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Estimating the biomass of commercially exploited fisheries stocks left in the ocean

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Estimating the biomass of commercially exploited fisheries stocks left in the ocean

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FOREWORD

It is with great delight that I write the foreword for “Estimating the biomass of commercially exploited fisheries stocks left in the ocean.” It is not often that I read a description of a methodology with rapt attention. But in this case, the vision and history that underpin the method render it a compelling read in addition to the method itself.

The authors start with the basic premise that we need to know how much fish is left in our oceans relative to what was there prior to commencement of industrial fishing in the 1950s. Moreover, we need to know this by population and by marine ecoregion. Is the reconstructed global catch of 100 million tonnes in 2018 a lot? Or is it a small remnant reflecting 70 years of industrial fishing? What populations have declined the least and the most, and where?

With great detail and transparency, the authors document how they generate estimates of “fish left” for over 2,500 populations of exploited species. The concept of “fish left” is powerful in that it is based on well-proven ecological theory. It is easily understood by non-specialists – the politicians who make decisions, the bureaucrats who advise them, and the broader community. “Fish left” is also a compelling metric: the thought of populations being reduced in numbers to less than half within a human lifetime as a result of our activities is challenging.

The vision and a long-road travelled with determination and data.

There are three major achievements that have made estimating “fish left” a reality.

- 1) An appropriate method based on catch maximum sustainable yield (CMSY) was developed to estimate trends in biomass. The CMSY journey began in 2013 with ongoing refinements of the method since. Importantly, the authors rigorously test the CMSY method across data-rich and data-poor populations and those that straddle complex geographies. That the method is flexible in terms of data inputs further expands its relevance to fisheries assessment.
- 2) FishBase and its cousin SeaLifeBase provide species-specific life history parameters such as growth and mortality that allow the CMSY method to be applied across a truly diverse range of taxa. Over 30 years in building, these online encyclopedias of ocean life are constantly improved as new research becomes available.
- 3) Reliable catch data are needed as an input to the CMSY models. The *Sea Around Us* took up this challenge 22 years ago. The project produces reconstructed catch data that more fully reflect the true scale of fisheries exploitation, an outcome now recognised by the FAO. Because the *Sea Around Us* catch data are spatially allocated, we have the resolution to determine the biomass trajectories of highly localised populations.

The standardised, systematic and transparent manner in which the team at *Sea Around Us* and their hundreds of global colleagues have built these three databases has created a highly valuable resource now and for future ocean management and conservation. Knowledge is power, the power to rebuild our marine life populations.

Professor Jessica Meeuwig,
University of Western Australia – Marine Futures Lab

EXECUTIVE SUMMARY

This report presents the key results of a multi-year activity of the *Sea Around Us* devoted to assessing the status of marine fisheries globally. This was accomplished by estimating, for the Exclusive Economic Zones (EEZ) of all maritime countries and the high seas, the fraction currently left in the sea of the exploited populations of fish and invertebrates that occurred before the onset of large-scale industrial fishing.

More precisely, the ‘fraction left’ is the current biomass (B) of a stock relative to its initial biomass (B_0), i.e., B/B_0 . This fraction was estimated for multiple exploited populations (or ‘stocks’) by applying a versatile stock assessment method (CMSY++), whose main features are also described. Altogether, over 2,500 stocks of fish and marine invertebrates (mainly crustaceans such as lobsters and mollusks such as squids) were assessed in the EEZs of countries on five continents and the high seas. These assessments were based mainly on long catch time series (typically 1950 to 2018) but considered, wherever they were available, the results of earlier assessments made by national or international fisheries management bodies.

Thus, the evaluations of fisheries status presented herein are not defined by data scarcity; rather, we used all available data pertinent to the status of fisheries in all maritime countries to reduce the uncertainty inherent in all stock assessments. The detailed results of these stock assessments and their supporting data are available on the *Sea Around Us* website (www.seaaroundus.org).

These results will also be used by the Flourishing Ocean Initiative of the Minderoo Foundation, which kindly funded a large part of our catch reconstruction update to 2018 and the stock assessment work described herein.

The Challenge of Assessing Fish Stocks

There is currently no effective, easily comprehensible, single-issue index for fisheries that exists globally and ranks countries such that their fisheries performance can be reported and improvements tracked. None of several other initiatives/indices (e.g., Ocean Health Index, Environmental Performance Index, etc.) that include aspects of fisheries address fisheries globally. Also, these indices are generally incomplete in their spatial coverage, with only a few translating their multi-sector data (maritime shipping, tourism, marine conservation efforts, protected areas, pollution, fisheries, etc.) into global rankings. It is also unclear how effective these platforms have been in promoting changes in policy, given the ongoing decline in global fisheries. As such, there is no single measure of fisheries performance, in terms of how well a country maintains its fish resources, that can help inform and challenge governments on the international level needed to find solutions to this national and transnational problem.

Since the 1990s, there has been a growing recognition and acceptance that global marine fisheries, the major driver of impacts on marine populations (Pauly *et al.*, 2002), even in the face of climate change (Cheung *et al.*, 2009; Cheung *et al.*, 2010), are in crisis almost everywhere, mainly due to a huge build-up in fishing effort and a declining resource base (Watson *et al.*, 2013; Costello *et al.*, 2016). A declining resource base in fisheries terms implies that the biomass of exploited fish populations has declined substantially, usually to levels below that which fisheries science suggests as optimum for maximizing long term sustainable catches (Pauly and Froese 2020). However, while detailed estimations of the biomass of fished stocks ('stock assessments' in fisheries terminology) are available for some of the major fisheries target populations in many economically developed regions (e.g., the EU, Norway, the US, Canada or Australia), similar biomass assessments are generally lacking for developing countries, even for their most heavily fished species.

