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Status and rebuilding of European fisheries

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ABSTRACT

Since January 2014, the reformed Common Fisheries Policy (CFP) of the European Union is legally binding for all Member States. It prescribes the end of overfishing and the rebuilding of all stocks above levels that can produce maximum sustainable yields (MSY). This study examines the current status, exploitation pattern, required time for rebuilding, future catch, and future profitability for 397 European stocks. Fishing pressure and biomass were estimated from 2000 to the last year with available data in 10 European ecoregions and 2 wide ranging regions. In the last year with available data, 69% of the 397 stocks were subject to ongoing overfishing and 51% of the stocks were outside of safe biological limits. Only 12% of the stocks fulfilled the prescriptions of the CFP. Fishing pressure has decreased since 2000 in some ecoregions but not in others. Barents Sea and Norwegian Sea have the highest percentage ($>60\%$) of sustainably exploited stocks that are capable of producing MSY. In contrast, in the Mediterranean Sea, fewer than 20% of the stocks are exploited sustainably. Overfishing is still widespread in European waters and current management, which aims at maximum sustainable exploitation, is unable to rebuild the depleted stocks and results in poor profitability. This study examines four future exploitation scenarios that are compatible with the CFP. It finds that exploitation levels of 50–80% of the maximum will rebuild stocks and lead to higher catches than currently obtained, with substantially higher profits for the fishers.

1. Introduction

Overexploitation of fish stocks occurs at global scale [1], and some stock depletions have received prominent media coverage (e.g. cod *Gadus morhua* in Canada: [2]). Despite this overall overexploitation pattern, current exploitation and biomass trends differ between few well-managed regions where stocks are recovering, and many badly managed regions where stocks continue to decline [3]. For example, the majority of fish stocks in North American and Australian waters are currently stable with the prospect that reduced exploitation will lead to rebuilding of their biomass [3]. In the rest of the world, fish biomass is, on average, declining due to overexploitation [4] or low fisheries management capacity [3,5].

The Common Fisheries Policy (CFP) of the European Union (EU) [6] calls for rebuilding all commercially used fish stocks above levels that are capable of producing the maximum sustainable yield (MSY) as its explicit objective in Art. 2, §2 of the legally binding Basic Regulation of 11 December 2013. As a first step to achieve this goal, fishing pressure (F) shall be reduced to the maximum sustainable level (F_{msy}) by 2015, latest by 2020. Rebuilding the biomass (B) of stocks above the MSY-level (B_{msy}) requires further reduction of fishing pressure, i.e., F must be smaller than F_{msy}, but the extent of this reduction is left unspecified in the CFP and is thus a matter of controversy among fisheries scientists and managers [7]. Three possible indicators for helping in the selection of adequate fishing pressure are the time required for rebuilding, the expected catches, and the profitability of the fisheries during and after the rebuilding phase. These indicators are functions of the current status of the stocks (B/B_{msy}), the remaining level of exploitation (F/

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F_{msy}), and the net productivity or intrinsic rate of population increase (r) of the stock [8]. The monitoring of the CFP implementation is of great importance for the European Union (EU), European Commission (EC) and its Directorate-General for Maritime Affairs and Fisheries (DG MARE). The Scientific, Technical and Economic Committee for Fisheries (STECF) is the main scientific advisory body on fisheries policy to the EC and has the task of reporting on the CFP implementation through the estimation and publication of a series of indicators [9].

Within EU waters, the proportion of stocks that are routinely and regularly assessed is higher in the northeast Atlantic [10] compared to the Mediterranean and Black Seas [11,12] partly due to the multi-specific nature of fisheries in the southern areas [13] and partly due to the higher fisheries management capacity in the wealthy countries of northern Europe. With respect to the Atlantic fisheries, Cardinale et al. [10] evaluated the status and exploitation of 41 demersal, pelagic and benthic fish stocks of the Northeast Atlantic, Gascuel et al. [14] examined the catches of major stocks in the European waters of the Atlantic Ocean, and Fernandes and Cook [15] reviewed recent stock assessments in the Northeast Atlantic. Recent evaluations of Mediterranean and Black Sea fisheries have been based on data from landings [16], scientific surveys [17], or stock assessments [18–22] and ecosystem models [23]. However, these studies did not use a coherent MSY framework as required by the CFP and covered only a fraction of the exploited stocks.

The purpose of this study was to examine all European stocks for which at least catch data were available and to determine stock status (B/B_{msy}) and exploitation (F/F_{msy}) in the context of the legal CFP requirements. This was done with an advanced implementation of a surplus production model [24] to assess how rebuilding time, catch and profitability depend on the rebuilding strategy, as determined by the chosen level of future exploitation. In summary, this study is meant to help European fisheries managers in the selection of future exploitation levels that are sustainable, profitable, ecologically sound, and compatible with the CFP.

2. Methods

2.1. Dataset

Fish and invertebrate stocks from ten ecoregions of the European Seas were assessed. Six of the ecoregions were located in the northeast Atlantic Ocean (Barents Sea and Norwegian Sea; Iceland, Faroes and Greenland; Greater North Sea; Baltic Sea; Celtic Seas and Rockall; Bay of Biscay, Iberian Coast and Azores), three in the Mediterranean Sea (western Mediterranean: includes Gulf of Lions, Balearic Sea and Sardinia; central Mediterranean: includes Adriatic and Ionian Seas; eastern Mediterranean: includes Aegean Sea and Cyprus waters), while Black Sea was assessed as a single ecoregion (Fig. 1). Overall, 397 fish and invertebrate stocks were assessed, of which 357 (90%) were being exploited within their respective ecoregions, whereas 40 of them were wide-ranging stocks.

For the northeast Atlantic, catch and biomass trajectories or relative abundance indices from formal stock assessment were extracted from the advice documents published by the International Council for the Exploration of the Seas (ICES) and the International Commission for the Conservation of Atlantic Tunas (ICCAT). For the Mediterranean, the landings were acquired from the Food and Agriculture Organization-General Fisheries Commission for the Mediterranean (FAO-GFCM) database (1970–2014) for each ecoregion [25] and the biomass or relative abundance data from the Data Collection Framework (DCF) programme. The reports from the regular assessments of STECF were used in some cases [20,26–30]. For the Black Sea, latest available stock assessment reports were used [31]. The aforementioned reports were also used as officially accepted independent stock assessments for comparison with the findings of the present work.

2.2. Estimation of reference points

The open-source CMSY stock assessment tool [24] was used to estimate the stock status for European stocks. The CMSY catch-only

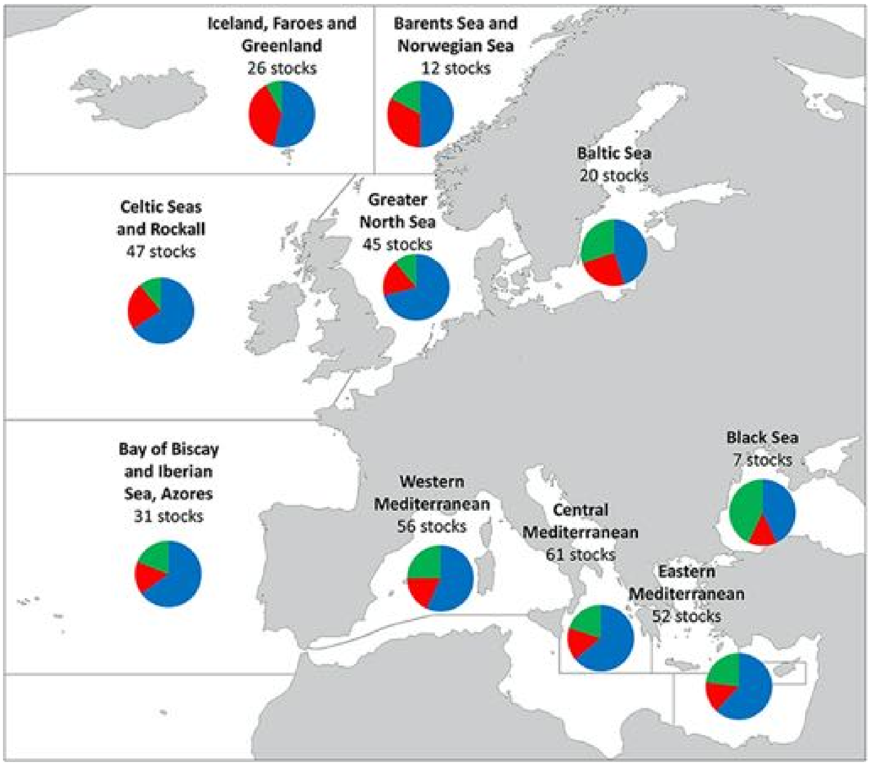

Fig. 1. Map with the ten ecoregions and the percentage of stocks per functional group (large predators: red; pelagic plankton feeders: green; benthic organisms: blue). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

approach applies advanced Monte-Carlo filtering to produce proxies for maximum sustainable yield (MSY), fishing pressure that can produce MSY (F_{msy}), biomass that can produce MSY (B_{msy}), and indicators such as relative stock size (B/B_{msy}) and exploitation (F/F_{msy}) based on catch data and resilience information within a Bayesian framework. In addition, a Bayesian state-space Schaefer surplus production model (BSM) is included within the CMSY software and produces refined stock status estimates if biomass or abundance indices are available.

CMSY aims to combine information on the stock's productivity and exploitation history with data from surveys and official catch reports and can also account for gaps (or absence) in abundance information, which is its main advantage with respect to other models. Priors for productivity can be specified using qualitative indications (e.g. medium, high, low resilience) that are automatically transformed into lognormal prior distributions. CMSY requires "expert" prior information to be specified for biomass depletion at the beginning and the end of the time series. Further details on the CMSY estimation framework and concepts are given in the detailed CMSY documentation in Froese et al. [24].

2.3. Estimation of rebuilding time

The time needed to reach B_{msy} is a function of biomass depletion and remaining fishing pressure [32] and can be calculated from Eq. (1).

$$\Delta t = \frac{1}{2F_{msy} - F} ln\left(\frac{\frac{B_{msy}}{B}2\left(1-\frac{F}{2F_{msy}}\right)-1}{2\left(1-\frac{F}{2F_{msy}}\right)-1}\right) \qquad (1)$$

where Δt is the time in years to reach B_{msy}, B is the biomass in the last year with available data, and other parameters are as defined above.

This estimate of rebuilding time corresponds well with the results obtained from projecting biomass forward in cases where the initial biomass is larger than half of B_{msy}. However, Eq. (1) assumes full productivity independent of stock size and is therefore too optimistic in severely depleted stocks where recruitment may be impaired and depensation may play a role [32,33]. For the purpose of this study we therefore estimated rebuilding time by projecting biomass forward with extended surplus production equations [24], which assume reduced recruitment at low stock sizes ($B/B_{msy} < 0.5$) and average recruitment otherwise (Eqs. 2 and 3) [34].

For the purpose of this study, the Schaefer model [35] was expressed as a function of B/B_{msy} and F_{msy} in Eq. (2), which was used to predict next year's status if current biomass was equal to or higher than half of B_{msy}.

$$\frac{B_{t+1}}{B_{msy}} = \frac{B_t}{B_{msy}} + 2F_{msy}\frac{B_t}{B_{msy}}\left(1-\frac{B_t}{2B_{msy}}\right) - \frac{B_t}{B_{msy}}F_t \quad \Big| \; \frac{B_t}{B_{msy}} \geq 0.5 \qquad (2)$$

Eq. (3) was used to predict next year's status if current biomass was lower than half of B_{msy}.

$$\frac{B_{t+1}}{B_{msy}} = \frac{B_t}{B_{msy}} + 2\frac{B_t}{B_{msy}}2F_{msy}\frac{B_t}{B_{msy}}\left(1-\frac{B_t}{2B_{msy}}\right) - \frac{B_t}{B_{msy}}F_t \quad \Big| \; \frac{B_t}{B_{msy}} < 0.5 \qquad (3)$$

where ($2\,B_t/B_{msy}$) is a multiplier that decreases linearly from 1 to zero as B_t/B_{msy} decreases from 0.5 to zero. Eqs. 2 and 3 were not simplified further to maintain readability.

Uncertainty estimates associated with the key input parameters B/B_{msy}, B_{msy}, and F_{msy} (Supplementary Table S1) were incorporated by means of Monte-Carlo simulations based on 1000 samples. The data used in this study and the source code in R are available for download as part of the online material.

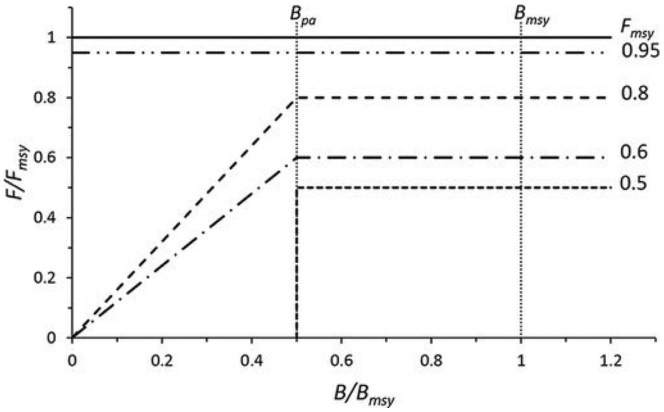

Fig. 2. Schematic representation of the different harvest control rules used as scenarios in this study. The vertical dotted line marked as B_{pa} indicates the biomass below which recruitment may be impaired. The vertical dotted line marked as B_{msy} indicates the lowest biomass at which stocks are capable of producing the maximum sustainable yield. The broken lines indicate the relative fishing pressure (F/F_{msy}) applied at a certain relative stock size (B/B_{msy}) under the different scenarios.

2.4. Exploitation scenarios in detail

The stock status projected for 2018, the first year for which managers had not yet set catch levels at the time of this study, was used to apply four different exploitation scenarios until the year 2030:

1. **The 0.5 scenario**: no fishing takes place in stocks where biomass is less than half of B_{msy} and which are therefore endangered by impaired recruitment and considered outside of safe biological limits [6]. If stock size is equal to or larger than half of B_{msy}, fishing occurs with 0.5 F_{msy}.
2. **The 0.6 scenario**: Fishing mortality of 0.6 F_{msy} is applied if stock size is at or above half of B_{msy}. Below that level fishing mortality is linearly reduced to zero with decrease in biomass ($F_{reduced}$), similar to the harvest control rule of ICES [36] (Eq. (4)).

$$F_{reduced} = 2\frac{B_t}{B_{msy}}F \quad \Big| \; \frac{B_t}{B_{msy}} < 0.5 \qquad (4)$$

3. **The 0.8 scenario:** Fishing mortality of 0.8 F_{msy} is applied if stock size is at or above half of B_{msy}. Below that level fishing mortality is linearly reduced to zero with decrease in biomass (Eq. (4)).
4. **The 0.95 scenario:** Fishing mortality of 0.95 F_{msy} is applied throughout, independently of stock size.

The different scenarios or harvest control rules applied in this study are shown in Fig. 2. Trajectories resulting from the four exploitation scenarios for rebuilding time, catch and profitability are presented separately for the Northeast Atlantic, the Mediterranean and Black Sea, and all stocks combined. Trajectories for rebuilding and catch start in 2013, the last year for which actual catch data and exploitation rates were available for all stocks. Biomass was then modelled using the last exploitation rates until 2018. From 2018 to 2030 the exploitation rates of the four scenarios were applied. Trajectories for profitability start in 2014, the last year for which estimates of net profit margins were available [37]. For consistency, all projections in the main text are shown from 2014 to 2030.

2.5. Addressing the underestimation of fishing mortality

In order to address the problem of surplus production models of underestimating fishing mortality in fully selected versus partly selected age classes in stocks with severely truncated age structure, the

Table 1

Stock numbers, stocks subject to sustainable exploitation ($F \leq F_{MSY}$), stock size above the level capable of producing MSY ($B > B_{MSY}$), stocks outside of safe biological limits ($B < 0.5\ B_{MSY}$), severely depleted stocks ($B < 0.2\ B_{MSY}$), sustainably exploited stocks, total biomass, total biomass level capable of producing MSY, total catch, total MSY level, and compliance with CFP targets, for 397 stocks in 10 European ecoregions and two wide-ranging regions. The unit (Mt) refers to million tonnes.

