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Rebuilding of marine fisheries
Part 2: Case studies

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FAO FISHERIES AND AQUACULTURE TECHNICAL PAPER

630/2

by

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Preparation of this document

This document on rebuilding of marine fisheries has been prepared jointly by the FAO Fisheries and Aquaculture Department and the Fisheries Expert Group of the IUCN Commission on Ecosystem Management (IUCN-CEM-FEG), with the coordination of the European Bureau of Conservation and Development (EBCD) and with contributions from many experts in the field. The document consists of two parts.

Part 1 contains a global extensive review of the literature regarding: the emergence of the concept of fishery rebuilding at stock, multispecies assemblages and ecosystem levels; the evidence available for depletion and rebuilding; the scientific foundations; the natural, and human dimensions of the challenge; the governance framework; and the rebuilding strategies, with their objectives, plans, tools, and performance assessment. Part 1 has been prepared by Serge. M. Garcia, Yimin Ye, Jake Rice and Tony Charles.

Part 2 contains a series of case studies of fisheries rebuilding initiatives and processes on different types of resources, in various areas of the world, describing the resources and the fisheries, the depletion process, the rebuilding process and measures, drawing some lessons for the future. The case studies were elaborated by various experts, many of which members of IUCN-CEM-FEG and edited by Serge M. Garcia and Yimin Ye.

FAO extends its appreciation to all authors for their contributions to both Parts.

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Abstract

This Part 2 of the global review of "Rebuilding of marine fisheries" provides 13 case studies of fisheries on which rebuilding initiatives were undertaken, in various parts of the world and under different circumstances. A 14th analysis considers specifically the role of closures (MPAs and fishery closures) in rebuilding. The case studies relate to the fisheries on: Northeast Atlantic and Mediterranean Bluefin tuna; Norwegian spring spawning herring and Northeast-Atlantic cod; Southeast Australia multispecies (scalefish and sharks); Japanese sardine, anchovy and chub mackerel; Western Australia snapper, multispecies demersal resources and scallop; South African hakes, sardine and rock lobster; and the emblematic Canadian (Newfoundland) cod. The MPA analysis considers many examples of MPAs and fishery closures, including the Great Barrier Reef. This small number of cases illustrates nonetheless a number of contrasting situations and the multiple dimensions of the rebuilding challenge regarding: the nature of the resources; types of governance; types of fisheries; environmental and socioeconomic contexts; causes of depletion; information richness; and outcomes. A number of lessons are learned regarding: the triggering factors; the likelihood of success in rebuilding; the importance of reactivity, timeliness and clarity of objectives; the weakly predictable nature of the process; the uncertainty inherent in rebuilding trajectories; the needed improvements in the legal, policy, governance and management frameworks; the rebuilding and post-rebuilding regimes; economic and social considerations; science & policy issues; environmental issues; enabling and limiting factors and challenges.

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Contents

Abbreviations and acronyms

B	Biomass
B_{lim}	Minimum (Safe) Biological Limit
B_{MSY}	Biomass at the MSY level
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DFO	Department of Fisheries and Oceans (Canada)
EAF	Ecosystem Approach to Fisheries
EEZ	Exclusive Economic Zone
F	Fishing mortality
FAO	Food and Agriculture Organization of the United Nations
F_{MSY}	Fishing mortality at the MSY level
HRC	Harvest Control Rule
ICCAT	International Commission for the Conservation of Atlantic Tuna
ITQ	Individual Transferable Quota
IUCN	International Union for Conservation of Nature
LOSC	United Nations Law of the Sea Convention
LRP	Limit Reference Point
MCS	Monitoring, Control and Surveillance.
MPA	Marine Protected Area
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	Northeast Atlantic Fisheries Commission
ICSEAF	International Commission for Southeast Atlantic Fisheries
NEA	Northeast Atlantic
NGO	Non-Governmental Organization
OECD	Organisation for Economic Co-operation and Development
OMP	Operational Management Procedure
RFMO	Regional Fishery Management Organisation
SARA	Species At Risk Act (Canada)
SSB	Spawning Stock Biomass
SESSF	Southern and Eastern Scalefish and Shark Fishery (Australia)
TAC	Total Allowable Catch
TRP	Target Reference Point
TURF	Territorial Use Right in Fisheries
UNCED	United Nations Conference on Environment and Development
UNCHE	United Nations Conference on the Human Environment
UNCLOS	United Nations Law of the Sea Conference
UNEP	United Nations Environment Programme
UNFSA	United Nations Fish Stock Agreement
UNGA	United Nations General Assembly

The Eastern Atlantic and Mediterranean bluefin tuna: an archetype of overfishing and rebuilding?