There are several reasons for this deficiency in availability of biomass trend estimates, notably:

1. a long-standing lack of critical technical expertise, only slowly alleviated through dedicated training workshops (Venema *et al.*, 1988; Palomares and Froese, 2017);
2. a frequently cited "lack of data"; and
3. until recently, a dearth of methods to generate at least preliminary biomass time series estimates with the limited data that are available in most regions of the world.

Issue (1) remains a real problem, particularly for the developing world which in recent decades has seen the most pressure on fish populations due to fishing (Alder and Sumaila, 2004; Atta-Mills *et al.*, 2004; Pauly and Zeller, 2016a). However, issues (2) and (3) have been increasingly mitigated over the last two decades by addressing the perceived "lack of data" through the comprehensive reconstructions of global marine fisheries catch data, and the development of straight-forward methods relying mainly on fisheries catch time series to estimate population biomass trends over time (Martell and Froese, 2013; ICES, 2014; Rosenberg *et al.*, 2014; ICES, 2015; Froese *et al.*, 2017).

Thus, this project was conceived to help in establishing an index or measure for the fish biomass currently left in the EEZs of the world's maritime countries as a contribution to the work of the Flourishing Oceans initiative of the Minderoo Foundation.

Reliable catch time series - the *Sea Around Us* catch reconstruction method

The catch of fisheries is their most important and most fundamental characteristic, no matter whether it is obtained on the deck of a mega-trawler in the frigid waters of the North Pacific, or in a canoe along an African coast, or by women and children collecting invertebrates for the family's next meal while 'reef gleanings' on islands in the Indian or Pacific Oceans. Thus, reliable information on current or past catches are the foundation for understanding fisheries (Pauly, 2013). Moreover, fisheries are globally integrated, not so much because fish move, as asserted by many, but rather because distant-water fishing fleets quickly move between fishing grounds and ocean basins.

Local, regional, and national fisheries studies can generally be conducted using local or national data sets, often including the data sets that the investigator(s) may have contributed to. Thus, the 'local' or situational knowledge of the investigators will ensure a high likelihood of knowing about possible issues or challenges with the datasets being used. However, such local 'context' or knowledge is lost in the fisheries catch data submitted annually to the Food and Agriculture Organization of the United Nations (FAO) by its member countries, and which the FAO, after some harmonization, disseminates as the world's capture statistics (Garibaldi, 2012). However, these fisheries statistics, even though they have been and continue to be used largely unchallenged (e.g., Costello *et al.*, 2012), suffer from numerous biases, of which the following may be the most important:

1. Several countries do not submit figures derived from the catch realized by their fisheries, but of the quantities they plan or anticipate to catch (see Watson and Pauly, 2001 for China; or FAO, 2018 for Myanmar);
2. The catch of artisanal (i.e., small-scale commercial) fisheries is often under-represented by the reporting agencies in both developed and developing countries (Pauly and Zeller, 2016a);
3. The catches of non-commercial subsistence and recreational fisheries are largely unreported, even though they can be considerable in various countries (see Kleisner *et al.*, 2015 for recreational fisheries; and Zeller *et al.*, 2015 for subsistence fisheries);
4. The discarding of fish, a common practice in certain industrial fisheries, especially trawling, although well covered in FAO publications (e.g., Kelleher, 2005) is explicitly excluded from consideration in their FAO fisheries statistics database, which therefore represent landings statistics, not catch statistics (Zeller *et al.*, 2018);
5. No attempt is made to account for illegally caught fish, which are generally not officially reported; and
6. Taxonomic resolution (i.e., identification of catch to species) is lost in the FAO reporting, which often requires detailed landings data to be aggregated to coarser groupings.

While item (1) often leads to catch overestimation, items 2-5 will lead to catches being underestimated. Item (6) obscures the catch trends of individual species, preventing assessments at the level of individual stocks on the basis of their catch data.

Over the last 20 years, the *Sea Around Us*, whose core mission is to research and communicate the impacts of fishing on the marine ecosystems of the world (Pauly, 2007), has collaborated with hundreds of colleagues throughout the world to complete 'catch reconstructions' (Zeller *et al.*, 2007; Zeller *et al.*, 2016) in all countries of the world. These catch reconstructions are based on the notion that the deficiencies in 1-6 can be overcome, or at least mitigated, by the systematic acquisition and analysis of secondary data (Zeller *et al.*, 2016). Such data may come from various sources, ranging from the local studies of fishing villages by anthropologists (e.g., Ota, 2006), or localized case studies of under-represented fishing sub-sectors (e.g., Wass, 1980), or seafood purchasing receipts by restaurants and hotels (e.g., Smith and Zeller, 2016), or Household Income and

Expenditure Surveys (e.g., Anon, 2014), to international databases on general food consumption (e.g., Khatibzadeh *et al.*, 2016).

The philosophy behind catch data reconstructions using secondary data rests on two conceptual pillars:

1. Fisheries are a social activity and thus never operate in a social vacuum. Therefore, they throw a ‘shadow’ on the society and economy in which they are embedded (Pauly, 1998). Thus, it is almost always possible to infer an approximate catch from some indirect measures of fishing activity, such as fuel use, employment, direct sales to restaurants and hotels, etc.; and
2. If a fishery operates somewhere, it generates a non-zero catch. Thus, if in the absence of detailed data on this catch, a government official decides not to enter an approximate figure for the catch (that may or may not be correct), the officially reported catch of that fishery will be precisely zero +/- 0 tonnes in the official national data reported to FAO. While this is a very precise estimate, it is guaranteed to be very wrong.

Thus, catch reconstructions involve replacing precise but erroneous estimates of zero catch by imprecise, but far more accurate estimates of the catch of the hitherto undocumented fisheries. The results we derived from the about 200 reconstruction studies that were performed for all maritime countries and their territories were presented in Pauly and Zeller (2016a; b). The title of Pauly and Zeller (2016a) “*Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining*” summarizes the situation that we find ourselves in: we catch far more than we thought, but we are increasingly in the process of losing these high catches, mainly due to overfishing.