Ecoregion	**Stocks n**	**$F \leq F_{MSY}$ n (%)**	**$B > B_{MSY}$ n (%)**	**$B < 0.5B_{MSY}$ n (%)**	**$B < 0.2B_{MSY}$ n (%)**	**Sustainable n (%)**	**Biomass (Mt)**	**B_{MSY} (Mt)**	**Catch (Mt)**	**MSY (Mt)**	**CFP conform n (%)**
Barents Sea and Norwegian Sea	12	10 (83)	8 (67)	2 (17)	1 (8)	8 (67)	19	21	1.9	4.6	6 (50)
Iceland, Faroes and Greenland	26	15 (58)	5 (23)	11 (42)	5 (19)	12 (50)	3.7	6.8	0.6	1.6	4 (15)
Greater North Sea	45	25 (56)	9 (20)	21 (47)	6 (13)	23 (51)	9.9	11	1.6	3.4	9 (20)
Baltic Sea	20	12 (60)	6 (30)	9 (45)	1 (5)	12 (60)	3.1	4.0	0.69	0.96	5 (25)
Celtic Seas and Rockall	47	24 (51)	11 (23)	19 (40)	7 (15)	22 (47)	1.3	2.1	0.23	0.48	10 (21)
Bay of Biscay, Iberian Coast and Azores	31	13 (42)	5 (16)	7 (23)	3 (10)	12 (39)	0.86	1.3	0.20	0.34	4 (13)
Western Mediterranean	56	4 (7)	0 (0)	40 (71)	4 (7)	3 (5)	0.48	1.00	0.15	0.30	0 (0)
Central Mediterranean	61	16 (26)	4 (7)	39 (64)	8 (13)	12 (20)	0.55	1.13	0.19	0.29	1 (2)
Eastern Mediterranean	52	5 (10)	0 (0)	32 (62)	4 (8)	5 (10)	0.19	0.38	0.07	0.11	0 (0)
Black Sea	7	1 (14)	1 (14)	3 (43)	2 (29)	1 (14)	0.68	1.3	0.24	0.40	1 (14)
Wide-ranging ICCAT	10	5 (50)	5 (50)	1 (10)	1 (10)	5 (50)	1.0	0.96	0.13	0.19	4 (40)
Wide-ranging ICES	30	13 (43)	5 (17)	18 (60)	10 (33)	9 (30)	10.6	11.9	2.8	2.7	2 (7)
TOTAL	**397**	**143 (36)**	**59 (15)**	**202 (51)**	**52 (13)**	**124 (31)**	**51.36**	**62.87**	**8.8**	**15.37**	**46 (12)**

estimate of F_{msy} was reduced as a linear function of biomass below 0.5 B_{msy} (Eq. (5)).

$$F_{msy\_red} = 2\frac{B_t}{B_{msy}}F_{msy} \qquad | \frac{B_t}{B_{msy}} < 0.5 \tag{5}$$

where F_{msy_red} is a reduced value of F_{msy} to account for reduced productivity in stocks with reduced recruitment.

2.6. Calculation of profitability

A simple comparison between the profitability of the four scenarios can be obtained from the equilibrium curve of yield over effort when average effort and average profitability of the current fisheries are known. We define profitability according to the official definition used in the EU, where net profit is income from landings plus other income minus crew costs minus unpaid labor minus energy costs minus repair costs minus other variable costs minus non variable costs minus depreciation cost minus opportunity cost of capital [37, section 6.4]. For European fisheries in 2014 the mean net profit margin, which is net profit as a percentage of fishing income, was $\mu_{mean} = 7.7\%$ (SD = 1.2%) for the whole region (excluding distant water fleets because they fish on other stocks and excluding Greece because of incomplete data), $\mu_{mean} = 8.5\%$ (SD = 1.6%) for the Northeast Atlantic (assuming that profit margins for Spain and France referred mostly to Northeast Atlantic stocks), and $\mu_{mean} = 3.8\%$ (SD = 3.5%) for the Mediterranean and Black Sea [37]. Based on data for stocks with more than 10,000 t of catch in 2013, $(C/MSY)_{mean}$ and $(F/F_{msy})_{mean}$ were 0.68 and 1.43 for the whole area, 0.67 and 1.36 for the Northeast Atlantic, and 0.72 and 1.79 for the Mediterranean and Black Sea, respectively. No data on other income were available and thus revenues from fishing were taken as the main income, assuming a constant fish price over time, as is common in the literature [38]. All variable cost were assumed as proportional to effort, i.e. marginal cost of effort are constant, and fishing mortality was used as a proxy for effort. This means that resource rents are not dissipated in European fisheries, as could be the case for example under conditions of regulated open access [39]. This is consistent with the 2016 STEFC report of overall positive profit margins in European fisheries [37]. Based on the above assumptions, an index of profitability is derived as annual net profit in percent of fishing revenues at MSY. Using the above data, this index was calculated as shown in Eq. (6).

$$\pi_t = \frac{F_t}{F_{msy}}\left(\frac{B_t}{B_{msy}} - \frac{\left(1-\frac{\mu_{mean}}{100}\right)\left(\frac{C}{MSY}\right)_{mean}}{\left(\frac{F}{F_{msy}}\right)_{mean}}\right) \tag{6}$$

where π_t is the profitability index for year t, μ_{mean} is the observed mean net profit margin (in percent), $(C/MSY)_{mean}$ is the observed mean catch relative to MSY and $(F/F_{msy})_{mean}$ is the observed mean fishing mortality relative to F_{msy} as a proxy for mean effort. F_t and B_t are fishing mortality and biomass in the four considered scenarios.

For the purpose of simplicity, discount rates were assumed zero for the projected period.

3. Results

3.1. Stock status and exploitation pattern

Out of the 397 considered stocks, the ecoregions of the Northeast Atlantic were represented by 181 stocks, those of the Mediterranean by 169 stocks and the Black Sea by 7 stocks (Fig. 1). The majority of the stocks were benthic organisms (60%), followed by large predators (22%) and plankton feeders (18%), with the variation per ecoregion shown in Figure.

Of the 397 stocks, 254 (64%) were subject to ongoing overfishing ($F > F_{msy}$) and 202 stocks (51%) had stock sizes outside of safe biological limits ($B < 0.5\ B_{msy}$) (Table 1). In 45 stocks (11%) catches exceeded the maximum sustainable yield ($C/MSY > 1$). Two hundred eight stocks (52%) were in critical condition, defined by being outside of safe biological limits and subject to overfishing or being severely depleted ($B < 0.2\ B_{msy}$) and still subject to exploitation. Altogether, 274 stocks (69%) were subject to unsustainable exploitation ($C/MSY > 1$ or $F > F_{msy}$ or $B < 0.2\ B_{msy}$). In contrast, only 46 stocks (12%) could be considered as being well managed and in good condition according to the CFP, defined by not being subject to overfishing and having a biomass above the one that can produce MSY

Barents Sea and Norwegian Sea have the highest percentage (50%) of stocks that comply with the goals of the Common Fisheries Policy (CFP 2013) by having a biomass above the level that can produce MSY and not being subject to overfishing (Table 1). Biomass and catches are also highest in this ecoregion, followed by wide-ranging ICES stocks and by the Greater North Sea (Table 1). The Mediterranean and Black Sea are still far away from the goals of the CFP, with only 2 out of 176 stocks in compliance. Average stock biomass in the ecoregions of the Mediterranean and Black Sea was about 50% of the level that can produce MSY, whereas in the northern ecoregions (Barents Sea to Iberian Sea) average biomass was about 80% of that level (Table 1).

The fishing pressure (F/F_{msy}) – stock state (B/B_{msy}) plot clearly shows that, across ecoregions, most species are overexploited and/or outside of safe biological limits in the last years with available data (2013–2015) (Fig. 3). Some of the stocks (n = 27) are not shown in the plot because they are located beyond the F/F_{msy} axis limits, i.e. their F/

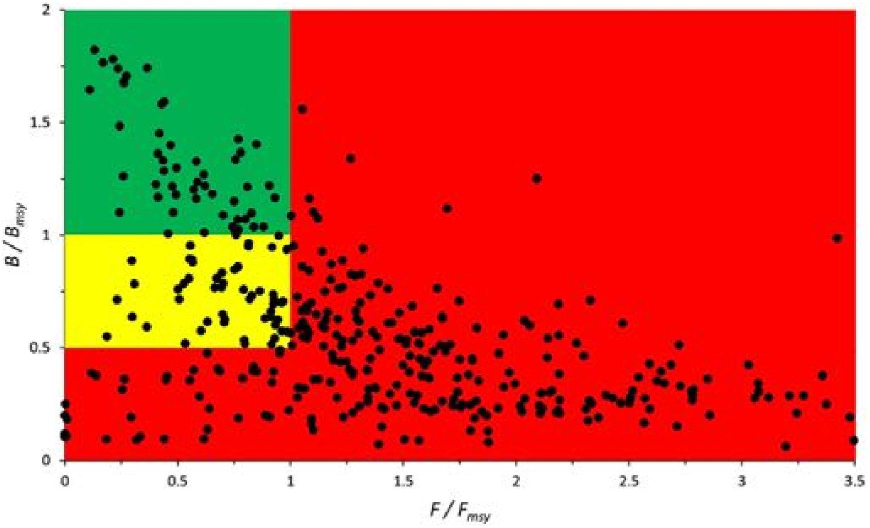

Fig. 3. Presentation of 397 stocks in European Seas in a pressure (F/F_{msy}) – status (B/B_{msy}) plot, for the last years with available data (2013–2015). Red area: stocks that are being overfished or are outside of safe biological limits; yellow area: recovering stocks; green area: stocks subject to sustainable fishing pressure and of a healthy stock biomass that can produce high yields close to MSY. Several stocks are not shown because their fishing pressure was beyond the upper end of the X-axis. Note that several depleted stocks are not recovering despite zero commercial catches (lower left corner). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

F_{msy} exceeds 3.5. Several depleted stocks located at the lower left corner of the graph are not recovering despite zero commercial catches (Fig. 3).

The percentage of stocks that fulfill the requirements of the CFP varied among ecoregions (Fig. 4, Table 1). There is a remarkable north-south gradient, with over 60% of the stocks exploited sustainably with a biomass above the one that can produce MSY in the Barents Sea and Norwegian Sea, compared to less than 20% of stocks with these properties in the Mediterranean Sea ecoregions and the Black Sea (Fig. 4).

Independent stock assessment estimates of F_{msy} and F in the final year with available data were available for 93 (23%) out of the 397 stocks examined in this study (Fig. 5). A comparison of independent stock assessment estimates with those derived from this work shows that 62 stocks (67%) were less than 50% different from the independent stock assessment estimates. More importantly, in 76 stocks (82%) the F/F_{msy} estimates derived from this work came to the same classification of overfishing ($F > F_{msy}$) as the independent estimates. In 14 of the 17 diverging cases (82%), the independent stock assessments diagnosed overfishing, while this work proposed sustainable exploitation levels (Fig. 5).

3.2. Rebuilding of stock biomass

With the exploitation rates of 2013 carried forward to 2017 (Fig. 6), there was an overall increase of the percentage of stocks at or above B_{msy} from 17% to 28%. The fastest and highest rebuilding from 2018 onward was predicted under the 0.5 scenario, with overall 86% of the stocks recovered in 2030. The slowest rebuilding was predicted for the 0.95 scenario, with 54% of the stocks recovered in 2030. The 0.6 and the 0.8 scenarios were intermediate.

Looking at the regions, the fastest and highest rebuilding for the Northeast Atlantic was predicted under the 0.5 scenario, with overall 84% of the stocks recovered in 2030 (Fig. 6). The slowest rebuilding was predicted for the 0.95 scenario, with 63% of the stocks recovered in 2030. The 0.6 and the 0.8 scenarios were intermediate. In the Mediterranean and Black Sea, the fastest and highest rebuilding was predicted under the 0.5 scenario, with overall 87% of the stocks recovered in 2030. The slowest rebuilding was predicted for the 0.95 scenario, with 43% of the stocks recovered in 2030. The 0.6 and the 0.8 scenarios were intermediate.

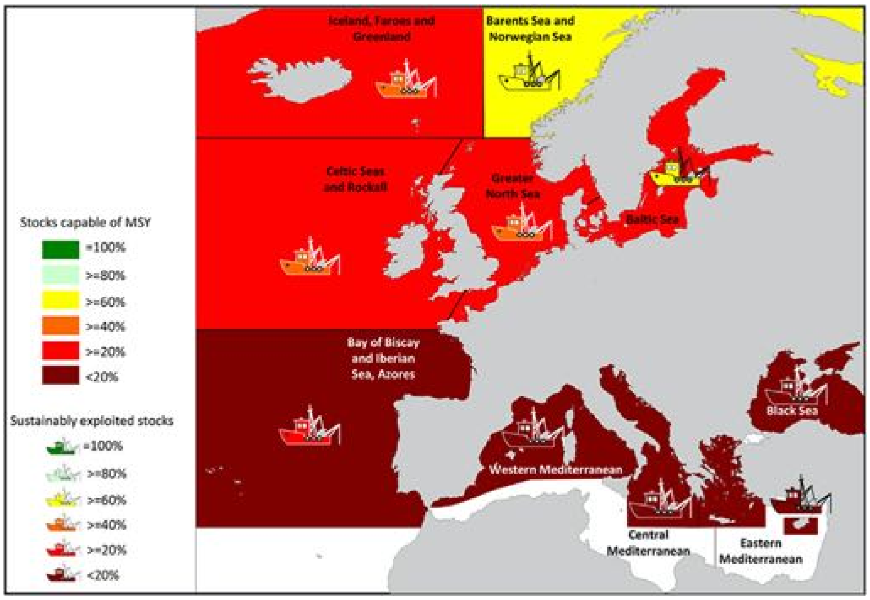

Fig. 4. Map of the European seas showing the compliance with the Common Fisheries Policy of the EU, for 357 stocks in 10 ecoregions, for the last years (2013–2015) with available data. The color of the areas indicates the percentage of stocks with sizes that are above the level that can produce maximum sustainable yields and the color of the fishing boats indicates the percentage of stocks that are exploited sustainably.

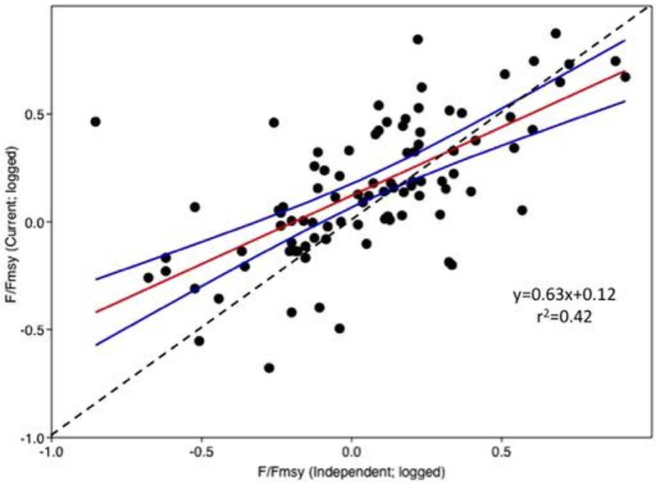

Fig. 5. Comparison of the F/F_{msy} (log-scale) by the present study with the corresponding independent estimates from official sources. The dashed line indicates the 1:1 relationship, suggesting that overexploitation may be even more severe than found by the methods used in this study.

3.3. Catch

Despite exploitation rates assumed constant from 2013 to 2017, overall catches were predicted to increase slightly from 8.5 million tonnes (Mt) in 2013 to 9.4 Mt in 2017 (Fig. 7), due to ongoing recovery of biomass in the Northeast Atlantic (stocks in the yellow and green areas of Fig. 3). Overall catches increase steeply in 2018 under the 0.8 and 0.95 scenarios, due to stronger exploitation of large stocks that were previously exploited at lower levels. In contrast, catches decrease from 9.4 in 2017 to 7.8 Mt in 2018 under the 0.5 scenario, mostly because under this scenario no fishing occurs on stocks outside of safe biological limits and less fishing occurs on stocks that were previously exploited above 0.5 F_{msy}. After 2018, overall catches decline under the 0.95 scenario to 13.7 Mt in 2030. Under the 0.8 scenario, catches increase to 14.2 Mt in 2030, an increase of more than 5 Mt. Under the 0.5 and 0.6 scenarios, catches are predicted to increase gradually to about 11.3 and 12.5 Mt in 2030, respectively.

Looking at the regions, catches in the Northeast Atlantic start at a high level of about 8 Mt in 2013. The predicted trends thereafter are very much identical to the overall catch trends described above (Fig. 7). In the Mediterranean and Black Sea, catches start at a much lower level of about 0.7 Mt in 2013, remain about stable until 2017, and then drop steeply in 2018 under all but the 0.95 scenario. The decline in catch is strongest under the 0.5 scenario, because under this scenario no fishing occurs in the many depleted stocks and because most Mediterranean stocks were previously exploited well above 0.5 F_{msy}. Despite strong differences in catches in 2018, the 0.95 and 0.5 scenarios lead to similar catches of about 0.8 Mt in 2030. The 0.6 scenario results in 0.9 Mt and the 0.8 scenario results in about 1 Mt. Note that uncertainty of catch predictions is considerably higher in the Mediterranean compared to the Northeast Atlantic, because of shorter or missing time series of abundance in the Mediterranean stock assessments.

3.4. Fisheries profitability

Profitability in fisheries is a function of the market value of the catch and of the cost of fishing [37]. Contrasting cost with the expected equilibrium yield (= expected catches after the same level of effort has been applied for sufficiently long time) was used for a first simple comparison of the long-term profitability of the different exploitation scenarios examined in this study (Fig. 8). Highest profitability was predicted for the 0.8 scenario, with 5% less for the 0.6 and 13% less for the 0.5 scenario. Long-term profitability of the 0.95 scenario cannot be predicted, because equilibrium yield assumes rebuilding of all stocks, an assumption that is strongly violated by the 0.95 scenario (see above).