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Abstract

The overexploitation of East Atlantic and Mediterranean bluefin tuna (ABFTE) stock has been considered as an archetype of overfishing and general mismanagement of national and international fisheries bodies. The crisis highlighted, among other things, the fact that uncertainties that are inherent to any scientific advice can be used in lobbying to attempt to discredit science-based management. It also showed how interactions between science and management can change through time according to public awareness and opinion. This long and highly publicized crisis finally came to an end, in 2009, when ICCAT, under the pressure of NGOs and public opinion, fully endorsed the scientific advice within a rebuilding plan. Nowadays, the ABFTE stock is recovering, even more quickly than expected, although uncertainties involved in current scientific advice do not allow the precise quantification of the level of this recovery. Despite this, the case of the ABFTE stock clearly demonstrates that the effective management of international fisheries that exploit highly valuable species and have been overexploited for decades is still possible when there is strong political will.

1. INTRODUCTION: DESCRIPTION OF THE FISHERY

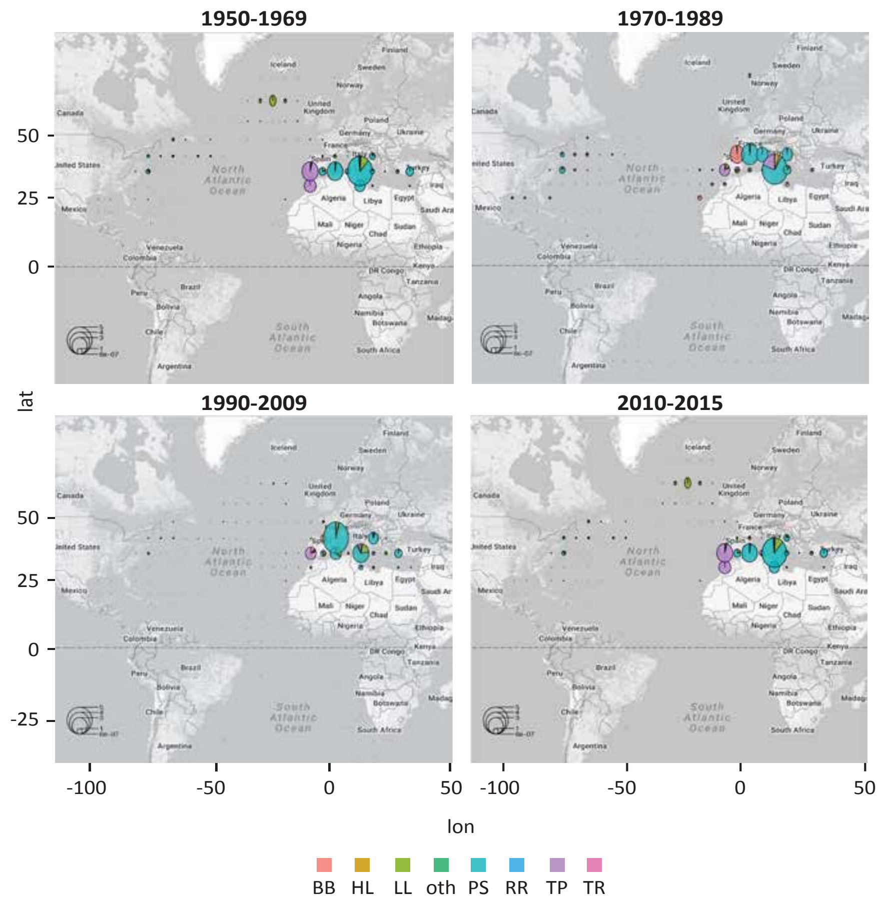
1.1 History

The tuna trap is one of the most ancient fishing systems targeting bluefin tuna in the Atlantic and the Mediterranean, particularly along the Spanish, Italian, Portuguese and Moroccan coasts (Ravier and Fromentin, 2001). Trap uses passive nets placed in the migratory path of bluefin tuna and was the most important fishing gear for centuries. Despites conspicuous long-term fluctuations, traps caught, in average, up to 15,000 tonnes/year (Ravier and Fromentin, 2002). After 1950, this gear was gradually replaced by longline and purse seine, but after a drop in the 1970s to the 1990s trap catches have increased again and represent up to 10% of the total catches (**Figures 1** and **2**).

