increasingly sophisticated methods, in hydroacoustics with paper band probes in 1970 and with video in 1993, and geographical positioning with the Decca Navigation System in 1965 and GPS at the end of the 1980s. The miniaturization of the electronic equipment and information technology resulted in, from the second half of the 1980s, the use of electronic navigation charts. Coupled with a satellite positioning system and numerical bathymetrics, these charts contributed to creating increasingly precise fishing paths, with a better consideration of the substrate.

Being strongly linked to the pulling capability of the vessel, fishing gear has followed changes in the methods of propulsion. Originally imported mainly from Italy and Spain [GOU 91], the Mediterranean trawls did not see any fundamental modifications until the introduction of divergent panels toward 1898, which increased the horizontal opening, and the introduction of the Vigneron-Dahl trawl in 1928. These innovations thus gave a determining advantage to the single-vessel trawl. After World War II, the hemp ropes used in the construction of trawls were replaced at the end of the 1950s by thinner

and more resistant nylon string. The design of French and Italian trawls benefited from this period from studies carried out in the North Sea on models in trial waters. These allowed improvements in hydrodynamics and behavior during fishing. Their vertical opening, mostly smaller than 2 m in 1973, went beyond 10 m in the 1980s, with fishing surfaces almost five times greater.

The introduction, from this period, of seabed trawlers with "large vertical openings" (LVOs) in the Gulf of Lions constituted a response to the stagnation of the production of seabed fish. It provided the market with a range of open water species, such as hake and small pelagic species that the traditional trawlers would rarely catch. In this spirit, to patch the irregularity of the supply of small pelagic fish by the purse seine, some Mediterranean countries, such as Italy [FER 81], Greece and then France [MEU 87], introduced trawlers with very large vertical openings (20–25 m), inspired by models created in Denmark in 1965 for herring fishing. In tandem, or with four diverging panels (Gulf of Lions), this new technique of catching sardines or anchovies experienced a rapid expansion due to the support of electronic prospection equipment (sonar and probes) and electronic trawler positioning systems ("Netzsonde"). It notably allowed for an improvement of the commercialization of the sardine and anchovy by spreading out the produce over more regular supplies [MEU 87], something that the Mediterranean technique of purse seining did not allow. However, it led to the construction of new, more powerful trawlers, but ones more economically dependent on the resource and market.

After more than 20 years of relative stability, the sardine industry has found itself again, from 2007, in a state of crisis. It must deal with a substantial shortage of resources and a rise in the price of diesel, leading to a relocation of the fishing effort of the trawlers to demersal species. This new crisis, which affects most Mediterranean pelagic fisheries, once again asks questions over the exploitation of unstable resources and the consideration of the influence of the variations of the surrounding environment on their abundance and presence

(see *The Land–Sea Interactions [MON 14a]*, and, *Ecosystem Sustainability and Global Change [MON 14b]*, in the "Seas and Oceans" Set.

Faced with the reduction of yields on the continental plateau, the deeper resources of the continental slope, notably of red shrimp, have also represented a hope of redeploying trawler fishing [SIM 61]. This orientation does, however, require the use of specific equipment adapted to deep water fishing such as high capacity winches, deep water echo-sounders and an as precise as possible position of the fishing hauls. While as early as the 1960s, some Mediterranean trawlers were able to equip themselves with fishing winches equipped with 3,000 m of dragging cable, it was only in the 1980s that part of the Mediterranean trawler fleet started to orientate itself more openly toward deep fishing. Some of these units became specialized in the fishing of Norway lobster and red shrimp, on beds of 400–800 m, while others carried out a double activity of seabed fishing on the continental shelf and deep crustacean fishing, depending on the season.