Because of the uncertainties associated with the assumption of equilibrium catch, predicted profitability of fisheries from 2014 to 2030 was also estimated dynamically from the annual interplay of predicted biomass, catch and fishing mortality (Eq. (6)) for the respective aggregated values of the regions (Table 2).

Changes in mean profitability of European fisheries are reported relative to the year 2014 (Fig. 9). Under the 0.8 and 0.95 scenarios overall profitability increases steeply in 2018, because of increased fishing intensity in several large stocks that were previously exploited at lower rates. In 2019, profitability decreases in the 0.95 scenario and is thereafter more or less flat, at about 50% above the 2014 value. The other scenarios reach about 220% above the 2014 value in 2030 (Fig. 9). The profitability trends in the Northeast Atlantic are very similar to the overall trends described above, because catches in the

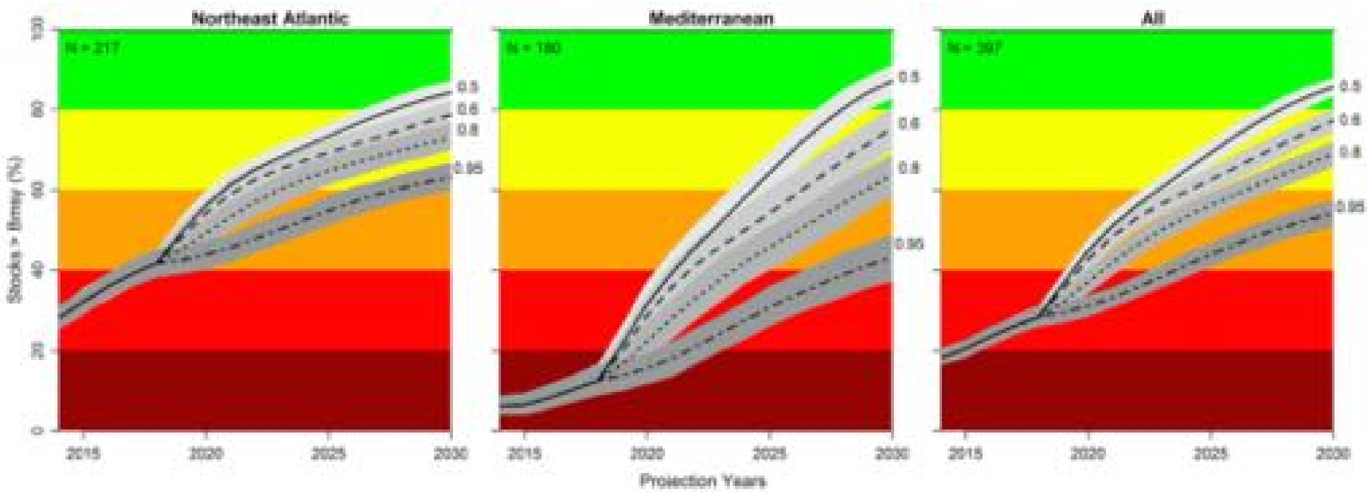

Fig. 6. Predicted percentage of stocks capable of producing MSY for the Northeast Atlantic, the Mediterranean and Black Sea and both areas combined under four different exploitation scenarios of F ranging from 0.5 to 0.95 F_{msy}. For the years 2014 to 2017, the same exploitation rates as in 2013 were assumed to project stock biomasses. The shaded areas indicate approximate 95% confidence limits.

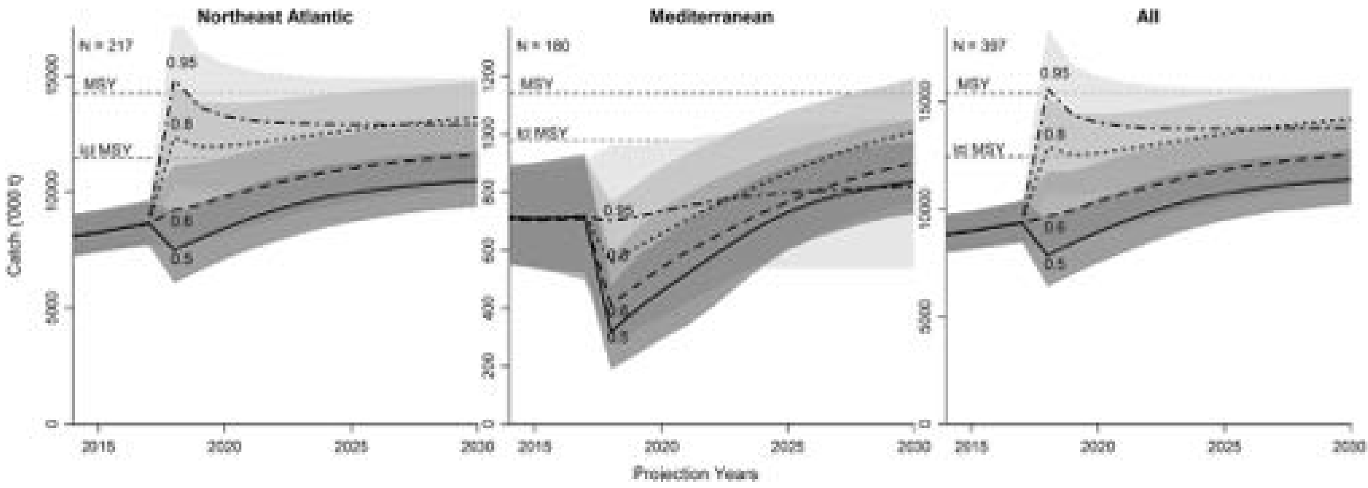

Fig. 7. Predicted cumulative catch for the Northeast Atlantic, the Mediterranean and Black Sea and both areas combined under four different exploitation scenarios of F ranging from 0.5 to 0.95 F_{msy}. The shaded areas indicate the range of uncertainty. Note different scales on the vertical axes, where catches are aligned relative to MSY; lcl MSY indicates the lower 95% confidence limit of MSY.

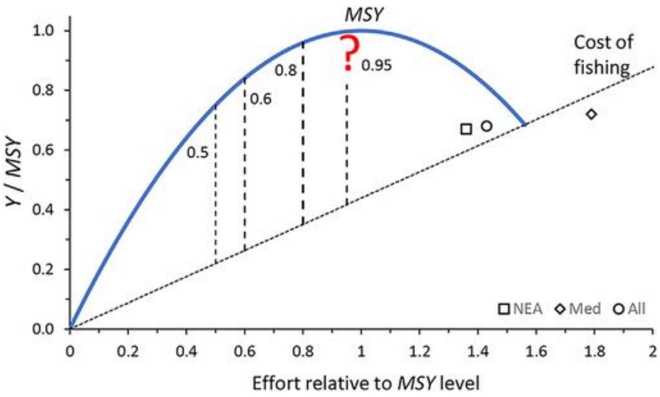

Fig. 8. Schematic exploration of the profitability of fishing, with cost of fishing assumed directly proportional to fishing mortality and expected catches indicated as equilibrium yields of a surplus production model. The three points indicate relative yield over relative effort for stocks with over 10,000 t of catch in 2013–2015. The vertical dashed lines indicate the potential maximum profits achievable under the scenarios explored in the study, highest at $F/F_{msy} = 0.8$ (100%), followed by 0.6 (95%) and 0.5 (87%), respectively. The profitability of the 0.95 scenario is questionable "?" because the equilibrium yield assumes that all depleted stocks have been rebuilt, an assumption that is strongly violated under this scenario.

Northeast Atlantic constitute about 90% of the total European catch. Predicted profitability in the Mediterranean and Black Sea increases steeply to about 3-fold in 2030 compared to 2014 in the 0.5, 0.6 and 0.8 scenarios. Under the 0.95 scenario, profitability first stagnates and then increases slowly to about 40% above the 2014 level in 2030 (Fig. 9).

3.5. Rebuilding of depleted stocks

In the context of this study, stocks are considered as depleted if stock size falls below half of B_{msy}. The percentage of depleted stocks is predicted to decrease until 2030 under all scenarios, albeit with large differences. Across all stocks, 37% remain depleted under the 0.95 scenario. The 0.5 scenario leads to the most substantial reduction in depleted stocks, with 8% remaining in 2030. Under the 0.6 and 0.8 scenarios, the percentage of depleted stocks decreases about linearly to 12% and 14% in 2030, respectively (Fig. 10).

The recovery of depleted stocks in the Northeast Atlantic starts from a level of 35% in 2018 and reaches 29% in 2030 under the 0.95 scenario (Fig. 10). The 0.5 scenario leads to the fastest reduction in depleted stocks, with 9% remaining in 2030. Under the 0.6 and 0.8 scenarios, the percentage of depleted stocks decreases about linearly to about 13% and 15% in 2030, respectively. In the Mediterranean and Black Sea, recovery of depleted stocks starts from a high level of 56% in 2018 and reaches 46% in 2030 under the 0.95 scenario. The 0.5 scenario leads to the fastest reduction in depleted stocks, with 6% remaining in 2030. Under the 0.6 and 0.8 scenarios, the percentage of depleted stocks decreases about linearly to about 10% and 14% in 2030, respectively (Fig. 10).

4. Discussion

4.1. General considerations

For the purpose of comparing the impact of different future fishing scenarios on the rebuilding of 397 stocks and profitability of the respective fisheries, a number of simplifying assumptions were made: (1)

Table 2

Mean predicted profitability index of fisheries and approximate 95% confidence intervals (C.I.) were estimated from the interplay of predicted biomass, catch and fishing mortality (Eq. (6)) for the respective aggregated values of the Mediterranean and Black Sea (MED); the Northeast Atlantic (NEA); and the regions combined (All). Estimates are shown for the year 2014 and for 2030 under four exploitation scenarios ranging from 0.5 to 0.95 Fmsy.

		NEA				MED				ALL			
		Mean	**C.I.**			**Mean**	**C.I.**			**Mean**	**C.I.**		
	2014	3.74	3.29	–	4.19	2.11	1.59	–	2.66	5.22	4.55	–	5.90
2030 scenario	**0.5**	9.32	9.08	–	9.54	8.30	8.02	–	8.58	17.38	17.00	–	17.78
	0.6	9.51	9.19	–	9.83	8.20	7.79	–	8.61	17.45	16.91	–	17.94
	0.8	9.68	9.34	–	10.05	8.23	7.76	–	8.72	17.50	16.91	–	18.07
	0.95	6.06	5.47	–	6.70	3.03	2.11	–	3.99	8.53	7.36	–	9.58

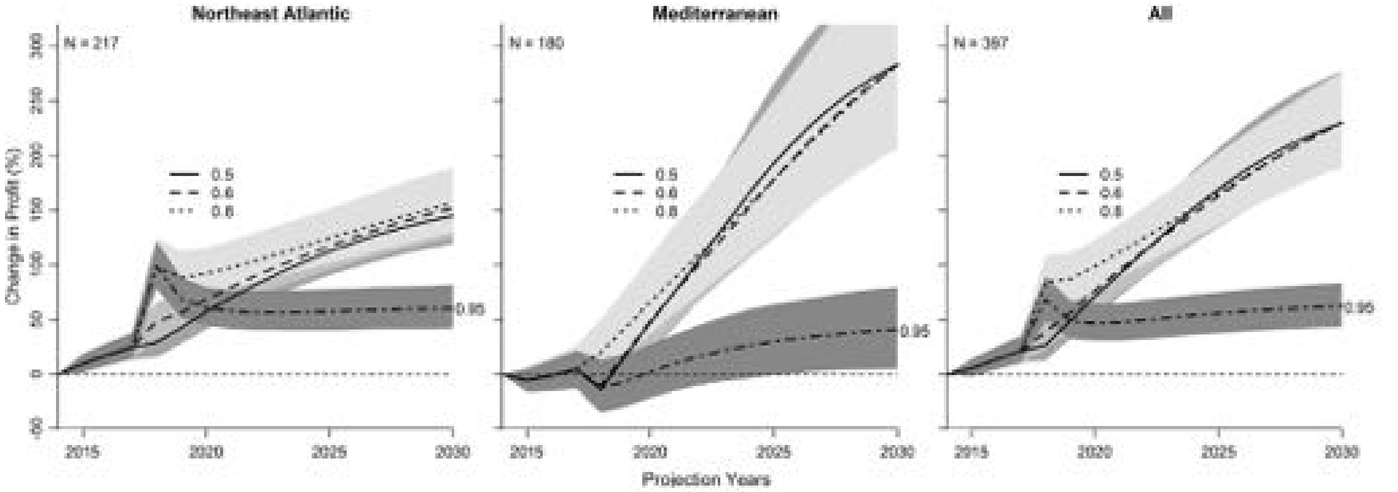

Fig. 9. Predicted profitability relative to the one in 2014 for the Northeast Atlantic, the Mediterranean and Black Sea and both areas combined under four different exploitation scenarios. The shaded areas indicate the range of uncertainty.

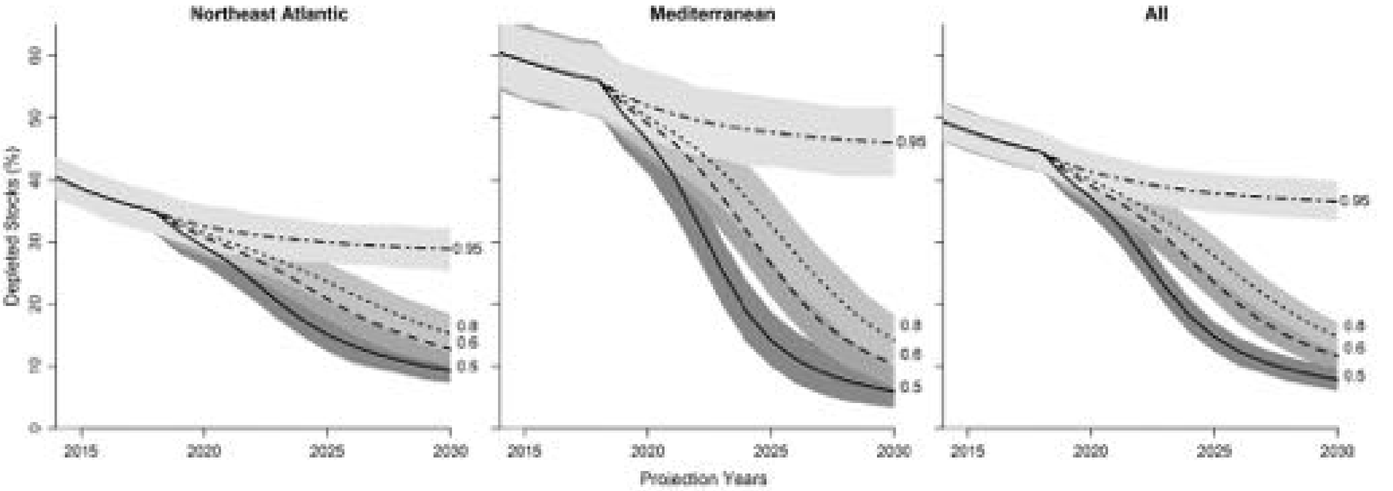

Fig. 10. Predicted percentage of depleted stocks in European waters for the Northeast Atlantic, the Mediterranean and Black Sea and both areas combined under four different exploitation scenarios. The shaded areas indicate the range of uncertainty.

environmental conditions and biological properties of the examined stocks were assumed to remain the same as they were in the last years with available data (2013–2015); (2) cost of fishing relative to effort were assumed to remain the same as they were in the year 2014; (3) the price of fish was assumed to remain constant and independent from supply; and (4) all fisheries were assumed to be profitable under all scenarios.

These assumptions are highly unlikely to be met by all considered stocks and fisheries over the projected period until 2030. However, the purpose of this study was not to provide the most realistic biomass, catch and profit estimates for all individual fisheries, but rather to get an overall impression of the performance of different future exploitation scenarios relative to each other. Cases where some of the assumptions are likely to be violated in a given scenario are pointed out below.

4.2. Stock status and exploitation

This is the first extensive assessment-based meta-analysis of all European stocks and an important step towards the implementation of the CFP requirements. The 181 assessed stocks of the northeast Atlantic and the 7 stocks of the Black Sea represent over 60% of total landings in these areas, while the 169 assessed stocks of the Mediterranean Sea represent around 50% of the total Mediterranean landings [25]. The missing landings consist mostly of catches not identified to the species level [25]. Previous assessments in the NE Atlantic were available only for 50 stocks [7], whereas previous assessments in the Mediterranean Sea represent around 25% of total landings and involved 24 species and 125 stocks that were assessed at a very narrow geographical range [11].

The stock status estimates of the present work were comparable with the results from corresponding age structured stock assessments such as provided as advice to the European Commission by ICES in the Northeast Atlantic and STECF in the Mediterranean. Looking at the discrepancies, the results of this study tended to be more optimistic in suggesting lower exploitation levels than the official stock assessments (Fig. 5).