Purse seiners became a major fishery catching ABFTE in the northeast Atlantic during the 1950s and then in the Mediterranean Sea since the 1970s (Fromentin, 2009, **Figure 1**). This fishery comprised vessels from France, Spain, Italy, Tunisia, Turkey and Croatia and its catch represents more than 50% of the reported ABFTE catches since 2000 (**Figure 2**). Initially, this fishery operated near the coast, on small young schooling bluefin tuna. In the mid-1980s, some fleets started exploring spawners aggregations in the Balearic Islands area, the Ionian Sea around Malta and later (Fromentin and Powers, 2005). By the early 2000s, the purse seine fishery expanded its fishing area to Libya and Egypt in the Levantine Basin and became the main provider of live fish to tuna fattening farms.

The Japanese longliners had operated in the Eastern Atlantic since the late 1950s and in the Mediterranean since the 1970s, targeting large fish and making substantial catches in the Mediterranean until the 1990s (Mather et al., 1995). Since then it has relocated in the Northeast Atlantic within waters under the Gulf Stream influence (**Figure 1**). Small scale longliners from various coastal countries also operate along the coasts of the Mediterranean, mostly on small- to medium-size bluefin tuna.

FIGURE 1
Geographic distribution of bluefin tuna catches per 5x5 degrees, per main gears and per period of 20 years



BB: Bait Boat; HL: Hand line; LL: Long line; oth: Other gear;
PS: Purse Seine; RR: Rod and Reel; TP: Trap; TR: Trawl

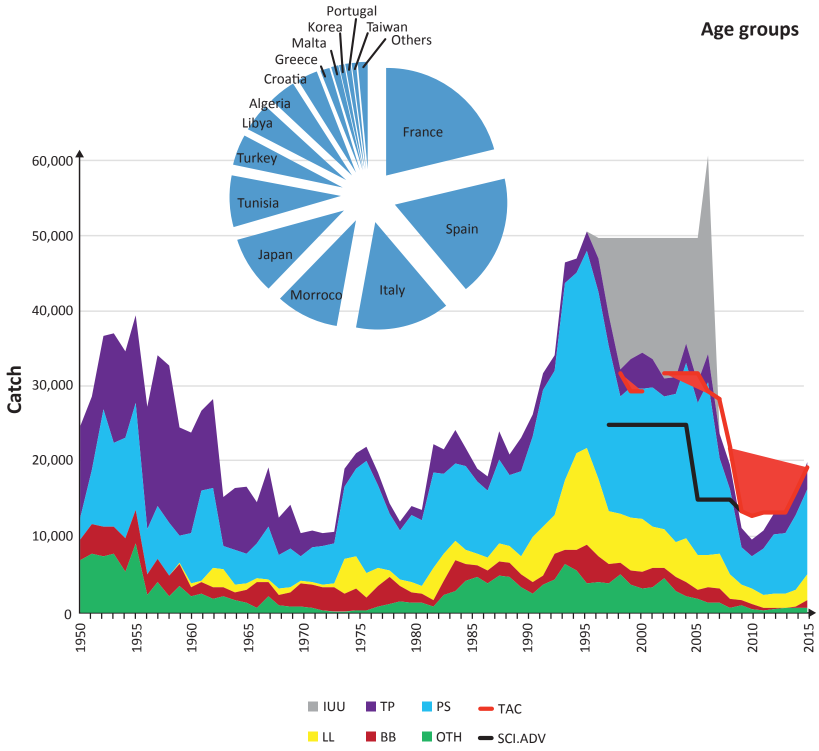
The bait-boat fishery (i.e. a pole and line fishery using live bait) was introduced in the Basque country in 1948. Traditionally, the bluefin tuna fishery operated in the south-eastern area of the Bay of Biscay and lasted from June to October (**Figure 1**). Most of the catches are composed by juveniles (1-4 years) and are usually concentrated in a very limited area (Cort and Abaunza, 2015). This fishery made its higher catches in the 1950s and 1960s and operated at a lower level since the 1970s.

