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Assessment of MSC-certified fish stocks in the Northeast Atlantic

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ABSTRACT

This study examines the status and exploitation level of 31 northern European stocks targeted by fisheries certified by the Marine Stewardship Council (MSC) as being sustainable and well managed. In the first year of certification, 11 stocks (52% of stocks with available data) were exploited above the maximum sustainable level and four stocks (16% of stocks with available data) were outside of safe biological limits. MSC states that it certifies sub-standard stocks because they will improve once they are in their program. However, after a duration of certification of one to ten years (average four years), no significant changes in fishing pressure or stock size were detected. In the last certified year with available data, seven stocks (44% of stocks with available data) were subject to overfishing and five stocks (21% of stocks with available data) were outside of safe biological limits. Certification should guarantee that fishing quotas are set correctly and are enforced. However, in 11 stocks quotas were set 20–60% above the level that fishers were taking, whereas in three stocks landings exceeded quotas by 30–50%. The study concludes that MSC should change its rules such that overfishing or unsafe stock sizes lead to immediate suspension of certification and that no certification is issued in the first place for a stock that is already in such a situation.

1. Introduction

Status and exploitation level of seafood varies widely, even between different populations of the same species. Consumers who want to make a responsible choice when buying seafood therefore need guidance, such as provided by ecolabels. The Marine Stewardship Council (MSC) provides a widespread ecolabel and sets and maintains standards for sustainable fishing based on three core principles, namely: 1) sustainable target fish stocks; 2) environmental impact of fishing; and 3) effective management [1]. Principle 1 entails that "A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery". More generally, for an exploited population (=stock) to be in sustainable good status, the stock must be sufficiently large and the fishing pressure must be below the maximum sustainable level. The European Union has recently reformed its Common Fisheries Policy [2], basically implementing in regional law the binding obligations provided by the Law of the Sea [3] and by the United Nations Fish Stock Agreement [4]. The new European policy requires that "exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield" [2, Article 2]. This goal can only be reached if fishing pressure is reduced below the rate of fishing mortality (F) corresponding to the maximum sustainable yield (F_{msy}).

This study examines relative biomass and fishing pressure for 31 northern European stocks which are targeted by MSC-certified fisheries and which are referred to as MSC certified stocks in the remainder of this text. The study aims to answer the following questions: (i) has fishing pressure (F) decreased after certification? (ii) is current fishing pressure below the one which can produce the maximum sustainable yield (F_{msy})? (iii) has stock size grown after certification? (iv) Is the current stock size (B) above the one which can produce the maximum sustainable yield (B_{msy})? (v) has management set realistic and precautionary levels of total allowable catches (TACs)? (vi) have TACs been enforced and/or obeyed by the fisheries?

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2. Material and methods

Information on MSC-certified fisheries was obtained from www.msc.org in September 2015. Data on stock size and fishing pressure were extracted from official advice documents available in September 2015 at www.ices.org. For the purpose of this study, all 31 stocks assessed by the International Council for the Exploration of the Seas (ICES) and targeted by MSC-certified fisheries were analyzed. The year that the first fishery on a stock was certified was used as start-year for the evaluation. The end-year was determined by the availability of assessment data (mostly 2014 for F and mostly 2015 for B) or by the suspension of certification. Estimates of F and F_{msy} were available for 20 stocks. In one stock (Icelandic saithe, *Pollachius virens*, sai-icel), the ratio of harvest rate relative to the MSY-compatible harvest rate was used. Estimates of B were available for most stocks. In some cases only stock size indices were available and were used to compare stock size at the beginning and the end of the certification period. The precautionary biomass (B_{pa}) above which the stock has a low probability of suffering from reduced recruitment [5] was available for most stocks and was used as reference point. If no estimate of B_{pa} but an estimate of $MSY\ B_{trigger}$ was available, $MSY\ B_{trigger}$ was assumed as being identical to B_{pa}, as recommended by ICES [5]. In Norwegian coastal waters cod (*Gadus morhua*, cod-coas), B_{pa} was not given explicitly but the management plan aims for rebuilding of "full reproductive capacity" [6]. This term is often used to describe B_{pa}. We therefore interpreted, for the purpose of this study, the corresponding biomass rebuilding target as equivalent to B_{pa}.

ICES did not provide estimates of B_{msy}, except for Northern Shrimp (*Pandalus borealis,* pand-barn). A proxy for B_{msy} was derived as $B_{msy} = 2 * B_{pa}$ (or $2 * MSY\ B_{trigger}$), as proposed by Froese et al. [7] and as used for example in the ICES stock assessment of Northern Shrimp, where $MSY\ B_{trigger}$ is set as half of B_{msy} [8].