Several independent studies agree with the present work on the general pattern that up to 2015, most European stocks were subject to high fishing pressure with a resulting overall decline in biomass, but with declining degree of overfishing and some improvements in stock size in northern Europe. For example, in their evaluation of the status and exploitation of 41 fish stocks of the NE Atlantic, Cardinale et al. [10] report improved exploitation status for the most important stocks within a decade following the 2002 CFP reform. Gascuel et al. [14] examined the catches of major stocks in the European waters of the Atlantic Ocean and report a decline in catches since the mid 1970s as a result of overexploitation. In recent years, the stock indicators these authors used show declining fishing mortality and stable spawning stock biomass in most areas [10,14]. In the cases of the Mediterranean and the Black Seas, a decline in catches and stock biomass has been recently shown to occur for the entire area [16,18,19,40]. Colloca et al. [18] collected the output of all stock assessments in the Mediterranean and concluded that over 90% of the assessed stocks are overexploited. Out of the seven stocks that have been recently assessed in the Black Sea, one (European sprat *Sprattus spattus*) is sustainably exploited, one is depleted (piked dogfish *Squalus acanthias*) and the remaining ones are overexploited [21].

The remarkable north-south gradient in fishing pressure and stock size (Fig. 4) is confirmed by Fernandes et al. [41] who examined 95 assessments in European waters and report 19 sustainable stocks in the Northeast Atlantic and none in the Mediterranean.

The better condition of the Atlantic stocks may partly be due to the improved fisheries management in the wealthy countries of northern Europe, the long time series of available data, and the early establishment of research and academic institutions focused on fisheries science [42,43]. For example, ICES stock assessments in the North Sea are available since the 1950s [14]. In contrast, the Mediterranean, which has been exploited for millennia, suffers from fleet overcapacity, illegal and unreported catches, unselective harvesting and lack of coordination among Mediterranean countries [11,12]. Furthermore, Cardinale and Scarcella [22] argue that the major reasons for the bad status of Mediterranean Sea stocks include the ineffectiveness of the current effort system to control fishing mortality, the continuous non-adherence to the scientific advice and inadequacies of existing national management plans as a key management measure. Stock assessments in the Mediterranean have a history of less than 20 years but are increasing in numbers and geographical coverage since 2010 [23].

In their evaluation of the world's unassessed fisheries, Costello et al. [44] analyzed hypothetical stocks that were defined as country/area combinations, instead of using real stocks based on working group decisions on stock delineations and the best available data, as in the present work. Their median B/B_{msy} ratio was calculated as 0.58 for the Northeast Atlantic, the Mediterranean and Black Sea. Thus, despite methodological differences, the work by Costello et al. [44] confirms that a large proportion of European stocks are outside of safe biological limits.

In a global meta-analysis of overexploited marine populations, Neubauer et al. [45] report reduced resilience of stocks that collapsed or suffered from prolonged and intense overexploitation, thus confirming the results obtained in this study.

4.3. Evaluating the different exploitation scenarios

The four future fishing scenarios explored in this study assume that the respective harvest control rules are enforced and followed and that catches include illegal, unreported and unregulated (IUU) removals. While inclusion of IUU removals in total allowed catches is common practice in ICES advice [46], this may be a challenge in the Mediterranean and Black Sea [47].

The 0.5 scenario was the only one to include a stop of fishing for stocks outside of safe biological limits, assumed here for biomass less than half of the biomass that can produce MSY, because at such low stock sizes recruitment may be impaired [6,48–51]. The 0.5 scenario was the fastest and best in reducing the number of depleted stocks and in rebuilding the biomass of stocks above MSY-levels. Thus, if fast rebuilding and best recovery of depleted stocks with high profitability of the fisheries are the main objectives of management and lower catches (about 80% of highest catch) are acceptable, then the 0.5 scenario should be considered. In that case special measures should be implemented to help the fishers through the initial year with reduced catch [52], especially in the Mediterranean.

The 0.6 scenario provides fast rebuilding in the first years, but then slows down and results in 10–20% fewer rebuilt stocks in 2030 than under the 0.5 scenario. Reduction of depleted stocks is also slower in this scenario, but still good with only 10–12% depleted stocks remaining in 2030. Profitability under this scenario increases fast and to a high level. Thus, if reasonably fast rebuilding and high profitability of the fisheries are the main objectives of management but a temporary drop in catches such as in the 0.5 scenario is unwanted, then the 0.6 scenario should be considered.

Under the 0.8 scenario, only 73% of the stocks in the Northeast Atlantic and only 64% of the stocks in the Mediterranean are predicted to rebuild by 2030. There is a strong increase in catches in 2018 in the Northeast Atlantic. In the Mediterranean, this scenario predicts the highest catches and profitability. About 15% of the stocks remain depleted in 2030. Biomass increases in the Mediterranean but remains about unchanged after 2018 in the Northeast Atlantic and overall. Thus, if high catch and high profitability are the main objective of management and slow rebuilding is deemed tolerable, then the 0.8 scenario should be considered.

An $F = F_{msy}$ scenario was not applied because, by definition, such scenario is not capable of rebuilding stock size above the *MSY*-level as required by the CFP, and the *MSY*-level itself is approached asymptotically and reached in infinite time. Instead, the 0.95 scenario was explored as a possible but least ambitious attempt to rebuild stocks above the *MSY*-level. Under this scenario, rebuilding of stocks is slowest with about 90% of the depleted stocks being unable to recover. Profitability is far below that of the other scenarios in the medium and long-term. Given the slow rebuilding, the inability to recover the most depleted stocks, long-term catches below those of other scenarios, and lowest profitability, the 0.95 scenario is not seen as viable option for management. Moreover, because of this list of problems it is questionable whether this scenario would comply with the CFP [6]. Note also that catches under this scenario may be too optimistic, because the assumption may be wrong that stocks that were exploited at much lower levels in 2013–2015 can be legally and profitably exploited at 0.95 Fmsy from 2018 onward.

Although the degree of required reduction of fishing pressure is unclear due to the inconsistency in Art. 2 § 2 of the Basic Regulation [6,53], the rebuilding of stocks above *MSY* must be viewed from the perspective of long-term environmental and social sustainability as emphasized throughout the CFP. The preamble to the Basic Regulation, which clearly emphasizes sustainability, serves as a guidance for interpretation of the CFP. Additionally, Art. 3 lit. d) of the Basic Regulation fosters “a long term perspective” as a principle of good governance applicable in the context of the CFP. Hence, in the 0.95 scenario that only marginally achieves a rebuilding of stocks above MSY and in the light of its low profitability one can argue that the CFP's objectives would not be met. Note that the CFP implicitly recognizes the need for rebuilding age and size structure by calling for the establishment of minimum conservation reference body sizes to be derived under consideration of the size at maturity (Article 4 of CFP) and for the establishment of fish stock recovery areas (Article 8 of CFP).

4.4. Suitability of surplus production models for stock assessment

The conclusions of this study are based on 397 stock assessments that used an advanced implementation of a surplus production model [24]. Species interactions and environmental impact are implicitly considered in such models by the rate of net productivity or intrinsic rate of population increase (r), which summarizes natural mortality such as caused by predation by other species, somatic growth such as modulated by available food sources, and recruitment such as impacted by environmental conditions and by parental egg production [32,54]. In addition, the applied model accounted explicitly for reduced recruitment at small stock sizes [24,55].

Note, however, that surplus production models do not account for size and age structure and tend to overestimate sustainable productivity in stocks where excessive fishing pressure has truncated the age structure [56], decreased age at maturity and generation time [57], and increased somatic growth due to reduced competition for food [58]. Compared with age-structured models where exploitation is typically reported for a narrow range of fully selected age classes, surplus production models estimate exploitation as total catch to total biomass ratio. This is similar to using the mean exploitation rate across all age classes weighted by their respective contribution to the catch. If the catch consists to a large part of juveniles that are only partly selected by the gear, then the overall rate of fishing mortality strongly underestimates the fishing mortality of the fully selected older year classes. Here, this problem was addressed by accounting for reduced recruitment and reduced productivity in depleted stocks (Eqs. 3 and 4).

The danger of uncritical use of surplus production models is visible in the assessment of 166 stocks by Worm et al. [59], where several constraints in the model biased the results and no correction for reduced recruitment and thus reduced productivity in depleted stocks was made. The constraints and uncritical application of the model contributed to the result that "[i]n 5 of 10 well-studied ecosystems, the average exploitation rate has recently declined and is now at or below the rate predicted to achieve maximum sustainable yield for seven systems" [59]. This surprisingly positive result is in stark contrast to other studies that found global fisheries in overall decline, despite some local improvements [4,5,40,60–63]. Looking at the 12 ecoregions supporting the 397 stocks analyzed in this study (Table 1), including nine large marine ecosystems also analyzed in Worm et al. [59], no region had an average exploitation rate at or below the rate predicted to achieve maximum sustainable yields (Table 1). Similarly, Rosenberg et al. [64] apply a combination of four data-limited methods with strong known biases [24,65] and no corrections for reduced recruitment to global catch data and conclude that, e.g., half of the stocks in the Northeast Atlantic and the Mediterranean and Black Sea have a biomass near or above B_{msy} in 2013, whereas our more detailed study shows that this applies to only 28% and 5% of these stocks, respectively.

4.5. *Relation among catch, biomass and profitability*

The profitability of a fishery is determined by the discounted difference between the revenues – the market value of the catch, with prices assumed here constant – and the cost of fishing, assumed here directly proportional to fishing mortality [66]. Note that there may be cases where increased catches lead to lower and reduced catches lead to higher market prices [67]. In such case, our assumption of constant prices tends to underestimate profitability at lower catches (thus overestimating the economic costs of rebuilding the stocks) and tends to overestimate the profitability at higher catches (thus underestimating the economic benefit of rebuilding). However, given the growing seafood consumption and thus demand in Europe [68], the decline of market price with increased regional catches may be compensated by the overall trend of increasing seafood prices. In order to focus on the comparison of future exploitation scenarios, this study ignored this and other economic sources of uncertainty. Therefore, under the assumptions of constant prices and constant cost per unit of fishing effort, the low profitability of the 0.95 scenario stems from higher cost associated with higher effort and slow and incomplete rebuilding of biomass, which leads to lower catches and thus low fishing revenues.

4.6. *The fallacy of 'High F is good for the fishery'*

In a 2011 World View article on the European fisheries reform [43], the prescriptions of the reformed CFP were praised, but its chances of success were questioned, given that implementation depended on the same people and institutions who had, for decades, justified and administered overfishing. Despite the well-established negative effects of overfishing on exploited populations [61,69], there is a widespread misconception among fisheries managers and fishing lobbyists that a high fishing mortality F is good for the fishery. This is visible in the request of the European Commission to its advisory body to provide "ranges of F_{msy}" including values larger than F_{msy} [7]. The CFP gives another example for this misconception in the preamble to the Basic Regulation where it is stated that exploitation rates above the level that can produce the *MSY* can be postponed "if achieving them by 2015 would seriously jeopardize the social and economic sustainability of the fishing fleets involved". Indeed, in the short term, catch equals F multiplied by the mean biomass [32], and thus the higher F, the higher the immediate catch. However, a high catch in the short term reduces future fish abundance [32] and thus reduces fishing revenues in the long term. Moreover, there are socio-economic trade-offs in fisheries: Employment in the fishery scales positively with F, but profitability scales negatively with F [70,71]. Increasing employment when profits are declining is not an economically viable option. Instead, economic sustainability of fisheries requires a reduction of fishing mortality. The EU policy of keeping fishing effort high undermines the long-term economic viability of fisheries, such as currently experienced in most European fisheries [37]. Sustainable fisheries management should not strive for the highest possible *F* and the associated short-term gain, but rather for fishing mortalities well below the maximum, thus sustaining fish populations and economic viability of fisheries in the medium and long term [72].

5. Conclusions

The concept of "pretty good yield" (PGY) was introduced by Alec MacCall (National Marine Fisheries Service, Santa Cruz, CA, USA, retired) at the Mote Symposium in Florida in 2000, proposing catches of about 80% or more of *MSY* as a meaningful and realistic target. The concept has been embraced by fisheries scientists because it deals with the fact that *MSY* itself is an often unknown, unobtainable or undesirable target [54,73,74]. In this study, rebuilding time, catch and profitability were examined for 397 stocks in the Northeast Atlantic, the Mediterranean and the Black Sea under four exploitation scenarios, all resulting in pretty good yields for most stocks. Implementation of one of the described scenarios would be straightforward for the stocks in the Northeast Atlantic which are already managed with total allowable catches (TACs) based on exploitation rates and harvest control rules for depleted stocks. The next meeting of the responsible EU ministers could set the respective TACs for the next years according to the selected scenario. For the Mediterranean and Black Sea implementation is a much larger and complicated problem as no TACs exist (except for Bluefin tuna *Thunnus thynnus* and swordfish *Xiphias gladius* starting in 2017) and management is mainly based on effort control and technical measures, with problematic enforcement and confounding effects [22]. In addition, numerous third countries are involved in the fisheries of wide-ranging species, with different objectives from the CFP and often no control or enforcement [75]. Such obstacles must be addressed and solved through better cooperation in the framework of the regional fisheries management organizations, so that all countries contribute to and benefit from the rebuilding of the stocks. Within this context, the CFP correctly foresees regionalization for a number of instruments and measures: multiannual plans, discard plans, establishment of fish stock recovery areas and conservation measures necessary for compliance with obligations under EU environmental legislation.

In summary, rebuilding of fish stocks in European waters is not only required by the CFP but also possible and, depending on the chosen management regime, would likely lead within a few years to pretty good catches and substantially higher profits for the fishers, with significant positive economic consequences for the fishing sector [76].

Acknowledgements

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.marpol.2018.04.018.

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Supplementary Table S1. *Analysis of 397 stocks in European waters [Mediterranean and Black Sea (MED); Northeast Atlantic (NEA)], with indication of Last Year with available data, Last Catch in tonnes, fishing mortality relative to the one that can produce the maximum sustainable yield* (F/F_{msy}) *corrected for reduced productivity in case of reduced recruitment (Equation 5), and biomass relative to the one that can produce the maximum sustainable yield* (B/B_{msy})*. Predictions for Catch and B/Bmsy are shown for the year 2030 under four exploitation scenarios ranging from 0.5 to 0.95* F_{msy}*. [BoB stands for Bay of Biscay]*

Region	Ecoregion	Species	Stock ID	Last Year	Last Catch (t)	F/F_{msy}	B/B_{msy}	Catch (t) scenario 2030				B/Bmsy scenario 2030			
								0.5	0.6	0.8	0.95	0.5	0.6	0.8	0.95
MED	Adriatic Sea	*Atherina boyeri*	Athe_boy_AD	2014	348	0.45	0.37	1,981	2,214	2,532	2,651	1.43	1.34	1.14	1.01
MED	Adriatic Sea	*Belone belone*	Belo_bel_AD	2014	4	0.29	0.19	129	141	158	159	1.41	1.29	1.08	0.91
MED	Adriatic Sea	*Bolinus brandaris*	Boli_bra_AD	2015	900	0.84	1.04	777	870	995	1,034	1.5	1.4	1.2	1.05
MED	Adriatic Sea	*Boops boops*	Boop_Boo_AD	2014	103	1.8	0.13	699	427	329	36	0.87	0.47	0.36	0.02
MED	Adriatic Sea	*Chamelea gallina*	Cham_gal_AD	2014	13,984	1.5	0.42	19,140	21,227	23,927	24,573	1.47	1.36	1.15	1
MED	Adriatic Sea	*Conger conger*	Cong_con_AD	2014	93	3.07	0.34	64	51	53	11	0.99	0.67	0.52	0.09
MED	Adriatic Sea	*Dentex dentex*	Dent_den_AD	2014	33	1.74	0.3	67	69	75	37	1.3	1.13	0.91	0.38
MED	Adriatic Sea	*Engraulis encrasicolus*	Engr_enc_AD	2013	32,761	1.31	0.7	26,631	29,771	33,876	35,104	1.49	1.39	1.19	1.03
MED	Adriatic Sea	*Homarus gammarus*	Hom_gam_AD	2013	6	1.75	0.24	18	17	18	4	1.18	0.92	0.73	0.15
MED	Adriatic Sea	*Illex coindettii*	Ille_coi_AD	2013	688	1.05	0.32	2,396	2,681	3,057	3,172	1.5	1.4	1.19	1.04
MED	Adriatic Sea	*Loligo vulgaris*	Loli_vul_AD	2013	100	0.89	0.2	870	895	973	542	1.25	1.07	0.87	0.41
MED	Adriatic Sea	*Lophius* spp.	Lophius_AD	2013	250	0.93	0.72	280	313	357	373	1.48	1.38	1.19	1.04
MED	Adriatic Sea	*Merluccius merluccius*	Merl_mer_AD	2013	9,542	4.05	0.24	11,296	8,419	7,815	525	1.08	0.67	0.48	0.03
MED	Adriatic Sea	*Micromesistius poutassou*	Micr_pou_AD	2013	132	0.55	0.36	695	777	887	924	1.48	1.38	1.18	1.04
MED	Adriatic Sea	*Mullus barbatus*	Mull_bar_AD	2013	3,373	1.68	0.51	2,862	3,125	3,468	3,269	1.45	1.32	1.1	0.87
MED	Adriatic Sea	*Oblada melanura*	Obla_mel_AD	2014	34	3.6	0.16	137	151	168	3	1.49	1.38	1.15	0.02
MED	Adriatic Sea	*Pagellus erythrinus*	Page_ery_AD	2013	79	1.76	0.25	211	205	218	61	1.18	0.95	0.76	0.18
MED	Adriatic Sea	*Palinurus elephas*	Pali_ele_AD	2014	10	0.79	0.36	28	32	36	38	1.19	1.11	0.95	0.85
MED	Adriatic Sea	*Pecten jacobeus*	Pect_jac_AD	2015	50	0.77	0.19	640	690	760	652	1.4	1.26	1.04	0.75
MED	Adriatic Sea	*Peneaus kerathurus*	Pena_ker_AD	2015	528	0.91	1.22	358	401	458	476	1.5	1.4	1.2	1.05
MED	Adriatic Sea	*Sardina pilchardus*	Sard_pil_AD	2013	59,814	1.58	0.57	48,951	54,257	61,159	62,872	1.47	1.36	1.15	0.99
MED	Adriatic Sea	*Scophthalmus maximus*	Pset_max_AD	2013	8,134	0.93	1.17	5,590	6,260	7,165	7,482	1.49	1.39	1.2	1.05
MED	Adriatic Sea	*Scophthalmus rhombus*	Scop_rho_AD	2015	65	1.55	0.26	211	219	237	120	1.33	1.15	0.94	0.4
MED	Adriatic Sea	*Sepia officinalis*	Sepi_off_AD	2015	3,411	2.14	0.46	2,542	2,412	2,465	154	1.33	1.05	0.81	0.04
MED	Adriatic Sea	*Seriola dumerili*	Seri_dum_AD	2014	93	1.27	1.34	41	46	53	55	1.5	1.4	1.2	1.05
MED	Adriatic Sea	*Solea solea*	Sole_sol_AD	2015	2,151	2.06	0.6	1,266	1,336	1,431	70	1.46	1.28	1.03	0.04
MED	Adriatic Sea	*Spondyliosoma cantharus*	Spod_can_AD	2014	9	2.03	0.22	30	28	29	3	1.3	1.02	0.79	0.07
MED	Adriatic Sea	*Squilla mantis*	Squi_man_AD	2014	3,150	1.09	0.7	2,999	3,351	3,823	3,990	1.46	1.36	1.16	1.02
MED	Adriatic Sea	*Trachurus* spp.	Trachurus_AD	2014	680	0.92	0.39	1,659	1,849	2,101	2,189	1.4	1.3	1.11	0.98
MED	Adriatic Sea	*Trisopterus minutus*	Tris_min_AD	2013	115	3.67	0.29	115	95	91	3	1.25	0.86	0.61	0.01
MED	Aegean Sea	*Atherina boyeri*	ATHEBOY_AL	2014	45	1.09	0.19	445	496	562	567	1.49	1.39	1.18	1
MED	Aegean Sea	*Belone belone*	BELOBEL_AL	2014	57	2.19	0.22	161	148	151	13	1.25	0.95	0.73	0.05
MED	Aegean Sea	*Boops boops*	BOOPBOO_AL	2014	4,387	1.01	0.51	6,361	7,119	8,121	8,433	1.5	1.4	1.19	1.04
MED	Aegean Sea	*Dentex dentex*	DENTDEN_AL	2014	123	1.18	0.47	156	173	197	206	1.33	1.24	1.06	0.93

