OCEANOGRAPHY AND MARINE BIOLOGY SERIES

SEAS AND OCEANS SET

Development of Marine Resources

Edited by

André Monaco and Patrick Prouzet

ISTE

WILEY

Development of Marine Resources

From the ***Seas and Oceans*** Set
coordinated by
André Mariotti and Jean-Charles Pomerol

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First published 2014 in Great Britain and the United States by ISTE Ltd and John Wiley & Sons, Inc.

ISTE Ltd
27-37 St George's Road
London SW19 4EU
UK

www.iste.co.uk

John Wiley & Sons, Inc.
111 River Street
Hoboken, NJ 07030
USA

www.wiley.com

Library of Congress Control Number: 2014953026

British Library Cataloguing-in-Publication Data
A CIP record for this book is available from the British Library
ISBN 978-1-84821-705-8

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Foreword

We have been asked by ISTE to stimulate work in the area of the environment. Therefore, we are proud to present the "Seas and Oceans" set of books, edited by André Monaco and Patrick Prouzet.

Both the content and the organization of this collection have largely been inspired by the reflection, initiatives and prospective works of a wide variety of national, European and international organizations in the field of the environment.

The "oceanographic" community, in France and internationally – which is recognized for the academic quality of the work it produces, and is determined that its research should be founded on a solid effort in the area of training and knowledge dissemination – was quick to respond to our call, and now offers this set of books, compiled under the skilled supervision of the two editing authors.

Within this community, there is a consensus about the need to promote an interdisciplinary "science of systems" – specifically in reference to the Earth's own "system" – in an all-encompassing approach, with the aim of providing answers about the planet's state, the way it works and the threats it faces, before going on to construct scenarios and lay down the elementary foundations needed for long-term, sustainable environment management, and for societies to adapt as required. This approach facilitates the shift of attention from this fundamental science of systems (based on the analysis of the

processes at play, and the way in which they interact at all levels and between all the constituent parts making up the global system) to a "public" type of science, which is finalizable and participative, open to decision-makers, managers and all those who are interested in the future of our planet.

In this community, terms such as "vulnerability", "adaptation" and "sustainability" are commonly employed. We speak of various concepts, approaches or technologies, such as the value of ecosystems, heritage, "green" technologies, "blue" chemistry and renewable energies. Another foray into the field of civilian science lies in the adaptation of research to scales which are compatible with the societal, economic and legal issues, from global to regional to local.

All these aspects contribute to an in-depth understanding of the concept of an ecosystemic approach, the aim of which is the sustainable usage of natural resources, without affecting the quality, the structure or the function of the ecosystems involved. This concept is akin to the "socio-ecosystem approach" as defined by the Millennium Assessment (http://millenniumassessment.org).

In this context, where the complexity of natural systems is compounded with the complexity of societies, it has been difficult (if only because of how specialized the experts are in fairly reduced fields) to take into account the whole of the terrestrial system. Hence, in this editorial domain, the works in the "Seas and Oceans" set are limited to fluid envelopes and their interfaces. In that context, "sea" must be understood in the generic sense, as a general definition of bodies of salt water, as an environment. This includes epicontinental seas, semi-enclosed seas, enclosed seas, or coastal lakes, all of which are home to significant biodiversity and are highly susceptible to environmental impacts. "Ocean", on the other hand, denotes the environmental system, which has a crucial impact on the physical and biological operation of the terrestrial system – particularly in terms of climate regulation, but also in terms of the enormous reservoir of resources they constitute, covering 71% of the planet's surface, with a volume of 1,370 million km^3 of water.

This set of books covers all of these areas, examined from various aspects by specialists in the field: biological, physical or chemical function, biodiversity, vulnerability to climatic impacts, various uses, etc. The systemic approach and the emphasis placed on the available resources will guide readers to aspects of value-creation, governance and public policy. The long-term observation techniques used, new techniques and modeling are also taken into account; they are indispensable tools for the understanding of the dynamics and the integral functioning of the systems.

Finally, treatises will be included which are devoted to methodological or technical aspects.