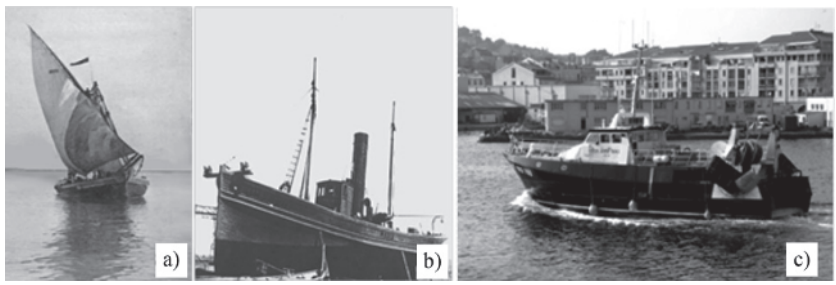

Figure 1.11. *Evolution of the Mediterranean trawler fleets (Source: J. Sacchi)*

COMMENTS ON FIGURE 1.11.– After World War II, Mediterranean trawlers quickly abandoned the sail (a) for steam (b) and diesel (c), thus allowing them to extend their field of activity far beyond the 12 nautical miles exploited by the "*chaluts boeufs*" of the 19th Century. This evolution became accentuated around the 1980s, notably by replacing wood with synthetic materials and steel (d) for the construction of the hulls.

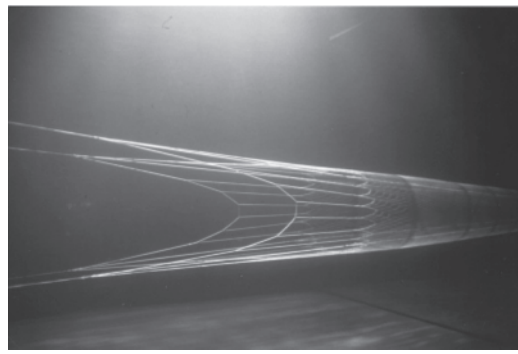

Figure 1.12. *Pelagic rope trawl, or "parachute trawl" (source: J. Sacchi)*

COMMENTS ON FIGURE 1.12.– This trawl for which the front and the wings are mainly made up of rayed ropes is one of the most recent creations introduced for fishing of small pelagic species in the Gulf of Lions. Its very large vertical and horizontal openings allow it to sweep over a section of water of more than 1,000 m^2.

1.4. Fishermen today in the Mediterranean

In 2008, without counting tens of thousands of small non-motorized boats, the number of declared fishing vessels active between the strait of Gibraltar and the Dardanelles has been estimated at around 82,000, of which 83% are small units of less than 12 m, essentially practicing a polyvalent activity of the small artisanal fishing. The vessels greater than 12 m are usually specialized in a limited number of techniques such as the towing (trawls and dredges), encircling (purse seines) and static (longlines, gillnets and fish traps) arts. The trawlers and dredgers represented around 10% of the Mediterranean fishing fleet, the purse seiners 4% and the longliners, gillnetters and potters 2%. To these fleets of motorized vessels can be added roughly eight *madragues* for the fishing of bluefin tuna. All of this fleet employed roughly 250,000 sailors, 55% of whom worked on vessels of low-scale fisheries. The engine power of all of the vessels was in the order of 6 million kW, 60% of which went to the trawlers, the purse seiners and the boats of static fishing of more than 12 m.

However, the countries of the EU had 58% of the Mediterranean trawlers and 26% of the purse seiners [SAC 11].

Fishing in the industrialized countries of the North Mediterranean has experienced a sustained decrease in its number of vessels and sailors from the first half of the 20th Century. Helped by the motorization and the mechanization of the vessels, it continued after World War II with a progressive decline of small-scale artisanal fisheries and, from 1983 onward, the implementation of European policies on the reduction of fishing abilities. On the contrary, the number of fishing units of the countries of the East of the Mediterranean and Northern Africa is slowly progressing, following in this sense the developmental policies of the countries involved [SAC 11].

Figure 1.13. *Small-scale artisanal fishers in Sète (source: J. Sacchi)*

COMMENTS ON FIGURE 1.13.– The vessels for small-scale fisheries represent more than 85% of Mediterranean fishing boats [SAC 11]; their activity is polyvalent and established for the production of varied species with the main target being regional fresh product consumption. Their evolution has benefited very little from technological innovation and has experienced, like most of Mediterranean fishing, a reduction in numbers.

