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Conservation-Status Gaps for Marine Top-Fished Commercial Species

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Abstract: Biodiversity loss is a global problem, accelerated by human-induced pressures. In the marine realm, one of the major threats to species conservation, together with climate change, is overfishing. In this context, having information on the conservation status of target commercial marine fish species becomes crucial for assuring safe standards. We put together fisheries statistics from the FAO, the IUCN Red List, FishBase, and RAM Legacy databases to understand to what extent top commercial species' conservation status has been assessed. Levels of assessment for top-fished species were higher than those for general commercial or highly commercial species, but almost half of the species have outdated assessments. We found no relation between IUCN Red List traits and FishBase Vulnerability Index, depreciating the latter value as a guidance for extinction threat. The RAM database suggests good management of more-threatened species in recent decades, but more data are required to assess whether the trend has reverted in recent years. Outdated IUCN Red List assessments can benefit from reputed stock assessments for new reassessments. The future of IUCN Red List evaluations for commercial fish species relies on integrating new parameters from fisheries sources and improved collaboration with fisheries stakeholders and managers.

Keywords: fishing importance; FAO; IUCN Red List; RAM Legacy; overfishing; sustainability

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1. Introduction

For millennia, mankind has had an especially close bond with the sea. Oceans contribute significantly to the support of many of the Sustainable Development Goals (SDGs) [1], as they provide people with food, as well as other ecosystem services that contribute to health, well-being, cultural identity, and to the economy of societies [2].

Marine fisheries are the main contributors of seafood (referred to as finfish and marine invertebrates) for human consumption [3,4], with almost six-billion tons of fish and invertebrates taken from the oceans since the 1950s [5], contributing to 17% of global human protein intake and sustaining millions of jobs [6]. In this context, their importance is closely linked to their long-term sustainability. The Convention on Biological Diversity (CBD), through the Aichi targets, aimed to achieve by 2020 both sustainable management of existent fish stocks (target 6) and prevention of the extinction and improvement of the conservation status of threatened species (target 12) [7]. In the same line, SDG14 on "Life below water" had the same goal of effectively regulating overfishing and rebuilding stocks to levels that produce maximum sustainable yield by 2020 (sub-target 14-4).

Unfortunately, overfishing is yet one of the main threats to marine biodiversity [8]. Increasing human pressures in response to rising demands for food [9] have led to marine fish populations' declines over the last decades [10]. Historically, humanity has failed in preventing fish-population collapses and has not taken conservation biology of marine fishes seriously enough, resulting in declines in species diversity and abundance [11,12].

Globally, a few fish species dominate catches, owing to several factors such as natural abundances, consumer preference, geography, history, and ease to catch [13]. Population declines of as much as 90% have been reported for pelagic fish species, which can cause a range of ecological impacts, restructuring communities with cascade top-down effects on other species and population assemblages [14]. For example, the selective extraction of species and individuals of higher commercial value leads to the disappearance of higher trophic levels of the marine food webs, implying an increased fishery reliance on organisms at the low levels of the food webs [15].

Assessing the extent to which stocks are being overexploited is a technically difficult and controversial issue. According Food and Agriculture Organization (FAO) assessments, the number of sustainably harvested stocks is decreasing [6]. However, there are disagreements about whether the FAO's data are reflecting the reality of stock assessments [16] or, conversely, whether using catch data overestimates the number of overexploited stocks [17]. Furthermore, other authors suggest that the FAO's catches are underestimating the amount of fish extracted from the sea as they may be misled by the omission of small-scale and recreational fisheries [3] and discards, as well as manufactured or altered data that locally would increase catches [18]. Acknowledging the limitations of its data but also offering detailed insight about how capture data are treated to produce fishing statistics [19], the FAO welcomes studies comparing their data and outputs with the those available in other databases [20].

Stock assessments, such as the RAM Legacy database [21], provide biomass estimates and management reference points for exploited aquatic populations by combining catch data with indices of stock status. However, they are usually only available for industrially exploited fisheries, leaving aside species captured in recreational or artisanal fisheries, which account for an important part of fishing effort [22].