Region	Ecoregion	Species	Stock ID	Last Year	Last Catch (t)	F/F_{msy}	B/B_{msy}	Catch (t) scenario 2030				B/Bmsy scenario 2030			
								0.5	0.6	0.8	0.95	0.5	0.6	0.8	0.95
MED	Aegean Sea	*Dentex macrophthalmus*	DENTMAC_AL	2014	385	1.08	0.84	317	355	406	421	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Dicentrarchus labrax*	DICELAB_AL	2014	221	3.06	0.28	332	339	356	16	1.41	1.2	0.95	0.04
MED	Aegean Sea	*Diplodus annularis*	DIPLANN_AL	2014	112	1.47	0.34	234	256	285	285	1.39	1.26	1.06	0.89
MED	Aegean Sea	*Diplodus sargus*	DIPLSAR_AL	2014	136	2.51	0.27	254	248	257	16	1.39	1.13	0.88	0.05
MED	Aegean Sea	*Eledone moschata*	ELEDMOS_AL	2014	430	0.86	0.75	495	554	634	660	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Engraulis encrasicolus*	ENGRENC_AL	2014	20,320	1.54	0.69	14,441	16,171	18,464	19,153	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Epinephelus marginatus*	EPINGUA_AL	2014	49	2.73	0.33	36	28	26	6	0.88	0.57	0.44	0.07
MED	Aegean Sea	*Illex coindetii*	ILLECOI_AL	2014	1,015	1.27	0.83	722	808	921	955	1.49	1.39	1.19	1.04
MED	Aegean Sea	*Loligo vulgaris*	LOLIVUL_AL	2014	494	1.29	0.63	448	500	567	587	1.47	1.37	1.17	1.02
MED	Aegean Sea	*Lophius budegassa*	LOPHBUD_AL	2014	557	1.39	0.49	595	662	747	770	1.44	1.34	1.13	0.98
MED	Aegean Sea	*Melicertus kerathurus*	PENAKER_AL	2014	1,450	1.03	0.73	1,451	1,624	1,854	1,927	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Merluccius merluccius*	MERLMER_AL	2014	2,610	1.57	0.52	2,390	2,669	3,030	3,120	1.5	1.39	1.18	1.03
MED	Aegean Sea	*Micromesistius poutassou*	MICMPOU_AL	2014	524	2.51	0.28	740	616	613	58	1.12	0.77	0.58	0.05
MED	Aegean Sea	*Mullus barbatus*	MULLBAR_AL	2014	1,920	1.97	0.39	2,208	2,151	2,234	153	1.38	1.12	0.87	0.05
MED	Aegean Sea	*Mullus surmuletus*	MULLSUR_AL	2014	1,474	1.75	0.45	1,551	1,698	1,874	129	1.48	1.35	1.12	0.06
MED	Aegean Sea	*Nephrops norvegicus*	NEPRNOR_AL	2014	228	4.01	0.19	445	384	395	65	1.12	0.8	0.62	0.09
MED	Aegean Sea	*Octopus vulgaris*	OCTOVUL_AL	2014	1,992	1.15	0.51	2,564	2,870	3,277	3,401	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Pagellus erythrinus*	PAGEERY_AL	2014	421	1.06	0.62	481	538	613	637	1.48	1.38	1.18	1.03
MED	Aegean Sea	*Pagrus pagrus*	PAGRPAG_AL	2014	630	1.3	0.62	582	650	739	765	1.49	1.38	1.18	1.03
MED	Aegean Sea	*Palinurus elephas*	PALIELE_AL	2014	116	1.23	0.77	85	95	109	114	1.38	1.29	1.11	0.98
MED	Aegean Sea	*Parapeneaus longirostris*	PARELON_AL	2014	749	2.62	0.35	858	955	1,062	11	1.5	1.39	1.16	0.01
MED	Aegean Sea	*Pomatomus saltatrix*	POMTSAL_AL	2014	110	1.61	0.37	187	209	237	243	1.5	1.39	1.19	1.02
MED	Aegean Sea	*Raja clavata*	RAJACLA_AL	2014	368	0.99	0.57	442	494	567	598	1.35	1.26	1.08	0.96
MED	Aegean Sea	*Sardina pilchardus*	SARDPIL_AL	2014	18,130	1.07	0.66	19,015	21,282	24,286	25,227	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Sardinella aurita*	SARIAUR_AL	2014	2,407	1.15	0.75	2,088	2,338	2,672	2,776	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Sarpa salpa*	SARPSAL_AL	2014	180	2.15	0.3	338	360	382	4	1.47	1.31	1.04	0.01
MED	Aegean Sea	*Scomber colias*	SCOMPNE_AL	2014	2,237	1.82	0.26	6,496	7,024	7,649	543	1.47	1.32	1.08	0.06
MED	Aegean Sea	*Scomber scombrus*	SCOMSCO_AL	2014	109	1.09	0.17	1,260	1,290	1,378	227	1.39	1.19	0.95	0.13
MED	Aegean Sea	*Scophthalmus maximus*	PSETMAX_AL	2014	82	1.45	0.61	68	76	87	89	1.48	1.37	1.17	1.01
MED	Aegean Sea	*Sepia officinalis*	SEPIOFF_AL	2014	1,031	0.94	0.62	1,309	1,465	1,673	1,739	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Solea solea*	SOLEVUL_AL	2014	420	2.32	0.27	816	754	762	52	1.28	0.98	0.74	0.04
MED	Aegean Sea	*Spicara smaris*	SPICSMA_AL	2014	1,274	2.18	0.21	3,629	3,111	3,169	430	1.13	0.81	0.62	0.07
MED	Aegean Sea	*Spondyliosoma cantharus*	SPODCAN_AL	2014	80	2.59	0.23	194	182	186	11	1.32	1.03	0.79	0.04
MED	Aegean Sea	*Squalus acanthias*	SQUAACA_AL	2014	103	1.38	0.55	86	96	109	114	1.27	1.18	1.01	0.89
MED	Aegean Sea	*Trachurus mediterraneus*	TRACHMED_AL	2014	1,720	0.92	0.35	5,700	6,363	7,229	7,499	1.47	1.37	1.17	1.02
MED	Aegean Sea	*Trachurus trachurus*	TRACTRA_AL	2014	700	0.71	0.61	1,213	1,359	1,553	1,615	1.5	1.4	1.2	1.05
MED	Aegean Sea	*Umbrina cirrosa*	UMBRCIR_AL	2014	14	2.46	0.26	33	36	40	0	1.5	1.38	1.15	0.01
MED	Aegean Sea	*Zeus faber*	ZEUSFAB_AL	2014	269	1.92	0.48	228	235	241	3	1.47	1.27	0.97	0.01
MED	Balearic	*Aristeomorpha foliacea*	ARISFOL_BA	2014	10	1.56	0.29	28	30	33	31	1.44	1.31	1.09	0.84
MED	Balearic	*Aristeus antennatus*	ARITANT_BA	2014	1,629	1.71	0.51	1,358	1,489	1,652	1,294	1.46	1.34	1.11	0.73
MED	Balearic	*Boops boops*	BOOPBOO_BA	2014	6,615	1.48	0.54	6,201	6,933	7,881	8,144	1.49	1.39	1.19	1.03

Region	Ecoregion	Species	Stock ID	Last Year	Last Catch (t)	F/F_{msy}	B/B_{msy}	Catch (t) scenario 2030				B/Bmsy scenario 2030			
								0.5	**0.6**	**0.8**	**0.95**	**0.5**	**0.6**	**0.8**	**0.95**
MED	Balearic	*Conger conger*	CONGCON_BA	2014	131	2.86	0.2	284	241	250	51	1	0.71	0.55	0.1
MED	Balearic	*Engraulis encrasicolus*	ENGRENC_BA	2014	22,203	1.2	0.56	23,924	26,671	30,261	31,411	1.44	1.34	1.14	1
MED	Balearic	*Lepidorhombus whiffiagonis*	LEPIWHI_BA	2014	19	1.64	0.23	84	93	104	19	1.49	1.37	1.14	0.18
MED	Balearic	*Loligo vulgaris*	LOLIVUL_BA	2014	361	1.1	0.36	837	929	1,049	1,089	1.33	1.23	1.04	0.91
MED	Balearic	*Merluccius merluccius*	MERLMER_BA	2014	3,028	4.79	0.24	3,526	3,271	3,373	395	1.24	0.96	0.74	0.07
MED	Balearic	*Micromesistius poutassou*	MICMPOU_BA	2014	1,222	2.12	0.23	2,731	2,179	2,224	398	1.02	0.68	0.52	0.08
MED	Balearic	*Mullus barbatus*	MULLBAR_BA	2014	634	1.48	0.66	489	548	625	649	1.5	1.4	1.2	1.05
MED	Balearic	*Mullus surmuletus*	MULLSUR_BA	2014	230	2.16	0.31	418	468	534	5	1.5	1.4	1.2	0.01
MED	Balearic	*Nephrops norvegicus*	NEPRNOR_BA	2014	397	1.23	0.53	451	504	574	594	1.49	1.39	1.19	1.03
MED	Balearic	*Pagellus erythrinus*	PAGEERY_BA	2014	1,811	0.92	0.95	1,563	1,750	2,000	2,079	1.5	1.4	1.2	1.05
MED	Balearic	*Parapenaeus longirostris*	PAPELON_BA	2014	1,043	3.38	0.25	1,854	1,997	2,085	24	1.49	1.34	1.05	0.01
MED	Balearic	*Phycis blennoides*	PHYCBLE_BA	2014	254	1.19	0.44	393	438	497	515	1.46	1.35	1.15	1
MED	Balearic	*Sardina pilchardus*	SARDPIL_BA	2014	66,120	1.06	0.55	85,550	95,797	109,415	113,643	1.5	1.4	1.2	1.05
MED	Balearic	*Sardinella aurita*	SARIAUR_BA	2014	16,151	1.61	0.44	19,108	21,376	24,332	24,910	1.5	1.4	1.19	1.03
MED	Balearic	*Scomber colias*	SCOMPNE_BA	2014	2,383	2.85	0.36	2,369	2,504	2,628	30	1.48	1.31	1.03	0.01
MED	Balearic	*Scomber scombrus*	SCOMSCO_BA	2014	1,554	1.38	0.32	3,678	4,019	4,478	4,502	1.37	1.25	1.04	0.88
MED	Balearic	*Sepia officinalis*	SEPIOFF_BA	2014	270	2.66	0.34	280	261	264	16	1.3	1.01	0.76	0.04
MED	Balearic	*Solea solea*	SOLEVUL_BA	2014	308	2.19	0.27	627	593	613	69	1.29	1.02	0.79	0.08
MED	Balearic	*Trisopterus minutus*	TRISLUS_BA	2014	145	1.07	0.54	187	209	239	248	1.5	1.4	1.2	1.05
MED	Black Sea	*Engraulis encrasicolus*	BS_anch	2014	157,462	1.23	0.51	189,403	211,795	241,071	249,723	1.49	1.39	1.19	1.04
MED	Black Sea	*Merlangius merlangus*	Whiting_BS	2014	8,861	1.49	0.54	8,206	9,163	10,388	10,717	1.49	1.38	1.18	1.02
MED	Black Sea	*Mullus barbatus barbatus*	RMullet_BS	2014	3,899	2.19	0.56	2,272	1,792	1,511	30	1.42	0.93	0.59	0.01
MED	Black Sea	*Scophthalmus maximus*	Tur_BS	2014	1,159	5.31	0.24	1,115	954	969	126	1.13	0.81	0.62	0.07
MED	Black Sea	*Sprattus sprattus*	Spr_BS	2014	58,380	0.83	1.1	48,207	53,991	61,705	64,132	1.5	1.4	1.2	1.05
MED	Black Sea	*Squalus acanthias*	PDogfish_BS	2014	75	1.51	0.09	4	48	60	154	0.13	0.12	0.12	0.06
MED	Black Sea	*Trachurus mediterraneus*	MHMackerel_BS	2014	12,357	7.57	0.11	44,770	39,172	37,872	781	1.34	0.98	0.71	0.01
MED	Cyprus	*Boops boops*	BOOPBOO_CY	2014	111	2	0.34	178	195	214	6	1.48	1.35	1.12	0.03
MED	Cyprus	*Dentex dentex*	DENTDEN_CY	2014	4	2.32	0.18	13	11	11	3	0.97	0.65	0.51	0.1
MED	Cyprus	*Mullus barbatus*	MULLBAR_CY	2014	32	1.53	0.3	88	98	110	112	1.49	1.38	1.17	0.99
MED	Cyprus	*Mullus surmuletus*	MULLSUR_CY	2014	35	2.19	0.21	136	152	171	2	1.5	1.39	1.18	0.01
MED	Cyprus	*Pagellus acarne*	PAGEACA_CY	2014	26	1.62	0.58	21	23	26	27	1.49	1.38	1.17	1.02
MED	Cyprus	*Pagellus erythrinus*	PAGEERY_CY	2014	12	2.31	0.23	33	31	32	4	1.31	1.04	0.81	0.08
MED	Cyprus	*Pagrus pagrus*	PAGRPAG_CY	2014	9	2.1	0.24	25	25	26	2	1.37	1.14	0.89	0.05
MED	Cyprus	*Sepia officinalis*	SEPIOFF_CY	2014	22	1.92	0.23	73	72	74	5	1.38	1.12	0.87	0.05
MED	Cyprus	*Seriola dumerili*	SERIDUM_CY	2014	8	2.4	0.29	14	15	16	1	1.45	1.26	1.01	0.03
MED	Cyprus	*Spicara smaris*	SPICSMA_CY	2014	109	1.59	0.23	452	475	512	128	1.39	1.22	0.99	0.21
MED	Ionian Sea	*Aristeomorpha foliacea*	ARISFOL_IS	2014	2,057	1.67	0.64	1,438	1,603	1,816	1,865	1.49	1.39	1.18	1.02
MED	Ionian Sea	*Atherina boyeri*	ATHEBOY_IS	2014	85	1.03	0.32	292	327	372	386	1.49	1.39	1.19	1.04
MED	Ionian Sea	*Belone belone*	BELOBEL_IS	2014	165	1	0.57	218	244	278	289	1.5	1.39	1.19	1.04
MED	Ionian Sea	*Boops boops*	BOOPBOO_IS	2014	1,312	0.84	0.42	3,386	3,791	4,330	4,502	1.5	1.4	1.2	1.05
MED	Ionian Sea	*Conger conger*	CONGCON_IS	2014	330	1.43	0.61	265	295	333	346	1.4	1.3	1.1	0.96