One of the major points made in Pauly and Zeller (2016a) is that the strong decline observed in the reconstructed total catches since the mid-1990s is partly masked in the data reported by FAO due to what is now called the ‘presentist bias’ (Zeller and Pauly, 2018). This bias is the inadvertent by-product of efforts by countries to regularly improve their national data collection and reporting systems, which is a commendable endeavor. Unfortunately, such improvement efforts often overlook the need to also comprehensively correct historical data back to 1950 for any changes in new data being incorporated into data reporting systems. Hence the focus on the present at the expense of the past, which leads to the presentist bias. Thankfully, there are signs that the FAO has recognized the importance of this bias (see p. 8 in FAO 2018) and the utility of catch reconstructions and other retroactive data corrections (see p. 93, Box 5 in FAO 2018). The catch data assembled through our massive catch reconstruction effort over more than 20 years are publicly available through our website (www.seaaroundus.org) and cloud data servers that are optimized for the delivery of large datasets.

The datasets are very large because they present annual marine catch data from 1950 to 2018 for the 273 individual Exclusive Economic Zone (EEZ) entities of all maritime countries and territories of the world, as well as a global reconstruction and harmonization of the industrial tuna and large pelagic fisheries conducted also in High Seas waters under the auspices of several Regional Fisheries Management Organizations (Le Manach *et al.*, 2016; Coulter *et al.*, 2019). These datasets are so large because they also present these data by fishing sector (industrial, artisanal, subsistence and recreational); by taxon (over 2000 species, genera, families or higher groups); by fishing country; by reporting status (reported or unreported catches); by type of catch (landed or discarded); by major fishing gear (trawls, purse seines, longlines, etc.); and by the end-use of the catch (direct human consumption, bait-use, fish meal etc.).

In addition to being more comprehensive and detailed than officially reported data, the reconstructed catch data of the *Sea Around Us* are spatially allocated to over 150,000 ice-free ½ degree latitude/longitude spatial cells in

a manner that is both ecologically viable and politically appropriate. This was achieved by intersecting, in our allocations, the catch data with biological probability distributions of occurrence for each of the over 2000 taxa in the catch data sets (Palomares *et al.*, 2016) and permitting access to countries' Exclusive Economic Zone waters only to those fishing countries that are known to access these waters, either via fishing access agreements or observed access (Zeller *et al.*, 2016). This intersection between catch data, biological distributions and fishing access information is obtained through allocation algorithms that have been derived, improved and refined in successive iterations (see Lam *et al.*, 2016). Thus, the availability of the comprehensive *Sea Around Us* reconstructed catch data at biologically and politically relevant spatial resolutions that are much smaller than those of the global FAO landings (which are reported by 19 very large FAO statistical areas) allows us to analyze global fisheries impacts more meaningfully in space and time.

The catch-by-cell approach implemented by the *Sea Around Us* implies that it is very straightforward to present, evaluate and analyze data for a vast number of 'geographies.' Thus, we present catches not only by EEZs and High Seas areas, but also by the 66 Large Marine Ecosystems defined by NOAA (Sherman and Duda, 1999); by the 19 large and ecologically uninformative FAO Statistical Areas; by the areas covered by the 17 Regional Fisheries Management Organizations (Cullis-Suzuki and Pauly, 2016); and, most recently, by the Marine Ecoregions of the World (Spalding *et al.*, 2007).

From catch time series to biomass estimates

To derive biomass trends over time from the global reconstructed and spatially allocated catch data, we used the now well-established and documented data-limited Bayesian 'Catch Maximum Sustainable Yield' or 'Catch-MSY' method originally proposed by Martell and Froese (2013), which, however, tended to overestimate F/F_{MSY} and underestimates biomass. Froese *et al.* (2017) revised and operationalized this early approach, and continuously refined and improved it (see Froese *et al.* 2018, 2020). This yielded an essentially new method, labelled 'CMSY', whose early version has been independently evaluated in a FAO technical report (Rosenberg *et al.*, 2014), and described as "... overall best performer ..." and especially "... suitable for fisheries in developing countries ..." among the data-limited stock assessment methods that were evaluated. Other evaluations of the CMSY method indicated similar performance to other models (notably performing well in estimating the depletion parameter, see Zhou *et al.* 2017). There was, however, a dependence of parameter results and associated uncertainties on the prior for the biomass at the end of time series prior (Kell *et al.* 2020; Pons *et al.* 2020). Zhou *et al.* (2017) concludes that these methods should be viewed more as complementary rather than competitive, and that the variable data sets available for such analyses may fit one model better than the other. Note that since it was published, the CMSY method has been applied in 58 scientific publications (see Appendix A). We applied the most recent version of CMSY, called CMSY++ for the assessments reported herein, which largely overcomes the deficiencies of earlier versions. Also, we based our assessments on our reconstructed catch data, and the decisions on the application of this model to various stocks were informed by expert opinions, notably from Dr Rainer Froese.

Like the Maximum Sustainable Yield (MSY) concept from which it gets its name, the CMSY method is based on an approach formulated by Schaefer (1954; 1957) to mathematically describe and understand fish population dynamics. This approach, also known as 'surplus-production' modeling, assumes that a given ecosystem has, for any animal population, a specific carrying capacity (k , roughly similar to unfished biomass B_0), and that if this population is reduced through an external event (e.g., fishing), the population will tend to grow back toward its carrying capacity.