From a biodiversity conservation point of view, the IUCN (International Union for Conservation of Nature) is the institution responsible for assessing the global conservation status of plants and animals through their periodically reviewed Red List of Threatened Species [23]. Overfishing is considered by the IUCN Red List as a threat to many marine fish species under the threat 5.4 "fishing & harvesting aquatic resources", acknowledging that it can lead to population declines, which is one of the criteria to classify a species under the IUCN Red List categories [24]. The IUCN Red List is recognized as the most authoritative institution in addressing species conservation status [25], but also valuable for informing natural resource policy and management [26]. Despite this, the status of only a small fraction of marine animal species has been evaluated by the IUCN Red List. FishBase [27], the most comprehensive database compiling fish species information, has more than 40% of "commercial" and "highly commercial" species unassessed in the IUCN Red List [28]. Other previous studies have also suggested that the IUCN Red List may not be adequately covering fished species [20]. Conservationists and fisheries scientists generally agree on the statuses of exploited marine fishes [29], but maintaining complete and up-to-date assessments (both in IUCN Red List and stock-management agencies) is essential to appropriately manage responses for species and populations of mutual concern.

Considering the existing level of overfishing in marine commercial species, together with its direct extinction risk, and the indirect impacts in communities, monitoring of the conservation status of top-fished marine commercial species is a priority. To identify the gaps in the conservation status knowledge of these species, we compared the information contained about the FAO's top-fished fishes in the IUCN Red List, FishBase, and RAM Legacy databases. We hypothesized that species of higher fishing importance would be better assessed in IUCN Red List than those of general fishing importance. Furthermore, for the subset of top-fished species, we hypothesized that more-threatened species in the IUCN Red List would have been more effectively managed in recent decades. The objective of the present study is, therefore, to understand how top-fished marine commercial species are categorized in the IUCN Red List and evaluate the degree of knowledge we have on their conservation status.

2. Materials and Methods

In this study, we explored several databases comprising information about fisheries trends, species conservation status, and other traits. We first identified the top-fished species globally from FAO statistics. Then, we collected information on IUCN Red List status for these highly fished species (with assessments between 1996 and 2021) and from FishBase about their commercial importance and vulnerability to fishing pressure. Finally, we explored the stock-assessment data available for these species in the RAM Legacy database.

2.1. FAO Data

In the late 1940s, the FAO began collecting global fishing statistics. In recent years, the FAO has produced several Yearbooks of Fishery Statistics and reports about the State of World Fisheries and Aquaculture (SOFIA). Countries submit their "best scientific estimates" of their annual landings, but the FAO acknowledges the presence of uncertainties in the reports that they receive [19]. Based on the FAO's work, we used the 2018 FAO Yearbook of Fishery and Aquaculture Statistics [30] that identifies the 70 top-fished species (based in landings data) at the global level. The subset of data analyzed represents almost half (48.3%) of the global landings in 2018 according to FAO statistics, considering not only fish sensu stricto but also squids and crustaceans (Table S1 in Supplementary Materials). Most of these species corresponded to marine species, with only three of them being freshwater-restricted fish. Henceforth, we will refer to this subset of most-important commercial species as top-fished species.

2.2. IUCN Red List and FishBase

To represent the conservation status of the top-fished species, we used the IUCN Red List [23]. The IUCN Red List establishes extinction risk of species, assigning them to a category according to their conservation status, assessing them against a series of criteria based on the size and decline rate of the population and home range [24]. From lesser to greater risk, these categories are Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW), and Extinct (EX). Moreover, there is a category for those species with insufficient information to assess their conservation status, Data Deficient (DD). These assessments are regularly updated (IUCN Red List recommends revaluating species every 10 years [31]) and contain information relevant for species conservation (population trends, biogeography, threats, or conservation actions). From the IUCN Red List database, we obtained five parameters: (1) Current conservation category; (2) Assessment date; (3) Population trends: Increasing, stable, decreasing, or unknown; (4) Current threats, focusing on Threat 5.4 "fishing & harvesting aquatic resources" (henceforth "fishing pressure threat"); and (5) Number of IUCN Red List assessments conducted on the species. IUCN Red List assessments are generated mainly at the global scale, and less frequently at the regional scale [32]. In our study, we considered only IUCN Red List global evaluations for top-fished species and not regional evaluations (e.g., European or Mediterranean evaluations).