Region	Ecoregion	Species	Stock ID	Last Year	Last Catch (t)	F/F_{msy}	B/B_{msy}	Catch (t) scenario 2030				B/Bmsy scenario 2030			
								0.5	**0.6**	**0.8**	**0.95**	**0.5**	**0.6**	**0.8**	**0.95**
MED	Ionian Sea	*Coryphaena hippurus*	CORYHIP_IS	2014	877	1.95	0.33	1,589	1,778	2,023	20	1.5	1.4	1.19	0.01
MED	Ionian Sea	*Dentex dentex*	DENTDEN_IS	2014	813	1.22	0.44	1,276	1,423	1,613	1,669	1.46	1.36	1.16	1.01
MED	Ionian Sea	*Dicentrarchus labrax*	DICELAB_IS	2014	91	2.57	0.17	422	403	413	27	1.34	1.07	0.82	0.04
MED	Ionian Sea	*Eledone cirrosa*	ELEDCIR_IS	2014	1,934	4.47	0.43	4	71	78	68	0.32	0.23	0.21	0.06
MED	Ionian Sea	*Engraulis encrasicolus*	ENGRENC_IS	2014	6,087	0.92	0.52	9,669	10,826	12,366	12,850	1.5	1.4	1.2	1.05
MED	Ionian Sea	*Epinephelus marginatus*	EPINGUA_IS	2014	44	1.88	0.08	3	40	45	26	0.19	0.14	0.13	0.02
MED	Ionian Sea	*Illex coindetii*	ILLECOI_IS	2014	791	0.6	0.58	1,695	1,898	2,173	2,271	1.49	1.39	1.19	1.05
MED	Ionian Sea	*Merluccius merluccius*	MERLMER_IS	2014	4,882	3.24	0.21	10,141	8,768	8,894	920	1.2	0.87	0.66	0.06
MED	Ionian Sea	*Micromesistius poutassou*	MICRPOU_IS	2014	51	0.64	0.23	522	573	640	650	1.39	1.27	1.07	0.91
MED	Ionian Sea	*Mullus barbatus*	MULLBAR_IS	2014	1,200	3.48	0.19	3,026	2,655	2,632	119	1.3	0.95	0.71	0.03
MED	Ionian Sea	*Mullus surmuletus*	MULLSUR_IS	2014	71	1.72	0.27	207	232	263	74	1.5	1.4	1.19	0.28
MED	Ionian Sea	*Nephrops norvegicus*	NEPRNOR_IS	2014	780	2.11	0.3	1,239	1,131	1,157	141	1.19	0.91	0.7	0.07
MED	Ionian Sea	*Octopus vulgaris*	OCTOVUL_IS	2014	980	1.21	0.28	3,920	4,388	5,006	5,192	1.5	1.4	1.2	1.04
MED	Ionian Sea	*Pagrus pagrus*	PAGRPAG_IS	2014	277	1.83	0.59	190	208	228	22	1.48	1.34	1.11	0.09
MED	Ionian Sea	*Palinurus elephas*	PALIELE_IS	2014	79	2.02	0.24	115	91	88	55	0.69	0.48	0.41	0.17
MED	Ionian Sea	*Parapeneaus longirostris*	PARELON_IS	2014	6,550	0.91	0.66	8,118	9,093	10,391	10,798	1.5	1.4	1.2	1.05
MED	Ionian Sea	*Penaeus kerathurus*	PENAKER_IS	2014	767	6.06	0.63	0	2	3	2	0.12	0.1	0.09	0.01
MED	Ionian Sea	*Sardina pilchardus*	SARDPIL_IS	2014	5,160	1.62	0.36	8,881	9,853	11,070	11,086	1.48	1.37	1.15	0.97
MED	Ionian Sea	*Scomber colias*	SCOMPNE_IS	2014	935	2.27	0.52	491	286	188	8	1.24	0.6	0.38	0.01
MED	Ionian Sea	*Scomber scombrus*	SCOMSCO_IS	2014	489	1.31	0.24	2,362	2,594	2,895	2,822	1.47	1.34	1.12	0.92
MED	Ionian Sea	*Scophthalmus maximus*	PSETMAX_IS	2013	161	2.57	0.28	212	167	169	25	1.04	0.68	0.52	0.06
MED	Ionian Sea	*Sepia officinalis*	SEPIOFF_IS	2014	6,410	1.43	0.76	4,378	4,894	5,565	5,760	1.49	1.39	1.18	1.03
MED	Ionian Sea	*Solea solea*	SOLEVUL_IS	2014	191	1.88	0.13	1,278	653	517	58	0.85	0.43	0.33	0.02
MED	Ionian Sea	*Squilla mantis*	SQUIMAN_IS	2014	1,230	2.72	0.51	281	124	114	32	0.64	0.34	0.28	0.04
MED	Ionian Sea	*Trachurus mediterraneus*	TRACHMED_IS	2014	179	1.27	0.38	365	409	467	485	1.5	1.4	1.2	1.05
MED	Ionian Sea	*Umbrina cirrosa*	UMBRCIR_IS	2013	1,172	1.35	0.73	886	992	1,134	1,178	1.5	1.4	1.2	1.05
MED	Lions Gulf	*Boops boops*	BOOPBOO_LI	2014	253	1.58	0.38	414	458	512	515	1.46	1.34	1.13	0.95
MED	Lions Gulf	*Conger conger*	CONGCON_LI	2014	115	1.34	0.28	353	377	416	383	1.3	1.16	0.96	0.74
MED	Lions Gulf	*Dicentrarchus labrax*	DICELAB_LI	2014	164	2.33	0.25	316	272	276	35	1.16	0.83	0.63	0.07
MED	Lions Gulf	*Engraulis encrasicolus*	ENGRENC_LI	2014	1,891	0.53	0.52	5,124	5,738	6,563	6,834	1.5	1.4	1.2	1.05
MED	Lions Gulf	*Loligo vulgaris*	LOLIVUL_LI	2014	225	3.08	0.31	194	153	156	26	1	0.66	0.5	0.07
MED	Lions Gulf	*Merluccius merluccius*	MERLMER_LI	2014	1,654	2.54	0.37	1,613	1,556	1,618	145	1.35	1.09	0.85	0.06
MED	Lions Gulf	*Micromesistius poutassou*	MICMPOU_LI	2014	104	2.78	0.27	193	211	231	6	1.48	1.35	1.11	0.03
MED	Lions Gulf	*Nephrops norvegicus*	NEPRNOR_LI	2014	27	1.35	0.32	74	82	92	95	1.48	1.37	1.16	1
MED	Lions Gulf	*Octopus vulgaris*	OCTOVUL_LI	2014	1,472	1.31	0.83	1,016	1,138	1,300	1,350	1.5	1.4	1.2	1.05
MED	Lions Gulf	*Pagellus erythrinus*	PAGEERY_LI	2014	175	1.34	0.4	286	318	359	370	1.42	1.32	1.11	0.97
MED	Lions Gulf	*Sardina pilchardus*	SARDPIL_LI	2014	826	0.25	0.32	12,214	13,680	15,643	16,281	1.5	1.4	1.2	1.05
MED	Lions Gulf	*Scomber scombrus*	SCOMSCO_LI	2014	739	1.6	0.42	967	1,077	1,217	1,242	1.49	1.38	1.17	1.01
MED	Lions Gulf	*Sepia officinalis*	SEPIOFF_LI	2014	120	1.83	0.35	164	168	183	100	1.25	1.07	0.87	0.4
MED	Lions Gulf	*Solea solea*	SOLEVUL_LI	2014	130	1.44	0.3	326	338	373	327	1.26	1.09	0.9	0.67
MED	Lions Gulf	*Trisopterus minutus*	TRISMIN_LI	2014	656	1.81	0.45	644	687	742	60	1.45	1.29	1.04	0.07

Region	Ecoregion	Species	Stock ID	Last Year	Last Catch (t)	F/F_{msy}	B/B_{msy}	Catch (t) scenario 2030				B/Bmsy scenario 2030			
								0.5	**0.6**	**0.8**	**0.95**	**0.5**	**0.6**	**0.8**	**0.95**
MED	Sardinia	*Belone belone*	BELOBEL_SA	2014	28	1.82	0.19	133	123	128	16	1.23	0.95	0.73	0.08
MED	Sardinia	*Boops boops*	BOOPBOO_SA	2014	1,397	3.27	0.29	1,793	1,723	1,740	49	1.38	1.11	0.84	0.02
MED	Sardinia	*Chamelea gallina*	CHAMGAL_SA	2014	11	0.32	0.09	1,276	994	942	30	1.26	0.82	0.58	0.02
MED	Sardinia	*Coryphaena hippurus*	CORYHIP_SA	2014	449	1.79	0.38	649	727	830	8	1.5	1.4	1.2	0.01
MED	Sardinia	*Dentex dentex*	DENTDEN_SA	2014	149	1.23	0.19	1,087	1,095	1,173	318	1.34	1.12	0.9	0.21
MED	Sardinia	*Engraulis encrasicolus*	ENGRENC_SA	2014	7,575	1.69	0.48	6,983	7,645	8,488	7,362	1.46	1.33	1.11	0.81
MED	Sardinia	*Epinephelus marginatus*	EPINGUA_SA	2014	48	2.37	0.19	138	115	118	21	1	0.69	0.53	0.08
MED	Sardinia	*Illex coindettii*	ILLECOI_SA	2014	624	1.07	0.59	723	808	919	957	1.46	1.36	1.16	1.02
MED	Sardinia	*Loligo vulgaris*	LOLIVUL_SA	2014	806	2.79	0.32	604	462	424	147	0.83	0.53	0.43	0.11
MED	Sardinia	*Merluccius merluccius*	MERLMER_SA	2014	4,482	1.66	0.51	3,787	4,124	4,593	4,548	1.44	1.31	1.09	0.91
MED	Sardinia	*Micromesistius poutassou*	MICMPOU_SA	2014	175	1.62	0.22	662	617	652	162	1.17	0.91	0.72	0.15
MED	Sardinia	*Mullus barbatus*	MULLBAR_SA	2014	2,631	2.33	0.71	1,170	1,244	1,320	15	1.47	1.3	1.04	0.01
MED	Sardinia	*Nephrops norvegicus*	NEPRNOR_SA	2014	208	2.5	0.26	407	383	396	44	1.28	1.01	0.78	0.07
MED	Sardinia	*Pagellus erythrinus*	PAGEERY_SA	2014	424	2.59	0.43	262	180	144	4	1.18	0.68	0.45	0.01
MED	Sardinia	*Palinurus elephas*	PALIELE_SA	2014	93	1.85	0.22	147	95	100	85	0.56	0.39	0.34	0.17
MED	Sardinia	*Parapeneaus longirostris*	PAPELON_SA	2014	3,056	1.32	0.94	1,843	2,064	2,359	2,451	1.5	1.4	1.2	1.05
MED	Sardinia	*Sardina pilchardus*	SARDPIL_SA	2014	7,460	1.53	0.47	8,284	9,182	10,341	10,604	1.47	1.36	1.15	0.99
MED	Sardinia	*Sepia officinalis*	SEPIOFF_SA	2014	320	1.21	0.76	258	289	329	342	1.5	1.39	1.19	1.04
MED	Sardinia	*Spicara maena*	SPICMAE_SA	2014	177	1.04	0.59	217	244	278	289	1.5	1.4	1.2	1.05
MED	Wide ranging	*Euthynnus alletteratus*	LTA_MED	2014	3,443	2.47	0.61	1,713	1,900	2,117	22	1.5	1.38	1.16	0.01
MED	Wide ranging	*Sarda sarda*	BON_MED	2014	22,823	1.01	0.95	17,519	19,606	22,430	23,434	1.48	1.38	1.19	1.04
MED	Wide ranging	*Thunnus alalunga*	ALB_MED	2014	2,374	0.41	1.17	3,682	4,124	4,714	4,902	1.5	1.4	1.2	1.05
MED	Wide ranging	*Xiphias gladius*	SWO_MED	2014	9,794	0.79	0.76	12,196	13,657	15,613	16,259	1.5	1.4	1.2	1.05
NEA	Azores	*Beryx* spp.	alf-comb	2015	365	0.96	0.57	450	503	578	609	1.36	1.27	1.09	0.97
NEA	Azores	*Pagellus bogaraveo*	sbr-x	2015	701	1.14	0.6	769	860	981	1,018	1.5	1.39	1.19	1.04
NEA	Baltic Sea	*Clupea harengus*	her-2532-gor	2015	174,433	0.82	0.96	165,958	185,862	212,843	222,366	1.49	1.39	1.2	1.05
NEA	Baltic Sea	*Clupea harengus*	her-30	2015	110,415	1.05	1.56	49,888	55,905	64,228	67,435	1.48	1.38	1.19	1.05
NEA	Baltic Sea	*Clupea harengus*	her-31	2015	4,527	0.96	0.7	5,038	5,639	6,439	6,697	1.5	1.4	1.2	1.05
NEA	Baltic Sea	*Clupea harengus*	her-3a22	2015	37,491	0.63	0.48	97,279	108,867	124,479	129,904	1.49	1.39	1.19	1.05
NEA	Baltic Sea	*Clupea harengus*	her-riga	2015	32,851	1.14	0.93	23,083	25,818	29,460	30,663	1.49	1.39	1.19	1.04
NEA	Baltic Sea	*Gadus morhua*	cod-2224	2015	11,982	1.67	0.26	37,911	41,204	45,443	18,448	1.47	1.33	1.1	0.38
NEA	Baltic Sea	*Gadus morhua*	cod-2532	2015	43,670	2.43	0.28	83,624	86,353	90,981	3,904	1.43	1.23	0.97	0.04
NEA	Baltic Sea	*Limanda limanda*	dab-2232	2015	1,268	0.49	1.3	1,481	1,659	1,896	1,970	1.5	1.4	1.2	1.05
NEA	Baltic Sea	*Platichthys flesus*	fle-2223	2015	1,130	0.26	1.67	1,931	2,166	2,491	2,614	1.5	1.4	1.21	1.07
NEA	Baltic Sea	*Platichthys flesus*	fle-2425	2015	11,090	0.42	1.45	13,690	15,334	17,538	18,258	1.5	1.4	1.2	1.05
NEA	Baltic Sea	*Platichthys flesus*	fle-2628	2015	4,443	3.03	0.42	1,475	521	433	41	0.72	0.33	0.26	0.01
NEA	Baltic Sea	*Platichthys flesus*	fle-2732	2015	176	2.71	0.15	965	969	1,008	54	1.38	1.16	0.9	0.04
NEA	Baltic Sea	*Pleuronectes platessa*	ple-2123	2015	2,687	0.44	1.29	3,564	3,992	4,563	4,745	1.5	1.4	1.2	1.05
NEA	Baltic Sea	*Pleuronectes platessa*	ple-2432	2015	647	0.11	1.65	2,678	3,002	3,445	3,604	1.5	1.4	1.21	1.06
NEA	Baltic Sea	*Salmo salar*	sal-2231	2015	790	0.85	0.4	2,167	2,419	2,754	2,866	1.46	1.36	1.16	1.02
NEA	Baltic Sea	*Salmo salar*	sal-32	2015	62	1.42	0.23	279	291	315	140	1.34	1.16	0.94	0.35