The apparent stability of these means hides the reality of an increase in the effective capabilities of the Mediterranean fleets as it

does not take into account the constant progress made in terms of the mechanization of fishing equipment, communications and detection; without forgetting the transmission of knowledge, hygiene and the improvement of living conditions at sea. The speed of the increase in fishing power has obviously been different between the north and the south or the east and the west of the Mediterranean, depending on the investment capacities of the fleets in technological innovation [SAC 11]. The first beneficiaries of progress, the same industrial fleets of the EU countries, therefore, saw their technical efficiency increase by 3% per year despite a decrease in their total number of vessels [DES 09].

1.4.1. *The role of fishing in the consumption of sea products*

Mediterranean fishing is mainly multispecific and polyvalent. While the Mediterranean trawlers do target mainly bottom fish with the gillnetters, crustaceans and mollusks of the continental shelf and slope, the purse seiners boats are, with some drifting longliners and the *madragues*, mainly orientated toward the capture of pelagic species, such as the sardine and the bluefin tuna.

The production of consumable sea products from Mediterranean fishing is estimated at slightly less than a million tons, according to the Food and Agriculture Organization (FAO), or less than 1% of global fishing. Established from quantities on the national markets, this estimation considers less than perfectly the produce from small-scale fisheries, mainly sold directly to local consumers.

Split into near equal proportions between demersal species and pelagic species, this production experienced a global stagnation of catches [GAR 11] from the start of the 1980s. Indeed, the production of the countries of the South, regularly growing since the beginning of the 1950s, caught up with the declining production of the countries of the North of the Mediterranean basin in the 1990s.

Sea fishing is only source of marine products for Mediterranean countries. There is also the increasing production of marine and lagoon cultures. A result of traditional shellfish farming and fish

farming of freshwater and brackish water, aquaculture experienced a rapid growth from the 1990s onward, currently reaching more than a million tons due to the development of marine fish farming in the countries of the EU.

The Mediterranean market for Mediterranean fish was dependent on imports coming from Atlantic and North Sea fisheries well before the beginning of the industrial revolution. Relayed in the 20th Century by the diet culture and the development of maritime tourism, the popularity of low-fat foods born in the previous century led to a spectacular increase of the dependence of diets of the countries of the North of the Mediterranean on sea products [ETI 10]. In the countries of the South Mediterranean, the increase in the consumption of marine products remains small, however, largely dependent on the ability to ensure proper nutrition and on local customs.

Without direct data on the consumption of marine products in the Mediterranean, we do not have any other information apart from the evolution of the types of food available published by the FAO to demonstrate the evidence of this situation. This estimated consumption has gone from around 7 kg/person in 1961 to 14 kg/person in 2008. However, the portion of the production that represented around 40% of this consumption in the 1960s has progressively dropped from the beginning of the 1990s, to only cover 21%. The slightly larger portion of demersal fish in the consumption of marine species in the Mediterranean (61% in 2007) is mainly linked to growing interest in fresh fish and a certain amount of distrust for small pelagic species (anchovies, sardines and sardinellas), too quickly altered and instead aimed at preservation. This fascination with bottom species is one of the causes of the deficit in the commercial balances of Mediterranean countries; these only produce, taking into consideration aquaculture and continental fishing, about 70% of what they consume.

Generally, the preference of Mediterranean consumers for whole, fresh fish remains today, and has even increased in the second half of the 20th Century. The progress carried out in the icing of products and refrigerated transport led to a favorable response to this demand by being able to distribute to any part of the world, in less than five days,

a fresh fish of a certified level of hygiene. This tendency is nevertheless affected by the buyers' age and culture, the proximity of the sale and the consumption and the size of the offer. This has benefited over the last 50 years from the development of "ready to eat" food, and from the expansion of large-scale food distribution in the provision circuits. Canned products (tuna, sardines and salted foods), which dominated the market up to the mid-20th Century, are slowly making way for more elaborate products, such as ready meals and frozen foods.