We searched the top-fished species in FishBase [27], the reference tool for fish studies. From this database, we obtained the Vulnerability Index of top-fished species, which estimates intrinsic extinction vulnerabilities of marine fishes to fishing [33] based on species life-history traits, including maximum length, age at first maturity, longevity, natural mortality rate, fecundity, strength of spatial behavior, and geographic range. This index assigns each species a value between 0 (low vulnerability) and 100 (high vulnerability) and a vulnerability category following a fuzzy logic approach [33]. We also retrieved from FishBase a list of fish classified as of "commercial" or "highly commercial" interest, for direct comparison with the top-fished species list. For these subsets of species, we obtained their Vulnerability Index values and their IUCN Red List status.

2.3. RAM Legacy Database

The last database we included was the RAM Legacy database. This database develops assessments on specific geographic and/or genetically distinct populations of a species, the so called "stocks". These assessments are used to set management reference points to work towards sustainable fisheries management [20].

This dataset contains information about 1433 stocks belonging to 387 unique species [34]. From the 70 FAO top-fished species, only 40 were included in the dataset. Among the several metrics provided by the database for each stock, we decided to use for comparison among different IUCN Red List categories the ratio between the catches and the maximum sustainable yield (MSY), henceforth catches/MSY ratio. This dimensionless metric is the coefficient between the catches of one stock and its MSY, the number of catches that ensure the maximum yield sustained over time [21]. We selected this value as we found it the most suitable way of addressing the questions of whether an individual stock was being fished above safe biological limits and allowed comparison among different stocks. In some stocks, different catches/MSY ratio values were available owing to different assessment methodologies. Thus, in these cases, the average of all the assessments conducted for the given stock was calculated to obtain the stock's catches/MSY ratio value. We selected stock-assessment data between 1996, when the current IUCN Red List classification scheme was created, and 2020. All data from the RAM Legacy database were retrieved using the associated R package *ramlegacy* [34] in R software version 4.1.1 [35] and can be found in the Table S2 in Supplementary Materials.

2.4. Taxonomic Checking

We joined the databases at the species level. Owing to the different sources of the data (four different databases), we corrected possible discrepancies in the taxonomy used. Discrepancies in the scientific name for a given species may result from differences in data entry across databases, revisions of species classifications owing to new taxonomies, or misspelling. In order to best match species names among the datasets, we checked each species in the Eschmeyer Catalog of Fishes [36] for fish species, and SeaLife (https://www.sealifebase.ca/, accessed on 15 September 2021) database for the remaining species, to update taxonomy to the most recent valid name and allow the correct alignment of the information among the databases.

2.5. Analysis

We compared the proportion of assessed species from the subset of top-fished species with the assessment rates of FishBase commercial categories (commercial and highly commercial) through chi-square tests for analyses of frequencies. We also analyzed differences in the Vulnerability Index for fish species between the three species subsets (top-fished, highly commercial, and commercial species) trough Kruskal–Wallis tests, owing to the non-normality of the data.

Focusing on the subset of top-fished species, we examined the number of top-fished species within each IUCN Red List category. Furthermore, for each IUCN Red List category, we calculated the number of species under fishing pressure (IUCN Red List threat 5.4) and their IUCN Red List population trend. We performed Kruskal–Wallis rank-sum tests to assess differences in the FishBase Vulnerability Index for top-fished species according to the different explanatory variables: IUCN Red List conservation status, population trends, and threat 5.4. All analyses were performed using the *stats* package in R software version 4.1.1 [35].