1.2 The market

ABFTE was traditionally canned or sold to the Mediterranean fresh market at a rather low value until the rise of the sashimi market in the 1980s, which deeply transformed the market (Fromentin and Powers, 2005). This new and strong demand for fresh ABFTE came from Japan because of increasing domestic demand, but also because of overfishing of the southern bluefin tuna, which used to be the main source of fresh tuna for the Japanese market (Polacheck, 2002). Consequently, the value of ABFTE increased in the following decades and bluefin tuna became, in the media, the fish that was worth its own weight in gold when quoting the New Year auctions on the Tsukiji fish market in Tokyo. Unfortunately but, not surprisingly according to the "race-for-fish" strategy (see Hilborn et al.,2003), the growing value of ABFTE induced a sharp increase in the fishing efficiency and capacity of various fleets during the 1990s and 2000s, especially in the Mediterranean Sea. In addition, new storage technologies and farming practices introduced in the late 1990s strongly reinforced the "race-for-fish", which finally led to a severe and uncontrolled overcapacity that in turn generated a critical overexploitation of the resource (Fromentin and Powers, 2005).

FIGURE 2

Reported catches for the East Atlantic and Mediterranean from 1950 to 2016 split by main gears (main graph) and proportion of the reported catches by flag State since 2000 (pie chart)



IUU: Illegal-unreported-unregulated catches estimated by the Scientific Committee; TP: Trap; PS: Purse Seine; LL: Longline; BB: Bait Boat; OTH: Other gear; TAC: Total Allowable Catch decided by the Commission; SCI. ADV.: Scientific Advice recommended by the Scientific Committee

Consequently, ABFTE fisheries crystallised most of the problems found in many fisheries, i.e. severe overcapacity, open access in international waters, geographical expansion of the fisheries, high market value and deficient governance at both international and national levels (Garcia and Grainger, 2005; Hilborn, 2007; Pauly et al., 2002). Therefore, Non-Governmental Organisations (NGOs) publicised Atlantic bluefin tuna (ABFT), especially the East Atlantic and Mediterranean stock (ABFTE) that supports the bulk of ABFT catches, as the archetype of overfishing and general mismanagement of the world fisheries (e.g. Greeenpeace, 2006; WWF, 2008).

2. FISHERIES MANAGEMENT HISTORY

The International Commission for the Conservation of Atlantic Tunas (ICCAT) is the Regional Fisheries Management Organisation (RFMO) established in 1969 to monitor and manage ABFT and other tuna and tuna-like species of the Atlantic Ocean. As all five RFMOs responsible for tuna fisheries, ICCAT includes: (i) a scientific body that aims at collecting and analysing fisheries data to evaluate stock status and propose management recommendations; (ii) a management body that endorses conservation and management measures and decides the budget of the RFMO; and (iii) a secretariat that performs administration and coordination functions. Decisions (i.e. recommendations) taken by ICCAT are by consensus among the 48 members and five Cooperating Parties. When consensus cannot be reached, decisions are made by voting, which remains rare. Conservation and management measures for tuna stocks are first elaborated by panels and then moved to the Commission to be approved. The decisions are mandatory for all contracting parties. However, there is a well-defined system in the ICCAT constitution allowing members to object to such decisions within a timeframe in order not to be bound by them.

ICCAT scientific body raised serious concern about ABFTE stock status since the early 1990s. This stock was estimated to be overexploited in 1996, about 15 years after the overexploitation diagnosis of the Western Atlantic stock (ICCAT, 1999). From 1998 onwards, a Total Allowable Catch (TAC) system was implemented while size limit regulations and time/area closures were progressively reinforced (see Fromentin et al., 2014 for more details). This TAC is not transferable or tradable among contracting parties, but some countries have operated joint-ventures and thus used a boat operated by another fishing country to catch its own quota[1]. Nonetheless, the TAC did not improve the situation because the ICCAT management body: (i) did not implement an efficient compliance and control procedure and (ii) did not follow the advice of its own scientific body and kept recommending TACs that exceeded the scientific recommendations (**Figure 2**).