Mean and median values were calculated for duration of certification and for relative F and B values. An observed mean or median was considered as significantly different from a target value if the target value was outside the respective 95% confidence limits. For the evaluation of relative values the median was preferred, because ratios are not normally distributed. Also, the median is robust against extreme values. Both mean and median are presented in Table 1.

The full data set used for the analysis, with links to the respective MSC and ICES assessment documents, is available as part of the online material (MSC_ICES_2015_4.xlsx).

For the evaluation of setting and enforcing realistic and precautionary TACs by management, actual annual landings (i.e. without considering discards or unreported catches) as reported by ICES were compared with allowed catches for the years that a stock was certified. Under effective management, landings should equal TACs, i.e. the ratio should be close to one. The actual ratios have been calculated from data on landings and TACs given in the ICES advice sheets from 2015. An exception is the Greater Silver Smelt in ICES division V to VII (arg-5b6a). Here the landings of EU member states have been calculated using data from the Report on Greater Silver Smelt [9].

3. Results

Of the 31 northern European stocks with MSC-certified fisheries, three stocks (ane-bisc, her-2224, nep-3-4) were certified in 2015 and were therefore only used for the analysis of biomass at the beginning of the certification period. For the remaining 28 stocks, the period of certification was from 1 to 10 years, with a mean duration of 3.9 years (Table 1).

In the first year of certification, 52% of the stocks were subject to overfishing ($F > F_{msy}$), 16% were outside of safe biological limits ($B < B_{pa}$), and 64% of the stocks had a spawning stock biomass of less than 2 B_{pa}, the proxy used in this study as indicator of the biomass that can produce the maximum sustainable yield. At the end of the examined certification period, 44% of the stocks were subject to overfishing, 21% were outside of safe biological limits, and 67% had a spawning stock biomass of less than 2 B_{pa}. The median ratios of end over start values, as indicators of change, were 0.89 (0.75–1.06) for fishing mortality and 0.94 (0.71–1.03) for spawning stock biomass. Both ratios were not significantly different from 1.0, indicating no significant change during the certification period (Table 1).

Of the 16 stocks with available data, only four stocks (25%; Icelandic cod, *Gadus morhua*, cod-iceg; North Sea herring, *Clupea harengus*, her-47d3; Northern shrimp; North Sea plaice, *Pleuronectes platessa*, ple-nsea) were not subject to overfishing and had stock sizes above the *MSY* level in the last year with available data (Fig. 1).

In the first certified year with available data, four stocks (16%; Faroe Plateau saithe, *Pollachius virens*, sai-faro; Norwegian coastal cod, *Gadus morhua*, cod-coas; Northeast Atlantic mackerel, *Scomber scombrus*, mac-nea; Southern sardine, *Sardina pilchardus*, sar-soth) were outside of safe biological limits [2].

In the last certified year with available data, five stocks (21%; North Sea saithe, *Pollachius virens*, sai-3a46; Norwegian coastal cod; Norwegian spring spawning herring, *Clupea harengus*, her-noss; Southern sardine; Sea bass, *Dicentrarchus labrax*, bss-47) were outside of safe biological limits (note that North Sea saithe missed the target by a very small margin).

Eight out of 23 stocks (35%) had landings within an assumed compliance range of $\pm$10% around the TAC (Fig. 2). Landings exceeded TACs by 30–50% in two of the certified stocks: Norwegian coastal cod (cod-coas) and European hake (hke-nrthn). In 9 stocks TACs were set 20–60% above the level that fishers were taking.

Table 1
Results of analyzing 31 stocks in the Northeast Atlantic targeted by MSC-certified fisheries, where *Years* refers to the duration of the certification, F is fishing mortality and B is biomass. The subscripts *start* and *end* refer to the first and last year of certification and available data, lcl and ucl are the lower and upper 95% confidence limits, respectively, and the *Target* values indicate a decrease in fishing pressure or a sustainably exploited stock (< 1.0), an increase in biomass (> 1.0), and a stock size above the level capable of producing *MSY* (> 2.0). The last column indicates the number and percentage of stocks that have met the target. [MSC_ICES_2015_4.xlsx].