Region	**Ecoregion**	**Species**	**Stock ID**	**Last Year**	**Last Catch (t)**	**F/F_{msy}**	**B/B_{msy}**	**Catch (t) scenario 2030**				**B/Bmsy scenario 2030**			
								0.5	**0.6**	**0.8**	**0.95**	**0.5**	**0.6**	**0.8**	**0.95**
NEA	Baltic Sea	*Salmo trutta*	trt-bal	2015	189	0.99	0.22	1,365	1,486	1,653	1,620	1.44	1.3	1.09	0.9
NEA	Baltic Sea	*Scophthalmus maximus*	tur-2232	2015	234	0.84	0.4	668	748	855	889	1.5	1.4	1.2	1.05
NEA	Baltic Sea	*Scophthalmus rhombus*	bll-2232	2015	40	0.93	0.54	59	66	75	78	1.49	1.39	1.19	1.04
NEA	Baltic Sea	*Sprattus sprattus*	spr-2232	2015	247,000	1.29	0.66	213,981	238,980	271,568	281,431	1.48	1.38	1.17	1.03
NEA	Barents Sea	*Brosme brosme*	usk-arct	2014	8,734	0.62	1.01	10,469	11,727	13,421	13,992	1.5	1.4	1.2	1.05
NEA	Barents Sea	*Gadus morhua*	cod-arct	2015	864,384	0.58	1.33	836,572	937,631	1,075,768	1,125,804	1.5	1.4	1.2	1.06
NEA	Barents Sea	*Mallotus villosus*	cap-bars	2015	115,000	0.26	0.36	1,240,562	1,388,653	1,589,482	1,661,304	1.49	1.39	1.19	1.05
NEA	Barents Sea	*Melanogrammus aeglefinus*	had-arct	2015	194,756	0.24	1.74	357,101	400,788	461,745	485,525	1.5	1.41	1.22	1.08
NEA	Barents Sea	*Molva molva*	lin-arct	2014	9,606	0.76	1.34	7,075	7,945	9,184	9,704	1.49	1.39	1.21	1.07
NEA	Barents Sea	*Pandalus borealis*	pand-barn	2014	16,671	0.24	1.1	47,056	52,704	60,250	62,654	1.5	1.4	1.2	1.05
NEA	Barents Sea	*Pollachius virens*	sai-arct	2015	131,765	0.48	1.22	170,480	191,006	218,762	228,300	1.5	1.4	1.2	1.06
NEA	Barents Sea	*Reinhardtius hippoglossoides*	ghl-arct	2014	22,244	0.85	1.4	13,919	15,603	17,936	18,832	1.49	1.39	1.2	1.06
NEA	Barents Sea	*Sebastes mentella*	smn-arct	2013	9,297	0.17	1.77	23,213	26,020	29,850	31,217	1.5	1.4	1.21	1.06
NEA	Barents Sea	*Sebastes norvegicus*	smr-arct	2015	3,630	9.37	0.1	60	1,049	1,109	668	0.32	0.22	0.19	0.04
NEA	BoB & Iberian coast	*Dicentrarchus labrax*	Bss-8ab	2014	2,991	1.23	0.89	2,050	2,294	2,616	2,716	1.5	1.4	1.19	1.04
NEA	BoB & Iberian coast	*Dicentrarchus labrax*	Bss-8c9a	2014	917	1.75	0.71	550	611	690	705	1.48	1.38	1.16	1
NEA	BoB & Iberian coast	*Engraulis encrasicolus*	ane-bisc	2015	25,134	0.55	0.89	38,048	42,614	48,704	50,619	1.5	1.4	1.2	1.05
NEA	BoB & Iberian coast	*Engraulis encrasicolus*	ane-pore	2015	9,597	2.19	0.69	4,117	2,650	2,024	60	1.3	0.7	0.45	0.01
NEA	BoB & Iberian coast	*Lepidorhombus boscii*	mgb-8c9a	2015	1,745	0.98	0.94	1,374	1,540	1,775	1,872	1.45	1.35	1.17	1.04
NEA	BoB & Iberian coast	*Lepidorhombus whiffiagonis*	mgw-8c9a	2015	297	1.28	0.39	566	634	724	752	1.5	1.4	1.2	1.05
NEA	BoB & Iberian coast	*Leucoraja naevus*	rjn-pore	2013	37	0.89	0.63	49	55	63	66	1.48	1.38	1.18	1.04
NEA	BoB & Iberian coast	*Lophius budegassa*	anb-8c9a	2015	1,040	0.48	1.1	1,473	1,652	1,903	2,001	1.5	1.4	1.21	1.07
NEA	BoB & Iberian coast	*Lophius piscatorius*	anp-78ab	2015	25,266	1.29	0.82	17,803	19,897	22,647	23,501	1.49	1.38	1.18	1.03
NEA	BoB & Iberian coast	*Lophius piscatorius*	anp-8c9a	2015	1,748	0.24	1.48	3,638	4,080	4,689	4,915	1.5	1.4	1.21	1.07
NEA	BoB & Iberian coast	*Merlangius merlangus*	whg-89a	2014	1,690	1.37	0.57	1,622	1,815	2,068	2,142	1.5	1.4	1.19	1.04
NEA	BoB & Iberian coast	*Merluccius merluccius*	hke-soth	2015	13,839	0.77	0.86	15,711	17,595	20,124	20,970	1.5	1.4	1.2	1.05
NEA	BoB & Iberian coast	*Nephrops norvegicus*	nep-2829	2015	247	0.91	0.64	318	356	407	423	1.5	1.4	1.2	1.05
NEA	BoB & Iberian coast	*Nephrops norvegicus*	Neph-IXa	2013	238	132.92	0.02	0	1	2	15	0.03	0.03	0.03	0.01
NEA	BoB & Iberian coast	*Nephrops norvegicus*	Neph-VIIIab	2013	7,344	1.08	0.57	8,916	9,975	11,371	11,804	1.49	1.39	1.19	1.04
NEA	BoB & Iberian coast	*Nephrops norvegicus*	Neph-VIIIc	2013	20	5.82	0.06	1	8	9	4	0.17	0.12	0.11	0.01
NEA	BoB & Iberian coast	*Pagellus bogaraveo*	sbr-ix	2015	295	0.95	0.48	510	570	650	675	1.49	1.39	1.19	1.04
NEA	BoB & Iberian coast	*Pleuronectes platessa*	ple-89a	2014	220	0.75	1.02	214	240	274	286	1.5	1.4	1.2	1.05
NEA	BoB & Iberian coast	*Pollachius pollachius*	pol-89a	2014	1,983	1.67	0.63	1,407	1,573	1,787	1,834	1.5	1.39	1.19	1.03
NEA	BoB & Iberian coast	*Raja brachyura*	rjh-pore	2013	275	1.51	0.52	192	215	248	264	1.09	1.02	0.88	0.79
NEA	BoB & Iberian coast	*Raja clavata*	rjc-bisc	2013	299	22.73	0.15	1	27	30	30	0.37	0.27	0.25	0.11
NEA	BoB & Iberian coast	*Raja clavata*	rjc-pore	2013	703	0.92	0.74	757	847	969	1,015	1.47	1.37	1.18	1.04
NEA	BoB & Iberian coast	*Raja montagui*	rjm-pore	2013	165	1.81	0.44	156	163	179	125	1.35	1.18	0.96	0.57
NEA	BoB & Iberian coast	*Sardina pilchardus*	sar-78	2014	45,312	1.08	1.16	26,954	30,179	34,470	35,828	1.5	1.4	1.2	1.05
NEA	BoB & Iberian coast	*Sardina pilchardus*	sar-soth	2015	21,000	1.03	0.28	96,295	107,361	121,421	125,204	1.47	1.37	1.16	1.01
NEA	BoB & Iberian coast	*Solea solea*	sol-bisc	2015	3,641	1.05	0.66	3,907	4,372	4,990	5,184	1.5	1.4	1.19	1.05
NEA	BoB & Iberian coast	*Solea* spp.	sol-8c9a	2014	829	1.3	0.56	843	943	1,072	1,110	1.49	1.39	1.19	1.03

Region	Ecoregion	Species	Stock ID	Last Year	Last Catch (t)	F/F_{msy}	B/B_{msy}	Catch (t) scenario 2030				B/Bmsy scenario 2030			
								0.5	**0.6**	**0.8**	**0.95**	**0.5**	**0.6**	**0.8**	**0.95**
NEA	BoB & Iberian coast	*Trachurus picturatus*	jaa-10	2015	1,136	0.8	0.52	2,057	2,303	2,631	2,736	1.5	1.4	1.2	1.05
NEA	BoB & Iberian coast	*Trachurus trachurus*	hom-soth	2015	32,723	0.78	1.37	22,985	25,751	29,510	30,846	1.5	1.4	1.2	1.06
NEA	Celtic Seas	*Capros aper*	boc-nea	2014	45,231	4.03	0.25	47,792	36,468	35,507	3,088	1.07	0.68	0.5	0.04
NEA	Celtic Seas	*Clupea harengus*	her-67bc	2015	19,885	0.36	0.59	69,147	77,483	88,850	92,937	1.5	1.4	1.2	1.06
NEA	Celtic Seas	*Clupea harengus*	her-irls	2015	18,355	0.65	1.18	17,814	19,952	22,816	23,750	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Clupea harengus*	her-nirs	2015	4,869	0.63	0.62	9,368	10,491	12,002	12,514	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Coryphaenoides rupestris*	rng-5b67	2015	701	0.19	0.55	4,876	5,486	6,384	6,802	1.42	1.33	1.16	1.04
NEA	Celtic Seas	*Gadus morhua*	cod-7e-k	2015	4,719	1.35	0.45	6,379	7,131	8,109	8,390	1.49	1.39	1.19	1.03
NEA	Celtic Seas	*Gadus morhua*	cod-iris	2015	385	0.14	0.38	7,280	8,154	9,327	9,710	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Gadus morhua*	cod-scow	2014	1,668	8.16	0.08	65	904	870	162	0.38	0.21	0.18	0.01
NEA	Celtic Seas	*Lepidorhombus whiffiagonis*	mgw-78	2015	13,076	0.57	1.2	14,278	15,993	18,290	19,040	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Lophius budegassa*	anb-78ab	2015	10,319	1.65	0.76	5,979	6,659	7,517	7,744	1.46	1.36	1.15	1
NEA	Celtic Seas	*Lophius* spp.	ang-ivvi	2014	13,203	1.12	0.65	13,288	14,838	16,904	17,615	1.45	1.35	1.16	1.01
NEA	Celtic Seas	*Melanogrammus aeglefinus*	had-7b-k	2015	15,239	0.88	1.04	12,454	13,946	15,970	16,688	1.49	1.39	1.2	1.05
NEA	Celtic Seas	*Melanogrammus aeglefinus*	had-iris	2015	833	0.69	0.4	2,892	3,239	3,702	3,848	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Merlangius merlangus*	whg-7e-k	2015	19,275	0.62	1.27	18,482	20,717	23,785	24,917	1.5	1.4	1.2	1.06
NEA	Celtic Seas	*Merlangius merlangus*	whg-iris	2015	1,922	15.63	0.08	3,686	1,157	936	97	0.72	0.31	0.24	0.01
NEA	Celtic Seas	*Merlangius merlangus*	whg-scow	2015	1,062	0.91	0.19	11,619	13,012	14,866	15,436	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Molva dypterygia*	bli-5b67	2015	2,758	0.31	0.78	8,484	9,535	11,047	11,702	1.49	1.39	1.21	1.08
NEA	Celtic Seas	*Nephrops norvegicus*	nep-11	2014	3,312	1.55	0.57	1,339	1,567	1,985	2,269	0.72	0.7	0.66	0.64
NEA	Celtic Seas	*Nephrops norvegicus*	nep-12	2014	3,394	0.97	0.71	3,721	4,166	4,759	4,947	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Nephrops norvegicus*	nep-13	2014	6,881	1	1.09	4,735	5,301	6,057	6,299	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Nephrops norvegicus*	nep-14	2014	711	1.18	0.8	559	625	712	740	1.49	1.39	1.19	1.04
NEA	Celtic Seas	*Nephrops norvegicus*	nep-15	2014	10,013	0.95	1	7,929	8,878	10,145	10,550	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Nephrops norvegicus*	nep-16	2014	1,189	3.12	0.28	1,222	942	910	122	1	0.64	0.48	0.05
NEA	Celtic Seas	*Nephrops norvegicus*	nep-17	2014	800	3.36	0.38	310	161	139	30	0.74	0.4	0.32	0.04
NEA	Celtic Seas	*Nephrops norvegicus*	nep-19	2014	468	0.93	0.6	623	698	796	828	1.49	1.39	1.19	1.04
NEA	Celtic Seas	*Nephrops norvegicus*	nep-2021	2014	1,837	1.63	0.48	1,767	1,943	2,173	2,145	1.47	1.35	1.13	0.94
NEA	Celtic Seas	*Nephrops norvegicus*	nep-22	2014	2,615	0.81	1.21	1,991	2,230	2,553	2,666	1.5	1.4	1.2	1.06
NEA	Celtic Seas	*Nephrops norvegicus*	nep-oth-6a	2014	245	1.15	0.59	271	303	345	358	1.49	1.39	1.19	1.04
NEA	Celtic Seas	*Nephrops norvegicus*	nep-oth-7	2014	174	1.26	0.4	312	347	394	407	1.47	1.36	1.16	1.01
NEA	Celtic Seas	*Pagellus bogaraveo*	sbr-678	2015	177	5.43	0.17	305	236	231	19	1.11	0.72	0.53	0.04
NEA	Celtic Seas	*Pleuronectes platessa*	ple-7b-c	2014	23	1.28	0.21	116	114	123	48	1.18	0.97	0.78	0.26
NEA	Celtic Seas	*Pleuronectes platessa*	ple-7h-k	2015	33	4.95	0.11	133	86	64	6	0.93	0.5	0.37	0.02
NEA	Celtic Seas	*Pleuronectes platessa*	ple-celt	2015	381	0.13	1.82	1,193	1,336	1,527	1,589	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Pleuronectes platessa*	ple-echw	2015	1,424	0.44	1.59	1,525	1,713	1,982	2,094	1.5	1.41	1.22	1.09
NEA	Celtic Seas	*Pleuronectes platessa*	ple-iris	2015	1,004	0.21	1.78	1,986	2,225	2,550	2,664	1.5	1.4	1.2	1.06
NEA	Celtic Seas	*Pollachius pollachius*	pol-celt	2014	5,255	1.16	0.62	5,463	6,115	6,977	7,242	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Solea solea*	sol-7b-c	2014	26	0.95	0.49	40	45	51	53	1.41	1.31	1.12	0.99
NEA	Celtic Seas	*Solea solea*	sol-7h-k	2015	244	0.55	0.81	411	460	527	551	1.5	1.4	1.2	1.06
NEA	Celtic Seas	*Solea solea*	sol-celt	2015	2,714	3.7	0.64	528	349	266	28	0.92	0.51	0.38	0.03

Region	Ecoregion	Species	Stock ID	Last Year	Last Catch (t)	F/F_{msy}	B/B_{msy}	Catch (t) scenario 2030				B/Bmsy scenario 2030			
								0.5	**0.6**	**0.8**	**0.95**	**0.5**	**0.6**	**0.8**	**0.95**
NEA	Celtic Seas	*Solea solea*	sol-echw	2015	772	0.7	1.09	756	848	973	1,020	1.49	1.4	1.2	1.06
NEA	Celtic Seas	*Solea solea*	sol-iris	2015	76	0.63	0.14	2,218	2,285	2,441	311	1.41	1.21	0.97	0.1
NEA	Celtic Seas	*Sprattus sprattus*	spr-celt	2014	4,392	1.21	0.63	4,336	4,854	5,541	5,751	1.5	1.4	1.2	1.05
NEA	Celtic Seas	*Sprattus sprattus*	spr-ech	2015	3,003	0.47	1.4	3,433	3,846	4,401	4,587	1.5	1.4	1.2	1.05
NEA	Faroes	*Argentina silus*	arg-5b6a	2014	15,642	2.3	0.46	7,119	5,683	5,559	1,401	0.9	0.6	0.47	0.09
NEA	Faroes	*Gadus morhua*	cod-farb	2015	17	0.44	0.1	1,330	1,140	1,099	32	1.29	0.92	0.67	0.02
NEA	Faroes	*Gadus morhua*	cod-farp	2015	7,394	1.38	0.32	19,598	21,939	25,026	25,943	1.5	1.4	1.2	1.04
NEA	Faroes	*Melanogrammus aeglefinus*	had-faro	2015	3,395	1.34	0.26	13,804	15,415	17,500	18,024	1.5	1.39	1.18	1.03
NEA	Faroes	*Molva molva*	lin-faro	2014	6,684	0.77	1.43	4,544	5,100	5,883	6,201	1.49	1.39	1.21	1.07
NEA	Faroes	*Pollachius virens*	sai-faro	2015	25,128	0.75	0.85	29,424	32,954	37,742	39,436	1.49	1.39	1.2	1.05
NEA	Greater North Sea	*Ammodytes tobianus*	san-ns1	2015	162,054	1.34	0.4	284,804	318,978	364,521	378,705	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Ammodytes tobianus*	san-ns3	2015	118,541	0.51	0.72	244,806	274,183	313,353	325,609	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Ammodytes tobianus*	san-ns4	2015	4,384	3.5	0.09	58,012	60,357	61,073	743	1.48	1.29	0.98	0.01
NEA	Greater North Sea	*Ammodytes tobianus*	san-ns6	2015	229	0.6	0.28	1,785	1,999	2,285	2,374	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Ammodytes tobianus*	san-ns7	2015	0	0	0.12	2,283	2,557	2,923	3,037	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Clupea harengus*	her-47d3	2015	494,099	0.43	1.58	546,394	611,961	699,390	726,752	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Coryphaenoides rupestris*	rng-kask	2015	1	0.01	0.11	2,482	1,880	1,676	274	0.92	0.58	0.44	0.05
NEA	Greater North Sea	*Dicentrarchus labrax*	Bss-47	2015	2,839	1.57	0.45	3,125	3,433	3,838	3,897	1.41	1.29	1.08	0.93
NEA	Greater North Sea	*Gadus morhua*	cod-347d	2015	52,313	0.3	0.64	206,117	231,039	265,208	277,757	1.5	1.4	1.2	1.06
NEA	Greater North Sea	*Gadus morhua*	cod-kat	2015	508	0.12	0.39	10,697	11,984	13,723	14,321	1.5	1.4	1.2	1.06
NEA	Greater North Sea	*Glyptocephalus cynoglossus*	wit-nsea	2014	2,646	0.77	1.07	2,421	2,712	3,105	3,242	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Lepidorhombus* spp.	meg-4a6a	2014	2,809	0.49	1.18	3,622	4,057	4,640	4,831	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Limanda limanda*	dab-nsea	2014	4,955	0.26	1.68	8,447	9,464	10,835	11,299	1.5	1.4	1.2	1.06
NEA	Greater North Sea	*Melanogrammus aeglefinus*	had-346a	2014	46,320	2.11	0.21	148,773	134,692	137,248	15,328	1.19	0.9	0.68	0.06
NEA	Greater North Sea	*Merlangius merlangus*	whg-47d	2015	33,188	1.18	0.35	87,343	97,808	111,712	116,012	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Merlangius merlangus*	whg-kask	2014	1,018	1.1	0.14	15,083	12,886	12,868	1,060	1.19	0.85	0.64	0.04
NEA	Greater North Sea	*Microstomus kitt*	lem-nsea	2014	3,689	0.67	0.81	5,079	5,689	6,502	6,762	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Mullus surmuletus*	mur-347d	2014	1,732	2.78	0.31	2,444	2,691	2,970	31	1.49	1.37	1.14	0.01
NEA	Greater North Sea	*Nephrops norvegicus*	nep-10	2015	15	1.41	0.15	155	145	147	9	1.31	1.02	0.78	0.04
NEA	Greater North Sea	*Nephrops norvegicus*	nep-32	2015	192	0.68	0.41	620	692	790	825	1.45	1.35	1.16	1.02
NEA	Greater North Sea	*Nephrops norvegicus*	nep-33	2015	1,003	1.94	0.56	634	609	619	23	1.37	1.1	0.84	0.03
NEA	Greater North Sea	*Nephrops norvegicus*	nep-34	2015	439	1.57	0.52	401	446	504	516	1.48	1.38	1.16	1.01
NEA	Greater North Sea	*Nephrops norvegicus*	nep-3-4	2015	4,388	0.56	0.89	6,538	7,324	8,376	8,721	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Nephrops norvegicus*	nep-5	2015	3,551	3.42	0.99	556	346	252	10	1.06	0.55	0.39	0.01
NEA	Greater North Sea	*Nephrops norvegicus*	nep-6	2015	1,561	1.74	0.37	2,408	2,625	2,899	2,216	1.45	1.32	1.09	0.7
NEA	Greater North Sea	*Nephrops norvegicus*	nep-7	2015	1,786	0.57	0.4	7,212	8,073	9,229	9,620	1.49	1.39	1.19	1.05
NEA	Greater North Sea	*Nephrops norvegicus*	nep-8	2015	1,892	0.8	1.07	1,654	1,852	2,117	2,201	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Nephrops norvegicus*	nep-9	2015	830	0.82	0.72	1,057	1,183	1,352	1,409	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Pandalus borealis*	pand-sknd	2014	12,340	2.69	0.42	6,624	3,857	2,555	121	1.04	0.5	0.35	0.01
NEA	Greater North Sea	*Platichthys flesus*	fle-nsea	2014	2,062	0.57	0.88	3,100	3,472	3,969	4,124	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Pleuronectes platessa*	ple-eche	2015	5,787	0.27	1.71	9,316	10,438	11,954	12,471	1.5	1.4	1.2	1.06