This management failure was partly due to the multilateral nature of ICCAT and to a decision-making process based on consensus, as noted above. Conflicts of interests between the numerous countries that fished ABFTE (**Figure 2**) impeded strong decision-making, especially to limit catches. In addition, the ABFTE market was highly profitable and economic interests took precedence over conservation-based ones. This is an unfortunate but quite common situation for many exploited stocks, even of lower economic value (Aps et al., 2007).

[1] Note that the TAC is decided every year by ICCAT and allocated among different contracting Parties according to an allocation scheme based on historical landings. The quota allocated to a Party, is allocated by that Party to its national fishery operators and may be transferable among them.

Management regulations were thus ineffective, at that time, in limiting ABFTE catches, especially in the Mediterranean Sea. The lack of compliance and control noted above further induced increasing levels of Illegal Unreported and Unregulated (IUU) fishing under flags of convenience (**Figure 2**). IUU catches were well documented by ICCAT scientific body (ICCAT, 2007; 2009) and several NGOs inquiries (e.g. Greeenpeace 2006; WWF 2008), but were apparently complacently ignored by ICCAT management body which took little action to curtail them until 2008. While the implementation of a TAC in 1998 was expected to decrease fishing mortality, the overall mismanagement finally led to an opposite outcome characterized by greater overexploitation and higher catches. ABFTE catches were probably at or above 50 000 tonnes per year during the 2000s, while ICCAT scientific body had recommended a TAC between 15,000 and 25,000 tonnes in the same period (**Figure 2**).

The ICCAT scientific body had alerted the ICCAT management body since the late 1990s and gave explicit statements in its 2006 report: "*Our evaluation of the current regulatory scheme is that, unless it is adjusted to impose greater control over the fisheries by improving compliance and to reduce fishing mortality rates, it will lead to further reduction in spawning stock biomass with a possibility of stock collapse*" (ICCAT, 2007). However, the scientific advice had little weight against fisheries lobbies, which were most influential at maintaining high catch levels. Using the argument of uncertainty in the scientific advice (inherent to any scientific diagnosis), stakeholders pushed managers to obtain higher TACs than those reflected in the scientific advice and avoided the recommended reduction in effort. During the 2000s, the environmental NGOs became, however, more and more powerful and very efficiently used communication tools to call the attention of the public to the poor stock status of ABFTE. To do so, unlike scientific bodies, NGOs sometimes used dramatic and scientifically incorrect terms and expressions such as "extinction" or "Race for the last bluefin" to describe ABFTE status and were also selective in communicating the scientific advice. Although such a strategy can undermine science-based management in the long-term, it was beneficial for ABFTE management because it raised public awareness of ABFTE stock status and, in turn, obliged ICCAT commission to really pay attention to the scientific advice and its Parties to more fully complying with their Flag States duties.

3. THE REBUILDING PLAN

Finally, the ICCAT management body implemented a first rebuilding plan in 2007, which included more restrictive management regulations, such as the reduction of the fishing season for the main fleets (purse seiners), an increase in the minimum size (from 10 kg to 30 kg) and new tools to monitor and control fishing activities. However, two key issues were not tackled: overly high catches and overcapacity (ICCAT, 2009). Under the NGOs pressure and scientific advice, the plan was reinforced in 2008, by strengthening the control measures and planning a reduction of fishing capacity over 5 years, but again the TAC remained 2 to 3 times higher than scientifically advised. The procrastination of ICCAT led, in 2009, to the demand by Monaco (with the support of most NGOs) to list ABFT under Appendix 1 of the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), introducing international trade controls. ABFTE was pointed as an archetypal example of mismanagement by its responsible body (ICCAT) and the intervention of CITES in the process was advocated by some parties to improve the situation (Fromentin, 2010a, b; Losada et al., 2010). This crisis clearly pushed

ICCAT management body to fully endorse the scientific advice and it recommended a low TAC for the three following years, at about 13 000 tonnes (a level that was recommended by ICCAT scientific body to reach the reference targets, i.e. F_{MSY} and B_{MSY}, within the 15 years of the rebuilding plan). Undoubtedly, such a drastic change in ICCAT management would not have happened without the strong NGOs' pressure.