Such growth (i.e., the population growth rate, or dB/dt) is conceived as the product of two elements, one being the *intrinsic* population growth rate of the population (r), as determined by the attributes of the individuals in the population in question (individual growth, age at first maturity, natural mortality, fecundity, etc.), the other being the current abundance or biomass (B) of the population, i.e., its closeness to B_0 (as expressed by the term $1-B/B_0$). Thus, the biomass of a very small population cannot grow by a large amount (i.e., dB/dt will be low), even if its r is relatively high, and neither will a population that is near carrying capacity because, in this case, $1-B/B_0$ is close to zero. In other words, the maximum population growth rate occurs at an intermediate abundance, i.e., $B_0/2$ (Pauly and Froese 2020). Note that the low values of dB/dt near carrying capacity are not caused by density dependence of adults, but of recruits (due to a ‘hockey stick’ stock-recruitment curve, Barrowman and Myers, 2000).

Thus, human extraction of biomass via a fishery can in principle maintain a fish population at any given biomass level by removing every year an amount of biomass equivalent to the natural growth of that population in that year. The CMSY fisheries stock assessment method is built on this conceptual framework (see Pauly and Froese 2020), and it essentially consists of tracing, for an exploited population with a time series of annual catch tonnage, multiple trajectories of its likely biomass, each defined by a pair of r - k values, and identifying the trajectories that remain viable while accommodating the catches taken from this population and a few other constraints (Froese *et al.*, 2017). Here, ‘remaining viable’ means a population that is not going extinct, while the constraints (or ‘priors’ in Bayesian terminology) that are to be accommodated are assumed biomass reductions caused by fishing, especially in the final year.

The range of r values within which this search is conducted can be taken from FishBase (www.fishbase.org) for finfishes and from SeaLifeBase (www.sealifebase.org) for invertebrates, which provide qualitative measures of r , i.e., resilience (as defined in Musick, 1999; and refined in Musick *et al.*, 2000). For most exploited fish species, FishBase also provides r priors from a range of biological parameters, especially natural mortality (M), the von Bertalanffy growth parameter K , generation time, maximum age, and fecundity, including results of r from previous stock assessments.

On the other hand, the range of carrying capacity (k , or B_0) that is appropriate to a given stock will be specific to it, with the catch itself providing a scale. Thus, the maximum of a catch time series can be used as the lower limit of the range of k , while some high multiple of this maximum can be used as upper estimate. The CMSY software contains a heuristic to generate appropriate k ranges.

Thus, in practice, the CMSY method amounts to producing a multitude of potential biomass trajectories given a catch time series, a wide range of pairs of intrinsic growth rate and carrying capacity (r and k) estimates, and broad constraints (or ‘priors’) on acceptable trajectories.

These broad constraints should express prior knowledge on (a) the approximate level (in %) to which carrying capacity was reduced at the start of the time series, here 1950, or the year when the fishery was opened, and (b) the level to which carrying capacity was reduced at the end of the time series (also in % of k). Such independent knowledge about the relative population depletion can be obtained from general knowledge about a given fishery (“good”, “not as good as it used to be”, “bad”, “very bad”) and translated into broad percentage or fractional ranges relative to carrying capacity (k). For example, for “good”, one can assign 0.4 - $0.8 \cdot k$, meaning 40-80% of the unfished biomass level; while for “bad” one would assign 0.01 - $0.4 \cdot k$.

Finally, the version of the CMSY model to be used here also implements a Bayesian version of the full Schaefer surplus-production model (BSM), which can use pre-existing and independently derived time series of relative biomass, e.g., catch per unit of effort (CPUE) data from official stock assessments when available. This typically results in narrower estimates of the confidence intervals around the best estimates of r and k and along the biomass trajectory that they imply.

Updating the underlying reconstructed catch data to the 2018 FAO data year

The reconstructed catch data time series for all maritime countries of the world, as maintained and hosted by the *Sea Around Us*, were updated using the latest FAO data, covering the year 2018, as released by FAO in May 2020. A standardized year is required for all country datasets, as all countries need to be updated before the spatial allocation to EEZs can be undertaken. Catch data updating is a time-intensive process that requires dedicated staff that are carefully trained and closely supervised to ensure appropriate data decisions are being made at every step based on best available information. Data updates also needed to follow the core catch reconstruction approach for methodological consistency, yet adjust data from various sources, update details and data corrections to country-specific circumstances.

The method for catch reconstructions are detailed in Zeller *et al.* (2007, 2016) and in the various chapters of Pauly and Zeller (2016b). This makes automatic updating impossible for many countries. However, for cases that did not imply a large increase in taxonomic resolution, the replacement of a fishing sector by another, or similar massive changes, a semi-automatic routine was devised (Noël 2020) which considerably accelerated our carry-forward procedures. The *Sea Around Us* prepared a *Handbook*, i.e., Research Protocol (Derrick *et al.*, 2019) to capture in one single document, and systematize for incoming research staff, the methods used for catch reconstructions. Derrick *et al.* (2020a, 2020b) provide details by country and territory on the processes followed in updating the reconstructed catches by EEZ, including a description of the semi-automatic carry forward of Noël (2020).

Marine Ecoregions vs EEZs

The EEZs that countries can claim since the UNCLOS was concluded in 1982 extend a maximum of 200 nautical miles from the coast of maritime countries and their territories. Over 90% of the world's marine fisheries catch originates from EEZs. In some cases, e.g., around isolated islands, the inshore fauna belongs to a distinct ecosystem, and hence their exploited fish populations can be treated as distinct 'stocks.' However, in the majority of cases, and especially for large countries (e.g., the USA, Australia or Russia), the EEZs along their coasts encompass a range of very different ecosystems. For example, the US East Coast EEZ ranges from high latitude temperate systems in New England (e.g., Gulf of Maine) to a (sub-)tropical coral reef ecosystem in southern Florida. Therefore, in order to better address ecosystem issues in fisheries data and assessments, a more nuanced spatial system of MEs is offered by the *Sea Around Us* in addition to EEZs and Large Marine Ecosystems (LMEs; see Pauly *et al.* 2008).

