**Supporting Information**

**Methods**

***Data compilation***

We compiled time series of catch data, fishing mortality rates, and model estimates of biomass to assess the status of 45 fish stocks currently targeted by MSC-certified fisheries (Table S1) and 179 uncertified fish stocks (Table S2). Additionally, for each stock we collected the biomass (*B*MSY) and exploitation rate (*u*MSY) or fishing mortality (*F*MSY) that result in Maximum Sustainable Yield (MSY). When available, we used MSY reference points estimated within a stock assessment model, and collected biomass time series that corresponded to the same units as *B*MSY. If these reference points were not reported by the stock assessment agency or scientific advisory body, we fit a surplus production model to time series of biomass and total catch to estimate these reference points (see description of surplus production fitting method below). If multiple estimates of biomass were reported (e.g., spawning biomass) total biomass estimates were used.

Data for MSC-certified stocks were collected from the most recent stock assessment reports or from personal communication with stock assessment scientists. The MSC defines the unit of certification for a fishery based on several variables (e.g., gear type, organizational framework, port of landing). As a result, a single stock may be fished by multiple certified fisheries or, alternatively, one fishery may target different stocks. Thus, the 45 stocks we analysed included 82 (62%) certified fisheries. Three types of MSC-certified fisheries were not included in our dataset, as follows: (1) fisheries that are assessed under different approaches than single-species MSY (for example salmon and invertebrates); (2) those stocks without MSY reference points and without time series from which to obtain such reference points; and (3) those certified fisheries managed under traditional or informal management schemes and/or categorized as data limited (without MSY reference points; Table S1). These fisheries are scored using MSC’s risk-based framework (RBF) [1], which takes into account a wide range of metrics including the resilience of the target species, the type of fishing method employed and the decision-making process of the management body to assess the sustainability of the fishery. The RBF was developed to increase the accessibility to the MSC program of sustainable small-scale fisheries, data-limited fisheries or fisheries in developing countries [1].

The majority of the data for uncertified fish stocks was sourced from the RAM Legacy Stock Assessment Database [2]. This database represents almost all of the world’s fish stocks for which assessments are regularly conducted. As such it is often geographically limited to stocks exploited by developed countries with well-established fisheries management agencies and large, industrial-scale fisheries, and so our data set is largely comprised of stocks that meet these characteristics, making them comparable with certified stocks. We used all stocks in the RAM Legacy database that met our data collection requirements (outlined above). For some stocks in the RAM Legacy database more recent stock assessments were available. We updated the data whenever possible (see Table S2 for a list of sources), and discarded assessments older than 2005.

In order to assess whether only sustainable fisheries were applying for MSC certification and to further evaluate the performance of MSC’s certification standards and the MSC screening process, we compared certified stocks with those that went through the pre-assessment process and were recommended not to pursue full certification. Pre-assessment is a confidential process used to assess a fishery’s ability to meet MSC’s standards. Fisheries receiving a recommendation not to go forward will usually withdraw before entering the full, public certification process. We compiled a subset of 25 non-recommended stocks from available MSC proprietary and confidential information on stocks that had undergone pre-assessment and were not recommended to proceed into full assessment and for which information on biomass reference points were available. We confined our subset to those stocks that showed weaknesses with respect to MSC’s standards for biological stock status (Principle 1).

***Assessing stock status***

We assessed the status of each stock based on: (1) the current biomass relative to the biomass that would produce MSY (*B*current/ *B*MSY), and (2) the current exploitation rate or fishing mortality relative to the exploitation rate that would produce MSY (*u*current / *u*MSY). When stock assessments provided estimates of instantaneous fishing mortality (*F*), those were used to calculate *F*current/*F*MSY. Whenever possible we used the MSY reference points estimated by the management agency conducting the stock assessment (30 certified and 136 non-certified stocks). For fish stocks under the International Council for the Exploration of the Sea (ICES), the assessments for many stocks report *F*MSY as the only reference point. For those cases (12 certified and 26 non-certified stocks), we used a combination of the *B*MSY estimated from the surplus production models and *F*MSY estimated by the scientific advisory body (see Table S1 for the method used for certified fisheries, and Table S2 for uncertified fisheries).

If no MSY reference points were available, we estimated MSY from a surplus production model [3]. To summarize, surplus production (*P*) in year *t* is given by the following equation:



(1)

where *B* is biomass and *C* is total catch. We fit a dynamic Schaefer production model, which uses a logistic growth function to update biomass in each year, to time series with ≥20 years of biomass estimates and catch data. The surplus production predicted the Schaefer model in year *t* is given by the following equation:

,

(2)

where *m* is the Maximum Sustainable Yield, and *K* is the unfished biomass. These parameters (*m* and *K*) were estimated using maximum likelihood in AD Model Builder [4]. We assumed that the residuals were normally distributed [3]. The Schaefer model assumes a symmetric relationship between biomass and yield, so production is maximized at 0.5*K*, providing an estimate of *B*MSY. The exploitation rate that results in MSY (*u*MSY) is defined as the yield (*m*) divided by the available biomass at this yield, or *m*/*B*MSY. Stocks with poor fits or unreasonable estimates were discarded.