We analyzed changes in the catches/MSY ratio for different IUCN Red List categories and population trends between 1996 and the most recent data for each stock, as not all of them were available until 2020. We performed linear (regression) models with the *stats* package in R software, to analyze the influence of the IUCN Red List category and population trend with the observed changes in the catches/MSY ratio.

3. Results

From the 70 top-fished species, twenty (28.6%) were not assessed by the IUCN Red List [23, including two of the ten most fished species (*Gadus chalcogrammus* and *Micromesistius poutassou*). We compared the IUCN Red List assessment rates and Vulnerability Index values (FishBase VI see Table S1) of top-fished species with the larger commercial species groups (commercial and highly commercial species). IUCN Red List assessment rates are higher in top-fished species than in commercial categories (χ^2 test $p < 0.05$) (Table 1). Vulnerability Index values were not significantly different among top-fished species and those considered to have a commercial or highly commercial interest ($p = 0.052$) according to FishBase's classification. Nevertheless, Vulnerability Index values for top-fished species tended to be lower than in the other categories (Table 1).

Table 1. Number and proportion of IUCN Red List-assessed and -unassessed species for each species sub-set, and their average vulnerability indices.

	Top-Fished Species	**Commercial Species**	**Highly Commercial Species**
IUCN Red List-assessed species	50 (71.4%)	1217 (59.2%)	126 (56%)
Unassessed species	20 (28.6%)	839 (40.8%)	99 (44%)
Vulnerability Index (Median, Q1, and Q3)	34.47 (24.7–50.67)	40 (30–56)	55.5 (33.3–63.75)

IUCN Red List assessment dates ranged between 1996 and 2021, with twenty species (40% of assessed species) assessed in 2011 and previous years, and thus having outdated assessments. Within the assessed species, we also found cases of deficient evaluation, with six of them classified as Data Deficient (DD), five fish and one cephalopod (Table 2). We also found two species with old assessments (*Gadus morhua* and *Melanogrammus aeglefinus*, dating from 1996) that do not have complete information. Most assessed species, 33 out of 50 (66.6%), were under fishing pressure (IUCN threat 5.4). Almost all assessed species (48 out of 50) had information on population trends, but many of them (23, 48%) had unknown trends. Most IUCN Red List-assessed species have only been assessed once (38 out of 50), whilst multiple assessment has been conducted twice for nine species and three times for three species, all of them from the genus Thunnus (Table S1 in Supplementary Materials).

Table 2. Number and percentage of top-fished species assessed in the IUCN Red List, and their population trends and vulnerability indices. IUCN Red List categories: DD (Data Deficient), LC (Least Concern), NT (Near Threatened), VU (Vulnerable), NE (Not Evaluated).

	IUCN Red List Conservation Status				
	DD	**LC**	**NT**	**VU**	**NE**
Top-fished species	6 (8.6%)	37 (48.6%)	4 (7.1%)	3 (5.7%)	20 (30.0%)
IUCN Red List fishing pressure threat	4 (66.7%)	31 (83.8%)	4 (100%)	1 (33.3%)	
Vulnerability index (VI) median (Q1, Q3)	47.9 (21.5–69.7)	36 (20.2–51.6)	37.1 (30–68.5)	45.5 (37.5–57.9)	41.4 (25.5–49.6)

No significant differences were found in the Vulnerability Index for different IUCN categories ($\chi2 = 4.8$, d.f. = 3, $p = 0.19$), populations trends ($\chi2 = 2.52$, d.f. = 3, $p = 0.47$), or IUCN Red List fishing-pressure threat ($\chi2 = 1.35$, d.f. = 1, $p = 0.25$).

Only 62 stocks, comprising a total of 92 assessments and belonging to 23 individual fish species, had catches/MSY ratio values in the RAM Legacy database. The number of assessments with catches/MSY ratio value has constantly declined since a maximum of 91 assessments in the 1998–2008 decade, and only 10 and 3 stocks had this value in 2019 and 2020, respectively.