	n	Min	Max	Mean	lcl	ucl	Median	lcl	ucl	Target	n/%
Years	28	1	10	3.9	3.1	4.8	3.5	2	5		
F_{end}/F_{start}	21	0.46	1.73	0.98	0.83	1.13	0.89	0.75	1.06	< 1.0	13/62
F_{start}/F_{msy}	21	0.08	2.31	1.12	0.91	1.32	1.05	0.90	1.27	< 1.0	10/48
F_{end}/F_{msy}	16	0.05	2.92	1.05	0.76	1.35	0.97	0.72	1.07	< 1.0	9/56
B_{end}/B_{start}	28	0.46	2.25	1.04	0.86	1.22	0.94	0.71	1.03	> 1.0	11/39
B_{start}/B_{pa}	25	0.28	4.49	1.88	1.49	2.28	1.87	1.44	2.08	> 1.0	21/84
B_{start}/B_{pa}	25	0.28	4.49	1.88	1.49	2.28	1.87	1.44	2.08	> 2.0	9/36
B_{end}/B_{pa}	24	0.38	9.62	2.12	1.34	2.90	1.62	1.11	2.14	> 1.0	19/79
B_{end}/B_{pa}	24	0.38	9.62	2.12	1.34	2.90	1.62	1.11	2.14	> 2.0	8/33

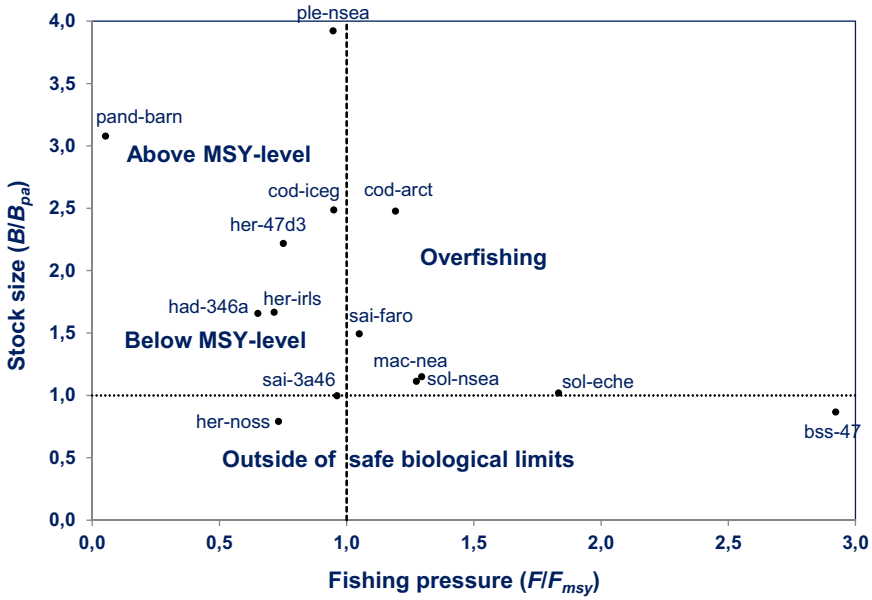

Fig. 1. Presentation of 16 MSC-certified stocks of the Northeast Atlantic in a pressure-state diagram, where fishing pressure (F) is shown relative to the maximum sustainable pressure (F_{msy}) and parental biomass (B) is shown relative to the one (B_{pa}) below which stocks are considered to be outside of safe biological limits. Good stock status capable of producing *MSY* is to be found in the upper-left area. Labels are the official stock identifiers. Mac-nea and bss-47 fisheries had their certificates suspended in 2012 and 2015 respectively; certification of mac-nea was resumed in May 2016 [MSC_ICES_2015_4.xlsx].