1.4.2. *Diagnosis, fragility and over-exploitation*

Maritime fishing in the Mediterranean is today experiencing a critical situation. It has truly gone beyond the optimal renewal capabilities of most of the exploited stocks. Currently, production from fishing and aquaculture only covers 70% of the food needs of aquatic products of the populations of the countries of the Mediterranean. With a constant increase in the consumption of aquatic products and a stagnation of production, most of these countries find themselves in a greater and greater situation of dependence on imports. This dependence should increase over the next few years, comforted by the necessary reduction of the current levels of exploitation and the development of a highly demanding touristic sector.

Over more than two centuries, the image of an endlessly bountiful sea dominated reflection on the exploitation of its comestible resources. With the exception of words by the likes of "Cassandre" [LEQ 00], the freedom to fish that had followed the freedom of navigation had, since the 17th Century, been met with very few objections. Far greater than the fear of a decrease in resources, it was mainly the fear of overproductions, and therefore a loss of potential profit, that opposed any technological progress.

It was only in the beginning of the 20th Century that the warning bells started to be rung by fishery researchers, resulting in the creation of scientific and diplomatic commissions aiming to limit access to the resource, such as the International Congress for Aquaculture and Fishing at the world exposition of 1900, the International Council for Sea Exploration (ICES) and then in 1914, the *Commission*

Internationale pour l'Exploration Scientifique de la Mer Mediterranée (CIESM).

> Between 1849 and 1850, special Commissions made up of lawyers, sailors and biologists carefully studied the basis of regulation of coastal fishing as, already in this period, the scientific world had recognized the fact that fishing could not be left unchecked on the coasts of France without fearing the rapid destruction of the main species of coastal fish. The scientists of the time had before them the example of the Mediterranean where fishing had been carried out since Antiquity without defined rules, and had caused a general and irremediable decline in the ichthyological fauna. [LED 34]

It is on these terms that the second director of the *Office Scientifique et Technique des Pêches Maritimes* (Scientific and Technical Office of Marine Fisheries), created in 1918, alerts for the scientific communities, professional representatives and politicians to the state of precariousness of the industry and the benefits of providing it with an institutional organization. The scientific desire does, however, go against the socio-economic interests put forward by the states in the name of a necessary growth of the fishing industry to subsidize the growing food and employment needs.

The establishment of true fishing policies by the public powers only took place after World War II, first with the creation in 1945 of the FAO of the United Nations , and then from 1970 the development of the community fishing policies within the EU.

The policies and the strategies will, however, be mainly focused on "development […] in domains of the reduction of poverty, of food and nutritional security" and more particularly for the EU "the stability of the community market of marine products so as to guarantee quality at reasonable prices and to maintain the income of fishermen at a certain level"[16]. Favoring development and consumption, the states will

16 www.touteleurope.eu/fr/actions/agriculture-peche/politique-commune-de-la-peche/presentation/la-politique-commune-de-la-peche.html.

notably provide financial incentives for the development and modernization of the production tools, while imposing upon the agents of fishing regulatory limitations of use, so as to limit the impact on the resource.

It is only with the observation of the state of over-exploitation of several stocks and new economical and social difficulties of the fishing sector, that the EU adopted in 1992 and 2002 measures aiming to reduce the pressure on the resource, through the reduction of the overcapacity of the European fleet, the limitation of the fishing effort (licenses) and the regulation of the Total Allowable Catches (TACs). Extended to the Mediterranean, the Common Fisheries Policy (CFP) is concretized by the establishment in 2006 of a set of technical conservation methods taking into account the particular context of the Mediterranean and the specificities of the region management systems. So as to minimize the economical and social consequences of these measures, financial aid is guaranteed by the EU (European fisheries fund), the States and the territorial collectivities. Not theoretically aimed at increasing the fishing capacities, this aid has favored the modernizing of equipment, and notably communication and detection. They have contributed to the improvement of security, hygiene and working conditions. They have, therefore, actually contributed to the improvement of the effectiveness of fishing vessels. The situation is even more critical for countries of the south coast of the Mediterranean, which, undergoing high levels of demographic growth and with a commercial deficit, have based part of their hope of development on the modernization of their fishing fleet and the connected industries. The fishing policies are, therefore, more than even faced with the difficulty of combining economical and social development with the conservation of resources.