The Marine Ecoregions of the World (often referred to as MEOWs, but here labelled MEs) are biogeographic entities along the world's shelves and coasts, as defined by Spalding *et al.* (2007) as part of a joint WWF/Nature Conservancy project. MEs, which have clearly defined boundaries and are generally smaller than LMEs, are used to represent and spatially group ecological patterns of species and communities in the oceans and to serve as a tool for conservation planning worldwide. The presently available ME system focuses on coast and shelf areas and does not consider open-ocean pelagic or deep benthic environments (see Figure 1).

Using GIS shapefiles of MEs as part of our spatial data system ensures that the stock assessments we performed for all maritime countries in the world are applied at appropriate ecosystem scales. Internal consistency in our global spatial data allocations is ensured in two steps: (1) we slightly modified some ME boundaries to correspond to existing EEZ boundaries; and (2) we assigned the 232 MEs of Spalding *et al.* (2007) to our 273 EEZs (and parts thereof) as a function of the MEs' overlap with the EEZs (see Appendix D). Thus, the ME boundaries as presented and used on the *Sea Around Us* website may differ slightly from the ME shapefiles available from the WWF.

An example may be provided for MEs' overlap with the EEZs: Mexico has two separate EEZ components, one in the Atlantic, the other in the Pacific. On the Mexico (Atlantic) EEZ page, the *Sea Around Us* website lists the Southern Gulf of Mexico and Western Caribbean MEs as overlapping extensively with the Mexican Atlantic EEZ. However, a third ME (Northern Gulf of Mexico) also overlaps with Mexico's EEZ, though this involves only 14% of Mexico's Atlantic EEZ surface. For such cases, the *Sea Around Us* has set a minimum percentage coverage requirement of 20% of a given EEZ in order for a partially overlapping ME to be included. Hence, in the present example, the boundary for the Northern Gulf of Mexico ME was slightly modified to exclude Mexican EEZ waters. Note also that some MEs will be accessible from two or more countries. For example, the ME called Chiapas-Nicaragua, which extends from Southern Mexico (Pacific) to the boundary of Nicaragua and Costa Rica, will also be listed in the EEZs of Guatemala (Pacific), El Salvador, and Nicaragua (Pacific).

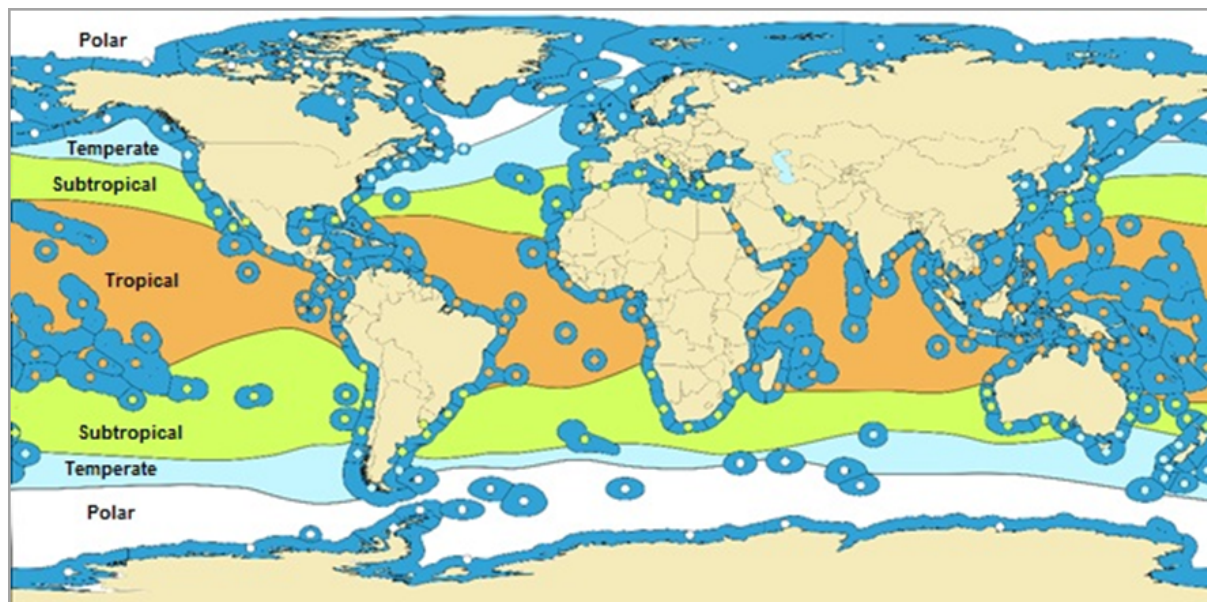


Figure 1. The global system of Marine Ecoregions (ME in dark blue, Spalding *et al.*, 2007) overlaid over climatic zones of the world (Anonymous, 1991). Centroid color in each ME indicates the climatic zone to which each ME was assigned. Adapted from Palomares *et al.* (2020).

Stock assessments¹

Selection of viable catch time series for CMSY analysis

The *Sea Around Us* reconstructed catch data for 1950-2018, disaggregated to species level, account for the catch of about 838 species, representing 59% of the global catch of 6.2 million tonnes. From this data pool, we identified species-level² catch time series for CMSY assessment at the ME-level using the following criteria (Figure 2):

- 1) With total catches consisting <20% of discarded catch, as discard data are often more poorly documented over time than landed catch and therefore result in uninformative time series;
- 2) With catch time series following desirable conditions for CMSY analysis, that is:
 - a) With continuous time series of ≥ 20 years;
 - b) With total accumulated catch for the whole time series >100 t;
 - c) Without a stretch of very low catches at the beginning of the time series that might be attributed to:
 - i) Catches generated only by subsistence and/or recreational fishing, e.g., prior to establishment of a commercial fishery;
 - ii) Catches extrapolated backward towards an assumed start of fishery, e.g., in 1950;
 - iii) Reconstruction was based on insufficient data sources, e.g., with low catch uncertainty score;
 - d) Without spikes in catch towards the last five years that might be attributed to:
 - i) Reconstructed forward-carry errors, e.g., due to a misapplication of the semi-automatic routine for updating catch time-series data; or
 - ii) FAO baseline data error (a rare occurrence, but which may occur when the original FAO reported data contains an error); and
- 3) With catch cumulatively accounting for the top 90% of the total catch within each ME for the whole time series.