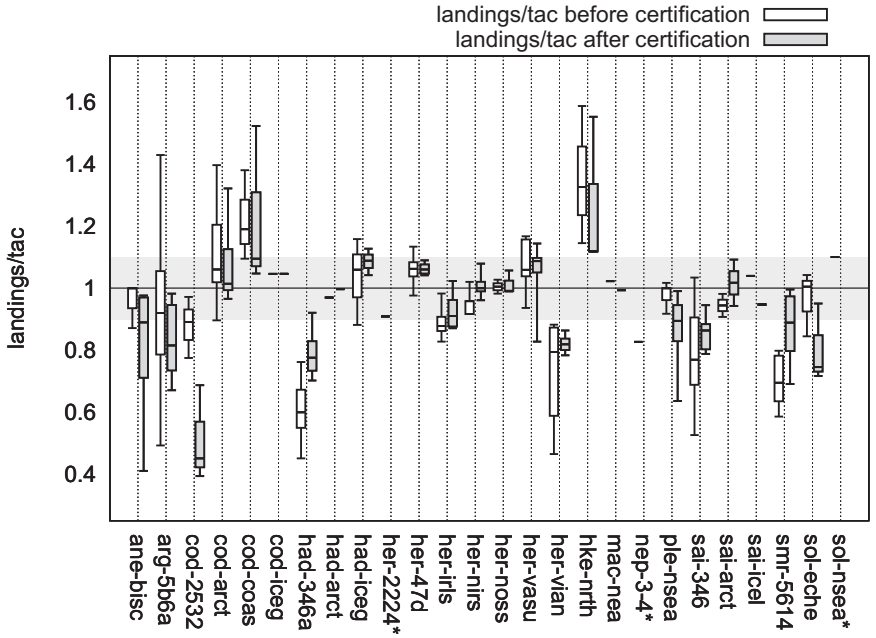

Fig. 2. Annual landings reported by ICES relative to the total allowed catches (TACs) set by management for 26 North Atlantic MSC certified stocks with available data. The grey boxes refer to certified years and the white boxes refer to the same number of years before certification. Whiskers denote minimum and maximum of observed landing/TAC ratios. Under effective management landings should not deviate much from TACs; the horizontal grey band indicates a "compliance" area of +/− 10% deviation.

4. Discussion

There are quite a number of critical assessments of the criteria and procedures used by MSC to certify seafood [10–22]. Staff and advisors of MSC have responded to previous critical assessments of certified stocks [e.g. 11,12] by claiming that the methods used were different from those used in the official stock assessments [23,24]. This study therefore restricted its analysis to the official ICES stock assessment data that form the basis for EC fisheries management and also for MSC assessments with regard to fishing pressure and stock size. Although MSC has chosen not to define the terms "overfished" and "overfishing" [24], there can be no doubt that a fishing mortality rate above F_{msy} means that the stock is subject to overfishing [2,4,11,12] and that a spawning stock biomass below B_{pa} means that the stock is outside of safe biological limits [2]. It is also undisputed that the biomass that can produce the maximum sustainable yield (B_{msy}) must be larger than B_{pa} [5]. A study analyzing 31 stocks outside the ICES area found a median B_{msy}/B_{pa} ratio of 2.19 [7]. That study also reviews the pertinent literature and concludes that twice B_{pa}, as used in this study, is a reasonable and not overly ambitious preliminary proxy for B_{msy} [7,8].

MSC-labeled seafood products are supposedly coming from wild populations that are responsibly managed with regard to

fishing pressure, stock size, and ecosystem considerations [1]. However, previous studies found that about 30% of the MSC-certified stocks were subject to overfishing or had smaller stock sizes than the one that can produce the maximum sustainable yield [11,12]. This study examined how the northern European stocks targeted by MSC-certified fisheries performed with regard to F_{msy}, B_{pa}, and a proxy for B_{msy}. Surprisingly, at the time of certification, about half of the stocks were subject to overfishing, two-thirds of the stocks were below the biomass level capable of producing MSY, and four stocks were even outside of safe biological limits. After a certification period of one to ten years (average four years) this picture did not change much: more than 40% of the stocks were still subject to overfishing, two-thirds of the stocks were below proxy B_{msy}, and five stocks were outside of safe biological limits.

The ratio of landings and TACs is an indicator for the effectiveness of quota management. As the TAC specifies how much can be fished legally from a stock in a given year, this ratio should not be greater than one. Otherwise the TAC has not been enforced properly. If the ratio is below one, then the TAC is not restricting fishing activities effectively. An observed ratio below one implies that the fishermen were allowed to land more than they actually chose to fish. Given that fishermen have an incentive to expand catches as long as it is profitable to do so, a landings/TAC ratio below one indicates that the TAC is set so high that fishers are not able to fish it without the cost of fishing exceeding the value of landings. Such situation may suggest that demand and prices are low, or that there are too few fish in the water or that overfishing is ongoing [25]. An exception to this reasoning is Northern shrimp, which has always been fished far below *MSY* levels, because there are regulations for some areas requiring vessels to sail long distances to specified entry and exit points and some other areas are subject to closures to prevent bycatch of other species and undersized shrimp. In addition, environmental changes have led to a change in shrimp biomass distribution and decreasing catch rates in traditional fishing grounds. In other words, while in this case the stock is not depleted or overfished, not the TAC but costs of fishing are limiting landings in this very sensitive area [26].

Certification of stock size, fishing pressure and management procedures by MSC should guarantee compliance with the total allowed catches set by management, i.e., actual landings should be within a "compliance range" of $+/-10\%$ of TACs, assumed for the purpose of this study. However, this was only the case for about one third of the stocks. In three stocks landings substantially exceeded TACs and in about half of the certified stocks TACs substantially exceeded what fishers landed, putting effective management in question.