1.4.3. *State of the resource and the environment*

The overcapacity of fleets, an insufficient mastery of the management of the stocks exploited and erroneous fishing strategies have caused takings exceeding the reproductive capabilities of the species, which has in turn resulted in the decrease in the abundance,

size and shapes[17] and a reduction of the specific components of the catches.

Without omitting the effects of urbanization, touristic development and water pollution, fishing is also held responsible for the modification of the environments exploited and the survival of vulnerable species.

The causes of the decline of these species are likely due to the combination of direct human impacts that have increased in intensity during the 20th Century and the intrinsic characteristics of this fauna, such as their slow growth, their longevity, their relatively low fecundity and their position as trophy catches. The impact of anthropic factors, such as global warming or the modification of waterways, the acidification of the oceans and increases in salinity play an aggravating role that is, however, difficult to evaluate [GRO 14, MAY 11].

It is only with the first international congress for the protections of nature (Paris, 1923), and the convention on the conservation of natural state fauna and flora (London 1933) that for the first time the notions of "species threatened with extinction", "integral natural reserves" and "national parks" were covered [FRO 98]. However, it was only the creation of the International Union for the Conservation of Nature (IUCN), in Fontainebleau, in 1948, which marked the start of modern engagement of the international community in favor of the protection of nature. The awareness of the tight links between the exploited resources and the environment became especially important at the beginning of the 1990s with the creation of work groups in the international commission for the exploration of the sea on the effects of fishing on ecosystems [HAL 99].

1.4.4. *Ecosystem approach of fisheries and governance*

The Ecosystem Approach of Fisheries (EAFs), appearing with the Code of Conduct for Responsible Fisheries (FAO, 1995), arose from

17 Fishing techniques, such as trawling, gillnetting and trap fishing that use meshes, favor the escape of fusiform and oblong species at the expense of more angular-shaped species or those with extensive skin expansions.

the observation of the dependence of the exploited species on each other and their environment, and the realization that the food provided by the fisheries industry is only one of the services provided by the environment, such as functions of the regulation of the climate, energy production, the provision of cultural or touristic activity [GAS 09].

The sustainable use of marine species can, therefore, only be ensured by measures combining ecological and socio-economic requirements and established through management plans defined specifically for the ecosystems concerned. By considering that man and his activities are an integral part of the ecosystem, this mode of governance imposes that benefiting parties are all associated with all of the stages of the process of implementing and applying these plans.

The application of this particular mode of governance aims to reduce the impact of human activity on all of the behaviors of the ecosystem. However, it does not have to involve the detailed knowledge of all of the interactions before taking decisions aiming to prevent deterioration of the environment.

On this basis, the General Fisheries Commission for the Mediterranean (GFCM) following its 36th session (Marrakesh, 14–19 May 2012) adopted the principle of the application of multiannual management plans chosen case-by-case, according to the scientific recommendations of its Scientific Advisory Committee (SAC).

The multiannual management plans must be designed to counter and prevent overfishing, while providing high, sustainable yields, and maintaining, as far as possible, the size of the stocks of the species exploited at levels that provide the highest sustainable yield possible, and with the smallest risk of a reduction of the stock beyond safe biological limits.

With this recommendation, the GFCM is reaffirming its desire for a spatial management of the resources, through large maritime areas (*Geographic Spatial Area*) and its desire to take into account the diversity of the socio-economic context of each country.