Even though the concept of MSY has been extensively used in fisheries science and in internationally agreed target or limit reference points, it is not uniformly defined or estimated. Numeric estimates of *B*MSY and *u*MSY are dependent on the vulnerability of different sizes or ages of fish to the fishing gear, on whether total biomass or spawning biomass are used to define *B*MSY, and on the model or method used for estimation [3]. For the latter, MSY reference points are particularly sensitive to the underlying assumptions in the stock-recruitment relationships. In order to minimize uncertainty related to stock-recruitment relationships and to avoid assumptions on steepness, we fit the described surplus production models against total biomass.

***Data analysis***

We examined the status of three groups of fisheries (certified, uncertified, and non-recommended) by plotting *B*/*B*MSY vs. *u*/*u*MSY or*F*/*F*MSY. The current (or most recent) status for each of the 45 certified stocks are plotted in Fig. 1A. The 179 uncertified stocks are plotted in Fig. 1B, and the non-recommended stocks are plotted in Fig. 1C. A kernel density smoothing function was used to describe the probability of occurrence in each quadrant (Fig. 1A, 1B, and 1C).

To determine whether *B*/ *B*MSY is significantly different between groups we used re-sampling inference, which allows us to assess how often a difference of the observed magnitude or larger would arise by chance. We combined our certified and uncertified datasets for *B* /*B*MSY (*n* = 224) and randomly drew (without replacement) a sample of 45 relative biomass points. We then calculated the average relative biomass of the selected data points as well as the average relative biomass of the unselected data points, and calculated the difference between the two. We repeated this process 100,000 times in order to calculate the probability of observing a greater difference in *B*/ *B*MSY between two randomly observed data groupings. The same process was repeated to determine the probability of observing significant differences in *u* / *u*MSY between groups.

We conducted three additional analyses using re-sampling inference. The first tested whether certified fisheries were more likely to have *B* > *B*MSY than uncertified fisheries. The second tested whether certified fisheries were more likely to have *u* < *u*MSY. We also ran each of these tests using *B*MSY and *u*MSY as strict cut-offs. The third tested whether the number of uncertified stocks that are below 0.5*B*MSY is significantly different from the number of certified stocks at the same biomass levels.

Because fish stocks can be highly variable from year to year, we examined the long-term performance of certified and uncertified stocks in relation to *BMSY* (Fig. 2). The available time series data (165 uncertified stocks and 31 certified stocks) was fit to the following model to test for a difference in the conditional mean of each group:



(3)

where *X* is the ratio of *B*/*B*MSY for stock *i* in time period *t*, and *I* is an indicator variable describing whether stock *i* is certified at any point in the observed time trajectory. Estimation of parameters using Ordinary Least Squares assumes that the error term is uncorrelated with the regressors. Because time series observations are not temporally independent, we included two autoregressive lag parameters in our linear model. Autoregressive models can correct for any biases that may result from correlation between the error term and one or more regressors. To select the appropriate number of lags, an autoregressive model was fit to each stock time series and the order was selected using Akaike’s Information Criterion (AIC; > 90% of all stocks had an order of two or less).

**Results**

The median *B*/*B*MSY was 1.25 for certified stocks (*n* = 45) and 0.87 for uncertified stocks (*n* =179). We found the difference (0.38) in *B*/*B*MSY between the two groups to be statistically significant (*P* < 0.05; see Supporting Table 3 for all statistical results). A similar resampling calculation was made to determine whether *u*/*u*MSY for certified stocks is lower than *u*/*u*MSY for uncertified stocks. In this case, the median was 0.67 for certified stocks and 0.73 for uncertified stocks, but the difference (-0.06) was not statistically significant (*P* = 0.19).

Some 74% of certified fisheries had a biomass above *B*MSY (i.e. *B* > *B*MSY), compared with 44% of uncertified fisheries. We found significantly more certified fisheries above *B*MSY than expected by random selection from all fisheries, compared with the uncertified fisheries (*P* < 0.05). In addition, 82% of certified fisheries vs. 65% of uncertified stocks had exploitation rates that would maintain the stock around *B*MSY or allow rebuilding to *B*MSY (i.e., *u* < *u*MSY). When we compared the difference in these percentages with the difference between randomly chosen groups of stocks, certified stocks had a significantly higher chance of being 17% better than uncertified stocks in this metric (*P* < 0.05). We also observed that 3 of 45 stocks (7%) were below 0.5*B*MSY (excluding the suspended Iberian sardine stock) whereas 49 of 179 uncertified stocks (27%) were below 0.5*B*MSY. We tested the probability of observing a greater difference in the number of overfished stocks in each group. Significantly fewer certified stocks were below *B*MSY compared to uncertified stocks (*P* < 0.05). Finally, when comparing the status of the certified, uncertified, and non-recommended stocks by using only those fisheries with stock assessment and reference points defined by the management agencies or scientific advisory bodies, we observed similar trends, and differences among categories (Table S4).

The median biomass in relation to *B*MSY for certified and uncertified stocks is shown in Figure 2. Certified stocks had significantly higher *B*/*B*MSY ratios than uncertified stocks (Table S5). Given that this analysis is conducted with time series data that include observations prior to the creation of MSC, we do not draw causal conclusions regarding the effect of certification. When we performed the same test on a subset of the observations prior to 1998 the same effect was observed. However, this test does indicate that the stocks that have been certified by MSC are outperforming other stocks in standing stock biomass, an important indicator of long-term stock sustainability.

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