This process identified just over 1,300 ME-level stocks³ with catch time series viable for CMSY assessment and is described in Palomares *et al.* (2018). These ME-level stocks were then assigned to EEZs overlapping with those MEs (see Appendix D). However, a large percentage of these ME-level stocks were wide-ranging and straddling, and sometimes did not represent the highest catches in an EEZ. Thus, there was a need to review the catch composition of EEZs and consider taxa⁴ with large contributions to the catch that were not identified in the process above. Two more selection rounds were performed to identify taxa by EEZ that could be viable for CMSY assessment, viz:

- 4) Review stocks rejected due to Criterion 2:
 - a) For stocks rejected due to Criterion 2a and where the catch time series were broken by only ≤ 5 -year gaps, the gaps were filled by interpolating missing catches, and the stock was then accepted as CMSY-viable. Note that time series where several of these gaps were present were again rejected;
 - b) Stocks rejected due to Criterion 2c were accepted if the time series could be truncated to start at a year in which the catch trend exhibited random behavior⁵ and which leaves at least 20 years of continuous time series. This reduces the uncertainty of the remaining time series and renders the time series viable for CMSY analysis;

¹ This section was prepared by Maria L.D. Palomares, Vina Angelica Parducho, Luisa Abucay, Selina de Leon, and Martin Nevado of Quantitative Aquatics, Los Baños, Philippines.

² This is catch identified to the species level. Note that more than half of the taxa with catch data in the *Sea Around Us* are aggregated species groups, i.e., genus, family, order, class, phylum, and the “not elsewhere identified” (nei) groups.

³ Here we define ME-level stocks as species with catch data for a given ME (non-straddling) or a group of MEs or FAO/RFMO areas or oceans (straddling).

⁴ Here the term “taxa” refers to all taxonomic groups, including “nei”.

⁵ As opposed to a straight line that indicates a forward carry assumption.

- c) Stocks rejected due to Criterion 2d were submitted for reconstruction process review to determine the source of instability in the last 5 years of the time series. If the trend of the last 5 years follows the underlying FAO data, then the dataset was accepted, albeit with the caveat that published evidence of the cause of the trend was required. In cases where such evidence could not be found, the dataset was excluded from the analysis and circled back to the reconstruction process for further investigation.
- 5) Review EEZs with the most pronounced bias towards straddling species⁶ or with hundreds of exploited species (e.g., in MEs with tropical coral reefs, as in Southeast Asia). Stocks passing Criterion 2 and rejected due to Criterion 3, but with catches >100 t reported for that EEZ were accepted.

This process added about 1,700 stocks, making a dataset of about 3,000 ME-level stocks for analysis. For some EEZs, this process failed to identify additional species for analysis and as such the ratio between straddling and demersal species remained higher than the threshold 60:40 ratio.⁷ For some island EEZs, this improved the straddling/demersal ratio to at least 70:30.

Selection of relative biomass time series to inform CMSY analysis

As part of the CMSY assessments, a series of literature searches were completed that enabled the assembly of a wide variety of supplementary data into a 'prior database' which is now included in the FishBase infrastructure.⁸ These priors include: a) independent biomass or relative biomass/abundance data from traditional stock assessments; b) fisheries independent survey data; and c) catch per unit of effort data. Publicly available data and material, or materials that are shared via our global network of colleagues and contacts were prioritized. This includes the RAM Legacy Stock Assessment Database (Ricard *et al.*, 2012) as well as assessments by national (e.g., Australia, Canada, Japan, New Zealand, USA) and international management organizations (e.g., RFMOs such as the ICCAT, IOTC and WCPFC⁹).

The first round of literature searches was used to identify the official fisheries governing body of stocks in EEZs overlapping with one or several MEs, and, if available, the most recent assessment published for the stock by the governing body.¹⁰ Reference points, catch data used in the assessment, and the relative biomass time series trend resulting from assessment models were extracted and encoded into a database (see discussion of the CMSY database below). The choice of the relative biomass time series used in the CMSY analyses followed the criteria below:

- The EEZ where most of a stock is caught best represents the stock in that ME and is the first choice for the source of relative biomass;
- Where such dominance is unclear, and if there are several official assessments available for a stock in a given ME, the relative biomass from the most recent assessment was used;
- Where there was more than one official assessment available for a stock in an ME for the most recent year, the average relative biomass trend was obtained using the harmonization process described in Winker and Sherley (2019);

⁶ For instance, EEZs of island ecosystems (e.g., in the South Pacific), where species-level catches consisted mostly of straddling stocks, and non-straddling species were reported at genus- or family-level catches only. In such cases, we opted to use only species-level catches for analysis, mainly because relative biomass priors are difficult to obtain for higher level taxa.

⁷ The balance between straddling and demersal species analyzed for each EEZ will improve with proper disaggregation of catch data to species level over time.

⁸ Available in the FishBase "Species summary" page under the "Estimates based on models" section.

⁹ Figure 9 for RFMO definitions.

¹⁰ These assessments are mostly available as 'grey literature' (e.g., technical reports) or as online publications that were downloaded as PDF files.

- Catch per unit of effort and total biomass are the most informative relative biomass types (Froese *et al.*, 2020) and are used where available; other relative biomass types used by order of importance are: standing stock biomass, spawning stock biomass, and 'abundance' estimates.