All IUCN Red List categories have reduced their stocks' catches/MSY ratio in the 1996–2020 period, but the reduction has only been significant for species assessed as Near Threatened and Vulnerable (Table 3). Regarding the IUCN Red List population trends, significant reductions in the catches/MSY ratio were only found in species with decreasing and increasing population trends in the period. However, data from the most recent years suggest an increase in the ratio, especially for Least Concern species' stocks, with catches/MSY ratio values over 1. Nevertheless, the low number of stocks assessed in recent years prevented us from considering these data as completely reliable.

Table 3. Linear models for the trends in catches/MSY ratio between 1996 and 2020 for IUCN Red List categories and population trends. LC: Least Concern, NT: Near Threatened, VU: Vulnerable, NE: Not Evaluated.

IUCN Red List Trait		Slope (Catches/MSY Year-1)	t	*p*
Category	NE	−0.001	−0.367	0.717
	LC	−0.004	−1.892	0.071
	NT	−0.033	−8.560	* <0.001
	VU	−0.009	−2.391	* 0.027
Population trend	Decreasing	−0.012	−5.557	* <0.001
	Increasing	−0.048	−5.221	* <0.001
	NA	−0.002	−0.398	0.695
	Stable	0.003	0.389	0.701
	Unknown	−0.001	−0.329	0.745

* $p < 0.05$.

We examined the catches/MSY ratio trend in NT and VU species and observed that one species, *Melanogrammus aeglefinus*, had increased this ratio since 2013 and currently was over 1 (Figure 1). The remaining species have stocks managed more sustainably, according to the RAM database.

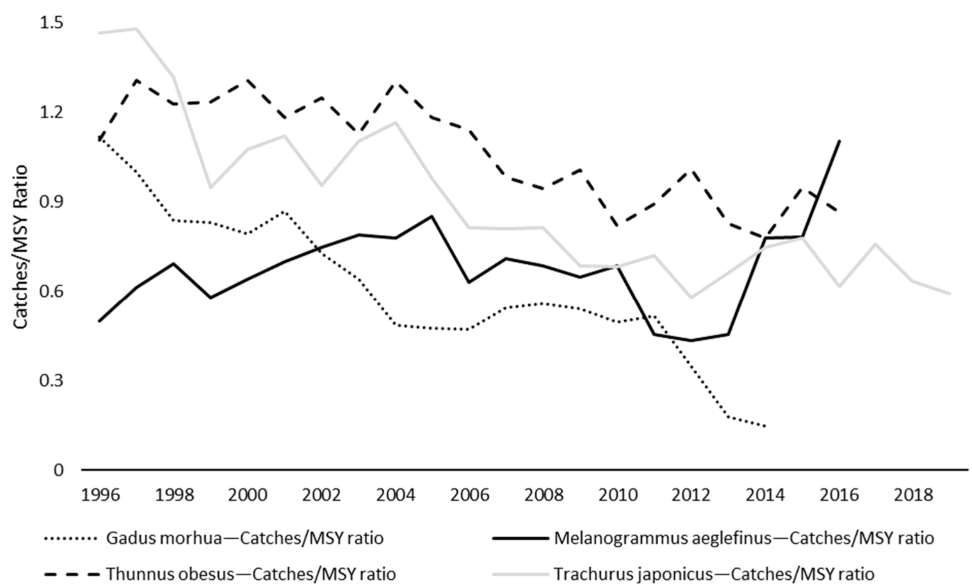

Figure 1. Trends in catches/MSY ratio between 1996 and 2020 for species in IUCN Red List categories NT (Near Threatened, grey line) and VU (Vulnerable, black lines).