Figure 1.14. *Sea bass and gilt-head sea bream farms in Greece (Argolida Gulf, 2013) (source: Daniel Faget)*

COMMENTS ON FIGURE 1.14.– Presented as an alternative to fishing by capture, aquaculture farms are in full development in the Mediterranean. Greece appears as one of the leading countries in this domain, since its production of marine species (111,000 tons) in 2008 equaled 30% of the total Mediterranean production (376,000 tons).

1.4.5. *Institutions*

In virtue of the United Nations Convention on the Law of the Sea (UNCLOS), the states bordering the Mediterranean must cooperate with each other, either directly or through an appropriate regional organization so as to, notably, coordinate the management, conservation, exploration and exploitation of the biological resources of the sea. To this day, two regional organizations dealing with the problems of sea fishing have been established: the ICCAT and the GFCM.

ICCAT, established in 1969, has the objective of guaranteeing the sustainable exploitation of tuna in the Atlantic Ocean and adjacent waters and, as a result, in the Mediterranean. The commission can, on

the basis of the scientific data available, make recommendations aiming to maintain tuna populations at levels that allow them to be exploited.

Created in 1952 under the FAO, the GFCM plays a major role in the management of fisheries in the Mediterranean and the Black Sea. Its 23 member states have had the power, since 2004, to adopt the restrictive recommendations submitted by a scientific committee, for the conservation of resources and the management of fisheries in the area covered by the Convention. A Committee of Compliance is charged in particular with examining the application of the measures adopted and eventually making recommendations for their application.

In collaboration with these two main organizations, various other international institutions contribute to the promotion in the Mediterranean of the modes of development integrating conservation and sustainable development, such as the Mediterranean Action Plan (MAP), the IUCN or the Agreement on the Conservation of Cetacean of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS).

1.4.6. *Seeking to promote the value of seas*

Faced with the precariousness of the resources, the hopes are very soon led to possibilities of increasing the possibility of the environment, by adapting spaces for farming (valliculture and aquaculture) or the protection of juveniles and reproducing individuals (artificial reefs, *cantonments*, reserves, etc.).

1.4.6.1. *Aquaculture*

Like in the 19th Century, aquaculture appears as the only possible solution for the dilemma caused by the need to respond to the increasing demand for aquatic products, and the obligation to reduce the amount of fish caught. Its main development came from the principle of the fattening of captured fish (*capture-based aquaculture*). The best-known examples in the Mediterranean are the eel, mullet and, more recently, bluefin tuna [LOV 08]. It is only around the 1980s that aquaculture really started to take off spectacularly with

the mastering of the reproduction of species of high-commercial value such as bass and sea bream. The farming of red tuna is thus presented as an ideal candidate in aquaculture of the future, notably due to the rapid growth of young individuals [LAB 10]. The development of aquaculture does, however, remain faced with the need to decrease its dependence on the resource, notably in the feeding of farms and its impact on surrounding areas.

Like industrial fishing, aquaculture has imposed itself on the professionals of neighboring artisanal fisheries, taking away part of their traditional activity and access to the market.

Its interactions with other human activities, such as the environment, are a result of the major questions. The Mediterranean countries decided to take them seriously into consideration, due to their socio-economic importance, and due to the growing importance of aquaculture for the food provision of main neighboring countries (Resolution CGPM/36/2012).

1.4.6.2. *Protected marine areas*

The interest in developing new methods of management based on protected marine areas (PMAs) has been revived in the last decade, supported by the feeling that it is possible to simultaneously protect threatened species and ensure the practice of certain activities of commercial fishing. For this, the PMAs must adapt their observation system to new objectives and integrate into their management the managing of all of human activity; this necessarily implies the participation of all parties – professional, scientific and administrative.

Several scientists and managers consider that the existing PMAs are often too small, and the status of the species and the habitats that they are meant to protect depend not only on the pressure of external fishing but also on the migration of the species. The creation of larger protection zones, as authorized by the UN convention on the rights of the sea (Montego Bay, 1994), would allow for a more effective application of the protective measures by better taking into account the scope of activity of the different maritime activities.