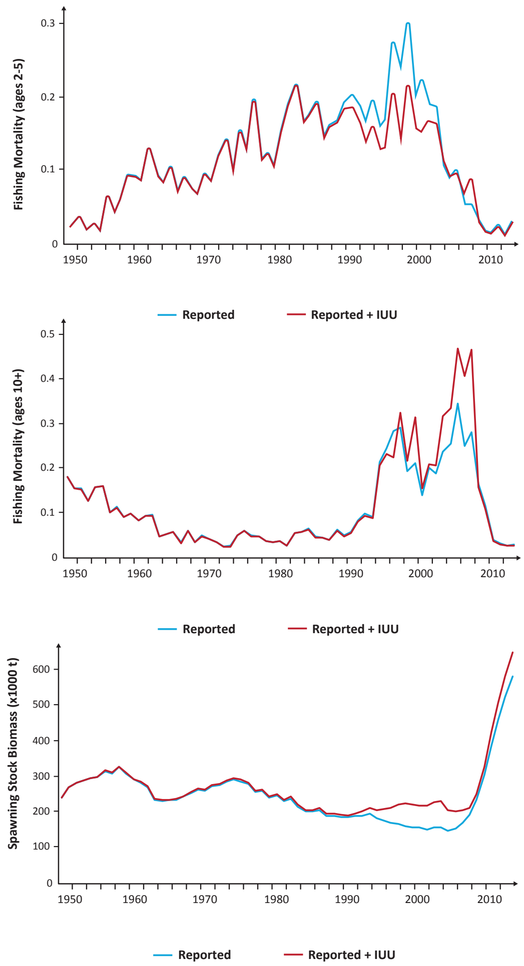
The reduction of fishing capacity and the strong reduction of the TAC since 2010, led to substantial reduction in the purse seine fleet size. For instance, the French purse-seine fleet decreased from 36 boats in 2007 to 23 boats nowadays, of which only 10-17 boats have been actually fishing since 2010. This reduction also led to ownership concentration at national levels. Similarly, the number of Japanese longline vessels had been significantly reduced and this fleet is not a major fishery for ABFTE anymore. The rebuilding plan also affected the area covered by most fisheries. The purse seine fishery increased its focus on the exploitation of spawning areas over May-June and targets the size classes favoured by the farms and the market. The Japanese longline fishery has concentrated in the Northeast Atlantic, especially in the southern waters off Iceland. EU small-scale longline fisheries (mostly from Spain, France, Italy and Malta) have benefited from the rebuilding plan, as lower TAC also translates into higher value, so that they have become more profitable on local/regional markets than before.

4. PERFORMANCE ASSESSMENT

One of the most spectacular effects of the rebuilding plan since 2010 was the drastic decrease in total catches of ABFTE. From 1998 to 2007, reported catches were about 30 000 to 35 000 tonnes, but, as mentioned before, ICCAT Scientific Committee estimated that actual catches were rather in the order of 50 000 t per year during this period (**Figure 2**; ICCAT, 2007). Since 2008, the ICCAT Scientific Committee did not detect any large quantity of unreported catches and concluded that a substantial decrease in the IUU catches had occurred following the reinforcement of the controls. In 2011 and 2012, reported catches were around 12 000 tonnes, i.e. the lowest catches recorded since 1950 and about four to five times less than four years before (**Figure 2**).

In contrast to the mid-2000s, all CPUE indices used for the 2012 and 2014 ABFTE stock assessments displayed positive trends in recent years. Fisheries-independent information from the aerial surveys performed on the juvenile fish in the north-western Mediterranean Sea provide similar indications, showing a four-fold increase in juveniles abundance in 2009-2012 compared to 2000-2003 (Bauer et al., 2015). In contrast to the 2006 and 2008 stock assessments, which detected a rapid and strong decline in the spawning stock biomass (SSB), the last stock assessments showed clear signs of increase in recent years in all the runs that have been investigated (**Figure 3**; ICCAT, 2013; 2015). Trends in fishing mortality (F) for the younger ages (ages 2-5) and for oldest fish (ages 10+) decreased sharply since the late 2000s, after 20 years or more of increase and reach the lowest historical levels (**Figure 3**). The general trend in F for the oldest fish is consistent with fisheries expert knowledge, especially the shift in targeting towards larger individuals destined for fattening and/or farming during the 1990s.