4. Discussion

The revision of the conservation status and population trends of the main fish species of commercial interest is urgent and mandatory. Solutions for restoring marine ecosystems and the fish species that live in them are still under debate, but scholars and international organizations agree that sustainable management is becoming more and more urgent in several fish stocks [37]. With a horizon of human population increase in the coming years, assessing species conservation status is more important than ever, and only possible if all players do their part to manage fisheries sustainably and sustain the oceans and their biodiversity. Instead of using catch data to assess the state of marine ecosystems, which has been previously criticized [38], we compared the information of different databases to envision which knowledge gaps are more urgent to fill to ensure species conservation and fisheries sustainability.

Since fishes sensu stricto represent most of the top-fished species, and some values such as the FishBase Vulnerability Index or commercial category were only available for them, we have focused the discussion on this taxonomic group. However, we acknowledge that many of the problems detected for fishes can be present in other groups. For instance, cephalopods have increased in commercial importance in the last decades [39] and yet face several threats from unregulated fisheries, bycatch, and poor life-history knowledge [40].

We found progress in the higher assessment rates for top-fished species, as they were significantly better assessed compared with the commercial or highly commercial counterparts (Table 2), acknowledging recent IUCN Red List efforts in evaluating some commercially exploited groups [23]. The absence of significant differences in the Vulnerability Index among IUCN Red List categories had already been noticed [41], and our results reinforce those findings. We have also demonstrated that the categorization of a species under fishing threat, or a declining population trend, are not related to a higher Vulnerability Index. In this sense, we consider that the Vulnerability Index may not be accurately measuring the extinction risk of a species, as fishing pressure is not only driven by biological traits and other factors are present too [13]. We consider that the IUCN Red List categorization provides us with more accurate information about species extinction risk.

Among assessed species, *Gadus morhua* (Atlantic cod) and *Melanogrammus aeglefinus* (haddock) have extremely outdated IUCN Red List assessments, classified as Vulnerable in 1996 (25 years ago). After the stocks' collapse in the late 1980s and early 1990s, some studies have stated that some cod stocks have not yet recovered from the collapse in northwest Atlantic [42], whereas IUCN Red List European assessment classifies *G. morhua* as LC, with increasing populations in some stocks [43]. In such cases, we acknowledge the big difference between assessing a whole species, as IUCN Red List does, and quantitative stock or population assessments [44], but we support the labor of regional IUCN Red List assessments integrating stocks statistics into this conservation tool, promoting both stock management and species conservation.

Apart from these two species assessed in 1996, remaining assessments dated from 2007 and onwards. IUCN Red List estimates assessments to be outdated after 10 years [31], so priority reassessments should be conducted for 40% of the top-fished species (most of them classified as LC or DD). In this sense, data deficiency not only implies "inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status" [24] but also affects conservation priorities, which rely upon threatened-species lists [45]. The uncertainty associated with data deficiency affects extinction-risk patterns and should be solved through a reassessment of DD species. The opposite situation is found in three *Thunnus* species: *T. alabacares*, *T. obesus*, and *T. alalunga*. These species have been assessed three times, with the last assessment in 2021. This is the result of the work carried by the IUCN Tuna and Billfishes Specialist (https://www.iucn.org/commissions/ssc-groups/fishes/tuna-and-billfishes), highlighting the importance of having organized resources to ensure high-quality and updated assessments.

Almost all species assessed (96%) had information about population trends in the IUCN Red List, with haddock and Atlantic cod lacking these data because of their outdated assessments. Almost half of IUCN Red List-assessed species had unknown populations trends, and as subjects of intensive fishing, we consider that they should be reassessed in the short term to examine if current data allow us to establish their population trends, at least at regional level. Recent regional IUCN Red List evaluations, such as those conducted for *G. morhua* and *M. aeglefinus* in Europe, show detailed information about populations trends in the different stocks [43,46] and are a good example to follow. Not all top-fished assessed species were under fishing pressure according to the IUCN Red List (Table 2). Certainly, species may indeed have abundant populations or be subjects of sustainable fishing or fishing quotas. However, FAO data indicate increasing overexploited stocks in recent years [6], which could lead to regional threats to extensively harvested stocks.