Another major difficulty is the management of PMA created beyond territorial waters, in "open" sea. In this space, which represents 60% of the surface of the Mediterranean waters, the Law of Seas covers surface navigation and the exploitation of mineral resources, while fishing is covered by the GFCM and threatened species by the Barcelona convention. The application of the measures necessary for scientific observation and control would involve the creation of a single international jurisdiction covering all of human activity [SAC 08].

1.4.7. *Education, raising awareness and labeling: the fishermen, agents of a sustainable exploitation of the environment*

One of the key factors for a sustainable exploitation of the environment is the integration of the fishing industry into the process of the management of the ecosystems exploited and in the choice of measures of application. A non-negligible part of the policy and regulation of fisheries is currently defined by the professionals themselves, as part of their respective instances. Among these, the Regional Advisory Council of the Mediterranean (RAC MED), created in 2008 as part of the common fisheries policy, is composed of representatives of fishing and other relevant groups such as organization for the protection of the environment, the consumers, the representatives of recreational or sport fishing. Its role is to allow the European commission to benefit from the knowledge and experience of the sector in the formulation and application of measure of fisheries management.

The awareness of the limited and precariousness of the resource has led to a questioning of the principle of a development of fishing essentially established on a greater and greater productivity of the fishing system. This economic system, born in the industrial revolution, became prominent in an era when it appeared to be the most efficient solution to ensure adequate provision of food to the population, and the social well-being of fishermen. The fishing industry must replace this conception of progress with a new approach, first of all founded on the preservation of the exploited ecosystems. The adhesion of those involved in this new form of

management implies a clear demonstration of the potential benefit that companies will be able to experience. Any development project or conservation project must necessarily plan an evaluation of the biological and socio-economic consequences of its impact. Raising the awareness of the agents and consumers to this new concept could also be stimulated by campaigns of eco-labeling (or eco-tagging) in support of practices of sustainable fishing. In this spirit, the fisheries and transformation companies must be able to prove the sustainability of their activity to obtain an eco-label. This approach does, however, require the establishment of reliable references that are not based on market considerations. In this aim, the FAO, during the 26th session of its Committee on Fisheries (FAO-COFI, Rome, 2005), exposed the general principles that must define eco-tagging, notably the "necessity for independent and reliable auditing systems, of transparency in the establishment of norms and of the sharing of responsibility, as well as the rules with solid scientific bases". In this spirit, the EU and France in particular have since started initiatives to determine the regulatory conditions of the eco-labeling of marine products.

1.4.8. *The necessary consideration of the patrimonial dimension of artisanal fishing*

Relatively neglected in fishing policy established around the Mediterranean in the second half of the 20th Century, coastal fishing fleets are today the objects of reflection linked to the definition of sustainable fishing. A living natural environment does require living fishing communities, which guarantee, beyond their traditional role of supplying the markets, the maintenance of local cultures. This patrimonial dimension appears today as constitutive of the rich identity of the Mediterranean coasts. It is today highly threatened. Its preservation is vital for, in the next decade, the reorientation of touristic policy in the Mediterranean, more open to the promotion of "blue tourism", on the model of "green tourism", very popular today in the countryside of occidental Europe. Guardians of landscape and knowledge, the agents of small-scale fishing remain today the first guarantors of the quality of their areas of activity. Upholding daily relations with the marine environment, they are able to detect the slightest of change. They must, therefore, today become more than

ever essential partners in the application of the management and preservation policies for fisheries. The preservation of these fisheries is, therefore, not reduced to a simple choice between destruction of the resource and making a sanctuary of this environment. The experiments carried out over 20 years around the national park of Port-Cros show that by favoring artisanal fishing over recreational fishing, and by implementing strict regulation over the practice, the density and the biomass of the fish remain high. The abandoning of certain techniques, such as the banning of trawling to the benefit of controlled trammel fishing, finally leads to catches by units of effort equal to those of the non-protected surrounding zones [BOU 04, PRO 13].

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