MSC maintains that sub-optimal stocks are certified because, once they are part of the MSC program, the obligations affixed during the annual assessments and the periodic full reassessments force management to adopt measures that will reduce fishing pressure, rebuild stock size, and maintain stock size at MSY-compatible levels [23,27]. This study did not find evidence in support of that claim. Especially disturbing was the apparent toleration of overfishing ($F > F_{msy}$) at the onset of certification as well as its continuation during the certification period. This is in clear violation of the implicit message of any seafood ecolabel that the certified product does not stem from a stock that is subject to overfishing. There is no perceivable justification for this tolerance, because setting fishing mortality such that overfishing is avoided with a high probability is the core task of effective fisheries management, the third principle of MSC certification. Instead, certification of overfishing rewards bad management and undermines efforts by others to enforce responsible management. Similarly, buyers of MSC-certified seafood would not expect that the product may stem from a stock that is outside of safe biological limits, which was the case in 16–21% of the stocks.

It should be noted that four of the analyzed stocks, Southern sardine, *Sardina pilchardus*, sar-soth, North East Atlantic mackerel, *Scomber scombrus,* mac-nea, Eastern Baltic cod, *Gadus morhua*, cod-2532, and sea bass, *Dicentrachus labrax*, bss-47 had their MSC certificates suspended. The stated reasons for suspension were the following:

(1) For Southern sardine the certificate was suspended in January 2012 after the audit team found that stock biomass was below B_{lim}, the lowest biomass level accepted for MSC certification, indicating a 50% probability that the stock suffers from impaired recruitment. Certification was resumed in 2013 following a corrected management plan but was suspended again in February 2014 as biomass levels were still below B_{lim}.
(2) Certification of Atlantic mackerel was suspended in April 2012 due to lack of international agreement on management of the stock. Certification was resumed in May 2016.
(3) MSC certification for Eastern Baltic cod was suspended in December 2015 for the stated reason that the 2015 benchmark stock assessment provided no advice on stock status or reference points.
(4) The Dutch rod and line fishery for sea bass had its certificate suspended in February 2015 with the stated reason that no management plan was in place. Meanwhile the fishery has withdrawn the request for certification.

Suspension of certification is a strong instrument that MSC could use to prevent overfishing ($F > F_{msy}$) or stocks being outside of safe biological limits ($B < B_{pa}$). However, of the four cases of suspension, only one (Southern sardine) referred to poor stock status, using a reference point (B_{lim}) well below B_{pa}. Poor stock status was also apparent in Eastern Baltic cod, where the stock size index had shown a steady substantial decline (about 50%) during the period of certification (2011–2015) [28]. Likewise seabass biomass had steadily fallen close to B_{pa} during 2011–2014 and was below B_{pa} in 2015, with a possibility of being below B_{lim}. Seabass overfishing reached an all-time high of three times F_{msy} during the period of active certification [29]. But these suspensions were based on formal management issues (missing plans) and not on the status of the stock.

MSC is the largest existing label for seafood from "sustainable fisheries" and in a recent study [30] a majority of consumers in Germany has responded to know the MSC label and 41% acknowledged that the label influences their decision to buy a certain fish product. This demonstrates that MSC certification has an influence on consumer choice and thus on competing products without the label.

There is no legally defined and protected designation of sustainable fisheries on the international or EU level. The Food and Agriculture Organization of the United Nations (FAO) has issued Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries [31]. However, compliance with the guidelines is voluntary and cannot be enforced. In essence, the lack of a legal definition and the associated lack of legal protection of the term "sustainable fisheries" means that industry and other bodies are free to use the designation and award relevant labels to influence consumer choice, even if stock status, fishing pressure and management of the population from which the seafood was taken do not live up to the proclaimed standards. The EU would be a particularly potent actor to legally define and protect the designation of fishery products as stemming from "sustainable fisheries" [11,12].

5. Conclusions

This study examined the status and exploitation level of northern European stocks targeted by MSC-certified fisheries. In the first year of certification, about half of the stocks with available data were exploited above the maximum sustainable level and four stocks were outside of safe biological limits. In the last certified year, 44% of the stocks were subject to overfishing and five stocks were outside of safe biological limits. Thus, after a duration of certification of one to ten years, no significant changes in fishing pressure or stock size could be detected across stocks. Certification should guarantee that fishing quotas are set correctly and are enforced. However, in about 1/3 of the stocks quotas were set 20–60% above the level that fishers were taking, whereas in three stocks landings exceeded quotas by 30–50%.

In conclusion, to maintain its credibility as a seafood ecolabel and its position as the de-facto market leader, MSC will have to change its rules such that overfishing ($F > F_{msy}$) or unsafe stock size ($B < B_{pa}$) leads to immediate suspension of certification and that no certification is issued in the first place for a stock that is already in such a situation.

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Appendix A. Supplementary material

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