Region	Ecoregion	Species	Stock ID	Last Year	Last Catch (t)	F/F_{msy}	B/B_{msy}	Catch (t) scenario 2030				B/Bmsy scenario 2030			
								0.5	0.6	0.8	0.95	0.5	0.6	0.8	0.95
NEA	Greater North Sea	*Pleuronectes platessa*	ple-nsea	2015	134,460	0.36	1.74	159,893	180,356	210,780	225,069	1.51	1.42	1.25	1.12
NEA	Greater North Sea	*Pollachius pollachius*	pol-nsea	2015	1,980	1.53	0.39	3,154	3,518	3,988	4,105	1.49	1.39	1.18	1.02
NEA	Greater North Sea	*Pollachius virens*	sai-3a46	2015	83,310	0.53	0.78	151,119	169,292	193,843	202,272	1.5	1.4	1.2	1.06
NEA	Greater North Sea	*Scophthalmus maximus*	tur-kask	2014	120	1.28	0.53	132	147	167	173	1.49	1.39	1.18	1.03
NEA	Greater North Sea	*Scophthalmus maximus*	tur-nsea	2014	2,834	2.19	0.38	2,492	1,938	1,894	149	1.14	0.74	0.54	0.04
NEA	Greater North Sea	*Scophthalmus rhombus*	bll-nsea	2014	1,942	1.05	0.86	1,605	1,797	2,053	2,133	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Scyliorhinus canicula*	syc-347d	2014	2,704	0.43	1.33	3,502	3,934	4,548	4,802	1.5	1.4	1.22	1.08
NEA	Greater North Sea	*Solea solea*	sol-eche	2015	3,441	0.81	0.95	3,337	3,738	4,271	4,439	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Solea solea*	sol-kask	2015	224	0.3	0.89	638	714	817	850	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Solea solea*	sol-nsea	2015	14,293	0.69	0.77	20,089	22,500	25,718	26,746	1.5	1.4	1.2	1.05
NEA	Greater North Sea	*Sprattus sprattus*	spr-kask	2015	13,276	9.14	0.1	28,644	14,609	11,565	1,295	0.85	0.43	0.33	0.02
NEA	Greater North Sea	*Sprattus sprattus*	spr-nsea	2015	290,380	0.75	1.15	252,011	282,324	323,509	338,118	1.5	1.4	1.2	1.06
NEA	Greater North Sea	*Trachurus trachurus*	hom-nsea	2014	13,388	2.78	0.29	17,528	15,199	15,253	1,131	1.24	0.9	0.68	0.04
NEA	Greater North Sea	*Trisopterus esmarkii*	nop-34-oct	2014	44,200	1.06	0.32	152,888	171,234	195,689	203,335	1.5	1.4	1.2	1.05
NEA	Greenland Sea	*Argentina silus*	arg-icel	2015	6,056	0.7	0.79	8,223	9,209	10,535	10,978	1.5	1.4	1.2	1.05
NEA	Greenland Sea	*Gadus morhua*	cod-ingr	2015	25,272	1.07	0.69	25,789	28,881	32,998	34,281	1.5	1.4	1.2	1.05
NEA	Greenland Sea	*Gadus morhua*	cod-segr	2015	15,755	15.33	0.12	18,468	12,652	10,553	1,059	1	0.57	0.42	0.03
NEA	Greenland Sea	*Gadus morhua*	cod-wgr	2015	4,860	0.62	0.1	189,112	115,740	87,553	8,296	0.89	0.48	0.36	0.02
NEA	Greenland Sea	*Molva dypterygia*	bli-5a14	2015	1,813	0.71	0.62	3,036	3,398	3,892	4,072	1.48	1.38	1.19	1.05
NEA	Greenland Sea	*Sebastes mentella*	smn-grl	2015	5,977	106.49	0.04	8	45	58	300	0.05	0.05	0.05	0.02
NEA	Greenland Sea	*Sebastes norvegicus*	smr-5614	2015	51,601	0.74	1.04	49,820	55,865	64,290	67,608	1.49	1.39	1.2	1.06
NEA	Iceland Sea	*Brosme brosme*	usk-icel	2015	4,822	0.58	1.16	5,339	5,982	6,850	7,148	1.5	1.4	1.2	1.06
NEA	Iceland Sea	*Clupea harengus*	her-vasu	2015	69,729	0.92	0.69	81,055	90,703	103,597	107,883	1.49	1.39	1.19	1.05
NEA	Iceland Sea	*Gadus morhua*	cod-iceg	2015	230,225	0.4	1.23	349,157	391,071	447,092	465,025	1.5	1.4	1.2	1.05
NEA	Iceland Sea	*Mallotus villosus*	cap-icel	2016	174	0.23	0.71	790	885	1,012	1,053	1.5	1.4	1.2	1.05
NEA	Iceland Sea	*Melanogrammus aeglefinus*	had-iceg	2015	39,646	0.83	0.73	48,922	54,788	62,614	65,101	1.5	1.4	1.2	1.05
NEA	Iceland Sea	*Molva molva*	lin-icel	2015	12,862	0.59	1.24	13,276	14,870	17,008	17,708	1.5	1.4	1.2	1.05
NEA	Iceland Sea	*Pandalus borealis*	Pan_bor_1	2013	201	1.12	0.36	513	574	655	679	1.5	1.4	1.19	1.04
NEA	Iceland Sea	*Pandalus borealis*	Pan_bor_2	2013	1,128	3.21	0.29	1,563	1,593	1,608	20	1.47	1.25	0.94	0.01
NEA	Iceland Sea	*Pollachius virens*	sai-icel	2015	48,476	0.76	1	47,799	53,532	61,215	63,740	1.5	1.4	1.2	1.05
NEA	Iceland Sea	*Reinhardtius hippoglossoides*	ghl-grn	2015	25,677	1.16	0.66	24,252	27,072	30,825	32,111	1.45	1.35	1.15	1.01
NEA	Iceland Sea	*Sebastes mentella*	smn-con	2015	9,311	0.7	0.65	14,673	16,452	18,973	20,037	1.43	1.34	1.16	1.03
NEA	Iceland Sea	*Sebastes mentella*	smn-dp	2014	23,755	2.52	0.31	16,190	12,164	12,278	9,030	0.66	0.45	0.39	0.19
NEA	Iceland Sea	*Sebastes mentella*	smn-sp	2015	5,595	66.16	0.03	15	63	82	587	0.04	0.04	0.03	0.01
NEA	Norwegian Sea	*Clupea harengus*	her-noss	2014	461,306	0.66	0.77	674,509	755,666	866,888	908,098	1.49	1.39	1.2	1.06
NEA	Norwegian Sea	*Gadus morhua*	cod-coas	2015	52,154	1.52	0.54	47,724	53,276	60,358	62,227	1.49	1.38	1.18	1.02
NEA	Rockall	*Brosme brosme*	usk-rock	2015	226	1.72	0.24	744	751	802	172	1.35	1.14	0.91	0.16
NEA	Rockall	*Gadus morhua*	cod-rock	2014	15	10.98	0.02	0	2	2	12	0.03	0.03	0.03	0.01
NEA	Rockall	*Lepidorhombus* spp.	meg-rock	2014	343	0.5	0.76	673	754	862	897	1.5	1.4	1.2	1.05
NEA	Rockall	*Melanogrammus aeglefinus*	had-rock	2015	2,972	1.47	0.24	12,719	14,240	16,249	16,816	1.5	1.4	1.2	1.04
NEA	Wide ranging	*Anguilla anguilla*	eel-eur	2014	3,329	4.77	0.15	6,161	4,650	4,178	1,309	0.84	0.53	0.42	0.09

Region	**Ecoregion**	**Species**	**Stock ID**	**Last Year**	**Last Catch (t)**	**F/F_{msy}**	**B/B_{msy}**	**Catch (t) scenario 2030**				**B/Bmsy scenario 2030**			
								0.5	**0.6**	**0.8**	**0.95**	**0.5**	**0.6**	**0.8**	**0.95**
NEA	Wide ranging	*Aphanopus carbo*	bsf-nea	2015	508	2.09	1.25	115	132	159	176	1.19	1.13	1.03	0.95
NEA	Wide ranging	*Argentina silus*	arg-123a4	2014	15,057	2.14	0.54	8,834	8,550	8,895	762	1.36	1.1	0.86	0.06
NEA	Wide ranging	*Argentina silus*	arg-rest	2014	1	0	0.25	1,436	1,567	1,786	1,848	1.1	1	0.86	0.75
NEA	Wide ranging	*Brosme brosme*	usk-mar	2013	0	0	0.11	11	8	6	1	0.83	0.49	0.39	0.06
NEA	Wide ranging	*Brosme brosme*	usk-oth	2014	4,585	0.56	0.95	6,483	7,264	8,327	8,705	1.5	1.4	1.2	1.06
NEA	Wide ranging	*Centrophorus squamosus*	guq-nea	2014	33	0.33	0.11	8	125	153	320	0.18	0.15	0.15	0.08
NEA	Wide ranging	*Centroscymnus coelolepis*	cyo-nea	2014	5	0.01	0.18	17	416	539	1,393	0.22	0.21	0.21	0.18
NEA	Wide ranging	*Cetorhinus maximus*	bsk-nea	2014	0	0	0.11	1	20	25	89	0.13	0.13	0.12	0.09
NEA	Wide ranging	*Chelidonichthys cuculus*	gur-comb	2014	5,060	2.64	0.39	4,583	4,851	4,908	58	1.49	1.32	1	0.01
NEA	Wide ranging	*Coryphaenoides rupestris*	rng-1012	2014	3,481	4.32	0.18	5,630	4,199	3,776	1,039	0.87	0.54	0.43	0.08
NEA	Wide ranging	*Coryphaenoides rupestris*	rng-oth	2014	51	1.8	0.25	148	146	154	31	1.27	1.04	0.83	0.14
NEA	Wide ranging	*Dalatias licha*	sck-nea	2014	0	0	0.2	336	346	386	333	1.13	0.97	0.81	0.59
NEA	Wide ranging	*Galeorhinus galeus*	gag-nea	2014	347	2.04	0.27	313	234	257	264	0.56	0.42	0.38	0.25
NEA	Wide ranging	*Hoplostethus atlanticus*	ory-comb	2015	90	1.57	0.09	7	94	107	97	0.19	0.15	0.14	0.03
NEA	Wide ranging	*Isurus oxyrinchus*	SMA_ATN	2014	2,899	1.39	0.79	1,204	1,413	1,802	2,070	0.91	0.89	0.85	0.82
NEA	Wide ranging	*Lamna nasus*	POR_NEA	2014	18	3.2	0.06	1	4	5	38	0.07	0.06	0.06	0.06
NEA	Wide ranging	*Lamna nasus*	por-nea	2014	7	0.18	0.1	2	30	39	162	0.11	0.11	0.11	0.08
NEA	Wide ranging	*Macrourus berglax*	rhg-nea	2014	654	1.4	0.24	2,351	2,308	2,505	1,155	1.14	0.93	0.76	0.29
NEA	Wide ranging	*Merluccius merluccius*	hke-nrtn	2015	101,066	1.12	1.07	61,818	69,179	79,213	82,910	1.47	1.37	1.18	1.04
NEA	Wide ranging	*Micromesistius poutassou*	whb-comb	2014	1,146,000	0.77	1.03	1,086,638	1,217,210	1,394,585	1,457,607	1.5	1.4	1.2	1.06
NEA	Wide ranging	*Molva dypterygia*	bli-oth	2014	240	1.25	0.44	357	397	449	465	1.43	1.33	1.13	0.98
NEA	Wide ranging	*Molva molva*	lin-oth	2014	17,024	0.46	1.01	27,678	31,034	35,662	37,399	1.5	1.4	1.21	1.07
NEA	Wide ranging	*Mullus surmuletus*	mur-west	2014	1,402	0.7	0.83	1,811	2,028	2,317	2,408	1.5	1.4	1.2	1.05
NEA	Wide ranging	*Mustelus* spp.	trk-nea	2014	3,690	1.18	0.87	2,527	2,830	3,255	3,431	1.41	1.32	1.13	1.01
NEA	Wide ranging	*Phycis blennoides*	gfb-comb	2015	4,243	2.04	0.62	2,272	2,028	1,992	54	1.36	1.01	0.74	0.02
NEA	Wide ranging	*Prionace glauca*	BSH_ATN	2014	36,516	1.1	1.1	20,661	23,365	27,536	29,681	1.38	1.3	1.15	1.04
NEA	Wide ranging	*Raja clavata*	raj-mar	2014	187	4.56	0.55	0	3	3	2	0.28	0.19	0.17	0.02
NEA	Wide ranging	*Salmo salar*	salmon-NEAC	2014	938	1.87	0.2	2,519	2,065	1,975	769	0.8	0.55	0.44	0.13
NEA	Wide ranging	*Scomber scombrus*	mac-nea	2014	1,394,454	1.7	1.12	551,402	616,738	702,327	726,206	1.5	1.4	1.19	1.04
NEA	Wide ranging	*Squalus acanthias*	dgs-nea	2013	2,384	0.45	0.36	6,815	7,449	9,242	10,066	0.66	0.6	0.56	0.51
NEA	Wide ranging	*Squatina squatina*	agn-nea	2011	1	1.39	0.07	0	1	1	2	0.13	0.11	0.1	0.02
NEA	Wide ranging	*Thunnus alalunga*	ALB_ATN	2014	26,539	0.41	1.36	35,418	39,668	45,345	47,148	1.5	1.4	1.2	1.05
NEA	Wide ranging	*Thunnus thynnus*	BFT_ATE	2014	13,250	0.26	1.26	30,369	34,018	38,914	40,521	1.5	1.4	1.2	1.05
NEA	Wide ranging	*Trachurus trachurus*	hom-west	2014	129,025	0.79	0.54	226,732	253,788	289,892	301,697	1.5	1.4	1.2	1.05
NEA	Wide ranging	*Xiphias gladius*	SWO_ATN	2014	10,813	0.62	1.22	10,708	11,993	13,712	14,266	1.5	1.4	1.2	1.05