FIGURE 3
Fishing mortality for ages 2-5, fishing mortality for ages 10+ and spawning stock biomass from the 2014 stock assessment, based on reported catch (blue line) and on catch corrected for IUU (red line) (see Figure 1)



The perception of stock status derived from the last assessments has thus greatly improved relative to past assessments. F_{2013} was significantly below the reference target level ($F_{0.1}$)[2] in all scenarios ($F_{2013}/F_{0.1} < 0.5$). If F_{2013} seems to be consistent with ICCAT Convention objectives, current biomass is most likely to be below the level expected at $F_{0.1}$ (i.e. $SSBF_{0.1}$) in the high-recruitment scenario, but above the expected level in the low- and medium-recruitment scenario (ICCAT, 2015). Note that the last SSB value is among the highest values of the time series, which is rather intriguing for a recently overfished stock, especially for a long-lived species such as ABFT. Nonetheless, absolute values of SSB can hardly be compared between each other because $SSB_{F0.1}$ changed considerably over time due to changes in recruitment levels and/or selectivity patterns. Most importantly, past and/or recent SSB estimates are likely to be heavily biased because of unquantified uncertainties (see below).

Projections of SSB from last stocks assessments for a range of TACs are consequently optimistic, in contrast with past stocks assessments, and they indicate that ABFTE rebuilding to the $SSBF_{0.1}$ level, as presently defined, could be achieved by the end of

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2 $F_{0.1}$ has been selected by ICCAT scientific committee as the proxy for the fishing mortality that would provide the maximum sustainable yield, so that SSBF0.1 corresponds to the SSB that is expected under maximum sustainable yield strategy.

the rebuilding plan (in 2022) for catch levels equal or below 26 000 tonnes. Based on current knowledge and modelling assumptions, ABFTE could thus be fully rebuilt by 2022, or before. Following the 2014 scientific advice, an increase of 20% per year in the TAC was then applied from 2015 to 2017, so that the TAC reached about 23 000 t in 2017. Based on last projections carried out during the 2017 stock assessment, the scientific committee recommended a progressive increase of the TAC up to 36 0000 tonnes by 2020 (ICCAT 2018), which has been recently endorsed by the Commission.

However, and as noted before, the scientific advice assumes that the outcomes of the stock assessment model (VPA-ADAPT) are not strongly impaired by current unquantified uncertainties. This is very unlikely according to Fromentin and Kell (2007) who showed how long-term fluctuations in ABFT abundance can severely bias the perception of stock status. Such uncertainties arise from three major sources: (i) process errors, or our understanding of ABFTE biology and population dynamics (i.e. population structure, natural mortality, age structure, population growth rate and recruitment), (ii) observation errors, or the quality/quantity of the data used (mostly catch data and CPUE indices) and (iii) model errors, or the ability of assessment models to correctly reproduce key population dynamics patterns (Fromentin et al., 2014). For such reasons, the last stock assessments outcomes may be over-optimistic, as they were possibly over-pessimistic in the early 2000s, and for the same reasons. Such a situation is worrying, as it could break the virtuous circle that was painfully instigated 10 years ago with the implementation of the rebuilding plan. One way to avoid such a deleterious process would be to agree on management measures that would be evaluated with respect to agreed objectives, in other words, to implement a harvest control rule within the frame of a Management Strategy Evaluation (MSE; Kell et al., 2005; Froese et al., 2011). Note that such an approach has been successfully implemented by the Commission for the Conservation of Southern bluefin Tuna (CCSBT) to unravel the long southern bluefin tuna dispute (Kolody et al., 2008; Kurota et al., 2010).

This rebuilding initiative has also highlighted the tensions between science, policy and civil society that might be exacerbated during processes of collapse and rebuilding. When the first signs of ABFTE rebuilding were mentioned, some NGOs (but not all) had the same strategy as the fishery lobbies in the past and attempted to discredit the scientific advice by exploiting the various sources of uncertainty to get more conservative management measures. The risk to the stock is nonetheless not symmetric, as high catches when overfishing occurs increase the risk of stock collapse while low catch when overfishing does not occur translate into lower profits for the fisheries. Furthermore, it is rational to advocate for low catches when there is high uncertainty in the scientific advice (Mäntyniemi et al., 2009). Nowadays, all the NGOs have recognized the ABFTE rebuilding and the relations between economic interests and the sustainable use of resources were more balanced until very recently.