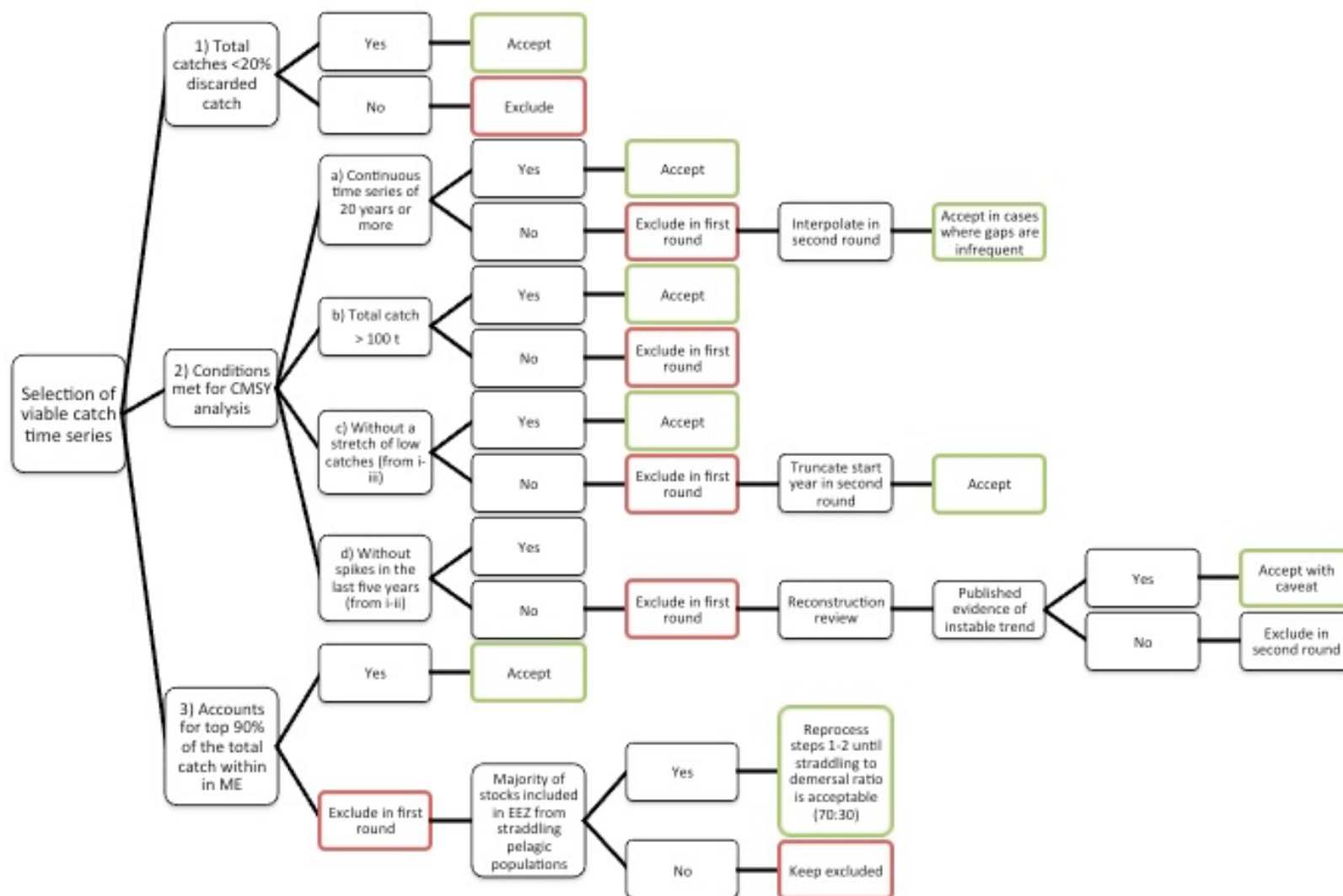


Figure 2. Flowchart for the three rounds of selecting populations with viable catch time series for CMSY analysis. Green boxes indicate stocks with time series that met the criteria and red boxes indicate stocks with time series that were excluded from CMSY analysis.

The second round of literature searches identified primary literature (e.g., scientific journals) that published any type of relative biomass information on exploited stocks. Primary literature accessed through the UBC Library, Google Scholar, Web of Science, FishSource, and CORE used the following search terms:

- Species name OR common name OR higher taxa name;
- ME OR EEZ OR RFMO OR country OR straddling area;
- Any combination of “fisheries stock assessment”, “stock status”, “fisheries management advice”, “CPUE”, “standing stock biomass”, “spawning stock biomass”, “relative abundance”, “stock assessment”, “biological reference points”, “BMSY”, “FMSY”, “fishing effort”, “biomass”, “abundance.”

In addition, Google Scholar alerts were set up for these terms for any new published stock assessments or relative biomass information that keeps the relative biomass database updated with the most recent assessments available for any given stock.

Selection of priors to inform CMSY analysis

The bulk of estimates for resilience and intrinsic rate of population growth (r), were extracted from FishBase (www.fishbase.org) for finfishes and from SeaLifeBase (www.sealifebase.org) for invertebrates. In cases where the r range from stock assessments was missing, but where resilience was available, resilience or the r range were assumed following Froese *et al.* (2017; see Table 1). In cases where neither of these priors were available, resilience was inferred from vulnerability (the inverse of resilience) and the preferred temperature of the species (both available in FishBase and SeaLifeBase). That is:

- Species with high vulnerability and preferring colder temperatures are assumed to be in the low resilience group;
- Species with low vulnerability and preferring colder temperatures (<15 °C) are assumed to be in the medium resilience group;
- Species with low vulnerability and preferring high temperatures (>15 °C) are assumed to be in the high resilience group.

Independent prior knowledge¹¹ on the reduction of biomass by fishing from carrying capacity at the start, intermediate, or end of the time series was translated into broad percentage or fractional ranges according to Froese *et al.* (2017; see Table 2). Where a rough estimate of B/k was available in the literature, a confidence interval of ± 0.2 was used. This corresponds to a fractional range of 0.4, e.g., 0.2 to 0.6 for terms equivalent to medium depletion (see Table 2).