The project thus conceived has been well received by numerous scientists renowned for their expertise. They belong to a wide variety of French national and international organizations, focusing on the environment.

These experts deserve our heartfelt thanks for committing to this effort in terms of putting their knowledge across and making it accessible, thus providing current students with the fundaments of knowledge which will help open the door to the broad range of careers that the area of the environment holds. These books are also addressed to a wider audience, including local or national governors, players in the decision-making authorities, or indeed “ordinary” citizens looking to be informed by the most authoritative sources.

Our warmest thanks go to André Monaco and Patrick Prouzet for their devotion and perseverance in service of the success of this enterprise.

Finally, we must thank the CNRS and Ifremer for the interest they have shown in this collection and for their financial aid, and we are very grateful to the numerous universities and other organizations

which, through their researchers and engineers, have made the results of their reflections and activities available to this instructional corpus.

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1

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

Chapter written by Daniel FAGET and Jacques SACCHI.

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.

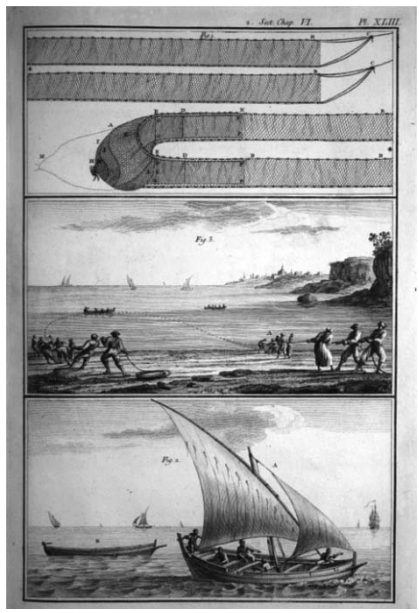

Figure 1.2. *Eissaugue (source: etching taken from Duhamel Du Monceau Henri Louis, Traité général des pêches, Guillaume de Bure, Paris, 1782)*

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.

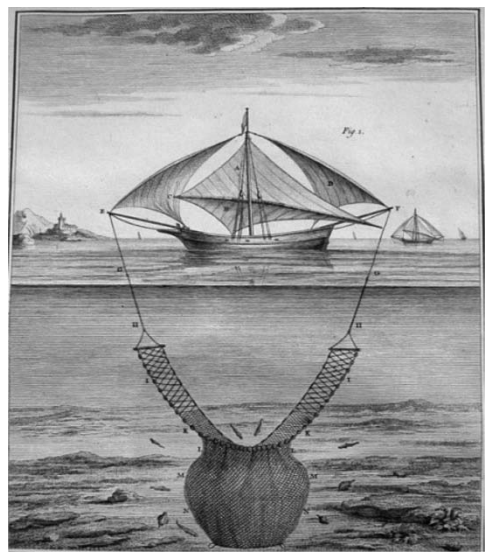

Figure 1.3. *Tartane (source: etching taken from Duhamel Du Monceau Henri Louis, Traité général des pêches, Guillaume de Bure, Paris, 1782)*

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.

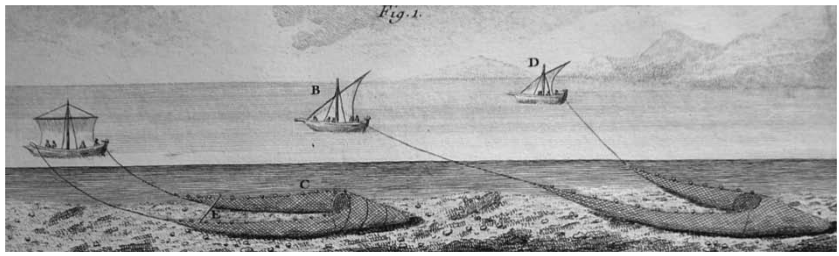

Figure 1.4. *Gangui "à la vache or plow" fishing (source: etching taken from Duhamel Du Monceau Henri Louis, Traité général des pêches, Guillaume de Bure, Paris, 1782)*

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