Questioning the scientific advice through the issue of uncertainty has been commonly used by different lobbies that wished to push their own agendas. Uncertainty is also a source of misunderstanding between scientists and managers for whom uncertainty often means poor advice. However, uncertainty is inherent to any scientific advice. Like in all scientific fields, fisheries scientists cannot provide certainties, but only probabilities and sometimes a consensual interpretation. In some cases, those probabilities can be seriously biased because of unquantified uncertainties. Some sources of uncertainties in the ABFTE stock assessment can be reduced by improving scientific knowledge and models, but stochastic uncertainty (i.e. variability in the population dynamics caused by natural variations in biotic and abiotic factors) will remain. It is up to fisheries scientists to actively communicate with managers, stakeholders and NGOs about the various sources of uncertainty, firstly to better inform about the scientific process and then to investigate alternative management strategies more robust to uncertainty. It is also crucial to identify those unquantified uncertainties and to evaluate their impact on the outcomes of the assessment, i.e. how different the true risk might be (EFSA, 2013). Such an approach is not trivial and implies to agree upon which of the known but unquantified uncertainties should be included in the evaluations. Some authors suggested that scientists and stakeholders debate a limited number of scenarios, which can be first identified in a qualitative way, as being areas of concern (Punt and Donovan 2007).

From a social and economic perspective, the rebuilding has noticeably modified fishermen viewpoint on governmental scientists and in general on the scientific approach. Formerly, fisheries scientists were mostly seen as the ones who brought bad news and were often accused to be biased towards a conservationist approach. The scientific debate around the CITES episode and the scientific documentation of ABFTE stock rebuilding have changed this perception, as fishermen have seen that scientists could also bring and endorse good news. Consequently, the dialogue between scientists and fishermen has improved and cooperation has restarted.

5. CONCLUSION

The recent history of ABFTE management demonstrated that improving stock status of a heavily overexploited and valuable stock can be achieved when there is real political will. However, the history of ABFTE management, as those of many other fish stock, showed that political factors firstly respond to economic interests. Without the strong NGOs pressure during the 2000s, ICCAT Commission would have probably continued doing "business as usual", i.e. paying little attention to the scientific advice and being reluctant to endorse efficient measures to stop overfishing. Nowadays, managers seem to really pay more attention to the scientific advice, so that the main challenge is to develop a scientific framework with clear management objectives that is robust to various sources of uncertainties. More science, less uncertainty and better management recommendations should finally translate into lower risks of fisheries and population collapse, mid- and long-term sustainable management and finally increased revenues of the fisheries.

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Management and rebuilding of herring and cod in the Northeast Atlantic

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Abstract

For centuries, Norwegian spring-spawning (NSS) Herring and Northeast Arctic (NEA) Cod, hereinafter referred to as herring and cod, have been the backbone of Norwegian fisheries, securing livelihood along the coast both as sources of food and monetary income. The depletion of herring in the late 1960s, and the overfishing of cod culminating 20 years later, were the two single most decisive incidents that led to an ongoing process shaping the framework and measures of modern Norwegian fisheries management. Although different regarding biological parameters, harvesting and the degree to which the stocks were depleted, the overall management measures needed for restoration and implementation of sustainable management of these two stocks, as well as for other stocks, are of the same general nature. The detailed measures depend obviously on stocks, fleets and fisheries concerned but all within a common political, legal and management framework, the general elements of which are:

- International agreement on the management and sharing of transboundary stocks;
- Improving exploitation patterns and the reduction of discards and waste;
- Reducing fishing mortality and the introduction of Harvest Control Rules (HCR);
- Measures to increase profitability in the fishing fleet;
- Sharing of resources nationally between fleet groups and individual vessels;
- Establishment of sufficient fisheries control and enforcement capacities; and
- Ongoing development and adaption of the management system.

1. INTRODUCTION: BACKGROUND ON THE STOCKS AND FISHERIES

This case-study tells the story about management and rebuilding of two fish stocks of the Northeast Atlantic Ocean: a herring stock and a cod stock. Both are transboundary, in that they have a distribution that extends in the exclusive economic zone of more than one coastal State. This feature implies that management actions need to be based on decisions arrived at through fisheries agreements by the relevant States. A summary timeline of some key events is given in **Annex 1**.

Both stocks can be considered as target stocks of the fleets exploiting them. The fishery for herring has generally little bycatch of other species, whereas there will often be bycatch of other whitefish species in the cod fishery. The dominant gears in