Previous studies have stated the importance of analyzing together IUCN Red List assessments with stock assessments, such as the RAM Legacy Stock Assessment Database, resulting in high agreement in the conservation status of exploited marine fishes [29]. In this sense, data from stock assessments have several advantages when compared with other data based on reported catches or reconstructions [47], whose utility to assess the collapse or overexploitation of fish stocks is also dubious [17]. When combining RAM database data with IUCN Red List evaluations, we observed a general improvement in the stock for all the categories in recent decades, having reached catches/MSY ratio values under 1 in the 2010s. However, this declining trend is only significant for Vulnerable and Near Threatened species, since those classified as Least Concern or not evaluated seem to have increased in their catches/MSY ratio in recent years. We found that stock assessments were substantially scarcer in recent years, and thus the reverted trend observed for LC and NE species can be the result of this bias. Thus, we support the labor conducted by stock-assessment agencies such as RAM Legacy and the value that these data can have in evaluating the conservation status of top-fished species. Specifically, we consider that the haddock *Melanogrammus aeglefinus* should be promptly assessed by the IUCN Red List, as some stocks have been increasingly exploited in recent years, and its outdated assessments may not be adequately reflecting the current conservation status of the species and its different populations. Similar to the regional assessment conducted for its European population [46], we consider that other populations or the global conservation status of the species should be evaluated using current information.

IUCN Red List assessments and criteria, despite having proven not to be biased towards exaggerating marine fishes' threat status [29], can pose problems when evaluating them, especially commercial fishes [48,49]. In particular, Criterion A, related to the reduction in population size, discards information that would be included under Criterion E and could help estimate recent trends and risk to extinction (such as age or length structure, recruitment of juveniles, and exploitation rate [48]). Considering these potential flaws, we suggest that further investigation is required on the adaptation of IUCN Red List categories and criteria for commercial fish species. The IUCN Red List is widely recognized among the general public as an authoritative source about species conservation status [25], but we support the inclusion of other methods such as management-strategy evaluation (MSE) to make more precise evaluations [50]. As previously stated, we consider that future IUCN Red List assessments for fished species should be developed at both global and regional level. Regional assessments can better reflect the situation and conservation status of regional stocks, in contrast to a global vision of the species conservation status, which may lack relevance in terms of stocks management.

Having failed in meeting most CDB Aichi targets [51–53], the sustainability of one of our main food sources is at stake. Climate change and global warming affect fish-populations' viability and compromise the subsistence of human communities linked to them [54]. Moreover, the growing proportions of unidentified catches in key regions such as Asia calls for better fisheries monitoring and management [20]. In the context of a global threat to marine species, where human and climate pressures combine to jeopardize them, we consider that the voice of conservation initiatives, such as the IUCN Red List, should be extensively heeded by fishing authorities. Governments, conservation agencies, and fishing authorities must work together to achieve useful conservation objectives and policies. The latest SOFIA report states that collaboration efforts between the FAO, CITES, and IUCN are taking place [6], but unless urgent measures are taken, the overexploitation of our seas can lead again to stock depletion and compromise not only species conservation but also food security and the way of life in many regions.

5. Conclusions

In this paper, we have demonstrated how the knowledge on the conservation status of marine top-fished species is far from being adequate. FishBase Vulnerability Index has proved to be a poor proxy for predicting species extinction risk. Several species have never been assessed by IUCN Red List (28.6% of top-fished species) or have outdated assessments that should be redone promptly (40 % of the assessed ones).

To this end, IUCN Red List evaluations can benefit from data stock assessments' data like the RAM Legacy database, especially in some cases with deficient evaluations and increasing fishing pressure as the haddock. In a context of increasing food demand by human population, fisheries sustainability is essential to ensure both human food security and species conservation.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/fishes7010002/s1. Table S1: FAO top-fished species and related traits used in the study. Detailed information about columns can be found in the metadata sheet. Table S2: RAM Legacy catches/MSY ratio data used in the study, corresponding to FAO top-fished species. Detailed information about columns can be found in the metadata sheet.

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