Table 1. Prior ranges for parameter r , based on classification of resilience after Froese *et al.* (2017).

| Resilience | prior r range |
|------------|-----------------|
| High | 0.6 – 1.5 |
| Medium | 0.2 – 0.8 |
| Low | 0.05 – 0.5 |
| Very low | 0.015 – 0.1 |

Table 2. Independent knowledge on the reduction of biomass by fishing or from carrying capacity following Froese *et al.* (2017). Prior ranges for parameter r based on classification of resilience following Froese *et al.* (2017).

| Depletion level | prior r range |
|--|-----------------|
| Very strong depletion | 0.01 – 0.2 |
| Strong depletion | 0.01 – 0.4 |
| Medium depletion | 0.2 – 0.6 |
| Low depletion | 0.4 – 0.8 |
| Very low depletion or nearly unexploited | 0.75 – 1.0 |

¹¹ This knowledge was found in the form of quotes in the literature and documented in the ‘prior database’.

In cases where the species were listed under the IUCN Red List of Threatened Species, the IUCN categories were translated into fractional ranges representing levels of biomass that are related to resilience levels (in Table 1) presented in Table 3.

Some official assessments available from FAO stock assessment reports lacked numerical reference points. In such cases, the FAO qualitative assessments were translated into B/k ranges by assuming B_{MSY} to be 50% of unfished biomass (B_o), assuming $B_o \approx k$, unless otherwise stated in the FAO assessment. Table 4 presents these ranges.

Table 3. Correspondence of the IUCN Red List Categories to prior relative biomass (B/k) ranges.

| IUCN Category | prior r range |
|-----------------------|-----------------|
| Critically Endangered | 0.01 – 0.1 |
| Endangered | 0.01 – 0.2 |
| Vulnerable | 0.01 – 0.4 |
| Near threatened | 0.1 – 0.4 |
| Least concern | 0.6 – 1.0 |

Table 4. Correspondence of FAO and *Sea Around Us* terms used to assess the status of exploited fish stocks. B_{MSY} is assumed to be 50% of unfished biomass (B_o), assuming $B_o \approx k$, unless otherwise stated.

| FAO assessment | <i>Sea Around Us</i> terminology | prior r range |
|---------------------|--|-----------------|
| Not fully exploited | $B \geq B_{MSY}$ (Healthy) | 0.50 – 1.00 |
| Fully exploited | $0.8 * B_{MSY} \leq B < 1.0 * B_{MSY}$ (Slightly overfished) | 0.40 – 0.50 |
| Fully exploited | $0.5 * B_{MSY} \leq B < 0.8 * B_{MSY}$ (Overfished) | 0.25 – 0.40 |
| Overexploited | $0.2 * B_{MSY} \leq B < 0.5 * B_{MSY}$ (Grossly overfished) | 0.01 – 0.25 |
| Overexploited | $B < 0.1 * k$ or $B < 0.2 * B_{MSY}$ (Collapsed) | 0.01 – 0.10 |

Where length-frequency data collected from the commercial fishery (preferably raised to the catch) was available, the exploited biomass relative to unexploited biomass (B/B_o) was estimated using the length-based Bayesian biomass estimator (LBB). This model applies asymptotic length (L_{inf}), length at first capture (L_c), relative natural mortality (M/K) and relative fishing mortality (F/M) from the length-frequency data. Such LBB data were most important in providing start year and/or end year priors where available.

Applying ME-based CMSY analyses to EEZs

Identifying ME-level stocks included in an EEZ was based on two criteria, viz.: 1) the extent of overlap of the ME with the EEZ (see Appendix D) should be 20-100%¹²; and 2) the catch of the stock in the EEZ should be ≥ 100 t. The first criterion was applied to ME-level stocks, and the second criterion refined the list of stocks obtained to create the EEZ-level stocks list. All CMSY results for these stocks were then applied to the resulting database of stock reference points for that EEZ. This process used about 3,000 ME-level CMSY stock assessments distributed to over 270 EEZs.

The resulting list of EEZ-level stock assessments were then submitted for review by country experts knowledgeable in the history and status of their countries' stocks. Results from the CMSY analyses (catch and B/k graphs and sources of priors when available) for each EEZ were prepared in a document with specific questions to the experts as those listed in Table 5. Experts were requested to provide additional CMSY priors data if these were lacking.¹³

A total of 68 country experts were contacted (see Appendix E), with about half of them agreeing to perform reviews. This process resulted in 1,642 ME-level stocks (more than half of the over 2,500 stock assessments) provided with at least a source and value for the end biomass prior or at most the source and biomass time series

¹² Where the EEZ/ME overlaps $< 20\%$, the EEZ was excluded from that ME.

¹³ Because they were not available via the worldwide web and/or they originated from recent studies or pending publications.

resulting from an official assessment (see Table 6). Of these, 42% are based on official assessments (with the highest data reliability score of 4); about 35% are based on relative biomass time series (CPUE or spawning stock biomass; data reliability score of 3); and 23% are based on priors provided by experts (B/k estimates at the end of the time series; data reliability score of 2). The 33 experts who agreed to review their countries' stocks provided priors for half of these ME-level stocks and improved the reliability of over 20% of these assessments. Thus, the experts agreed with 80% of the CMSY assessments.

Once the review results were integrated into the EEZ-level stock assessments, the average B/B_o for all stocks included per EEZ was calculated. This value and the material that went into its calculation will be made available in the *Sea Around Us* website.

To demonstrate the use of official assessments as priors in CMSY assessments with Bayesian Schaefer Model results, a sample of 20 non-straddling and straddling stocks are presented in Table 7. These show that, on average, the CMSY assessments are optimistic by about 23% if B/B_o is used for comparison, by about 8% if B/B_{MSY} is compared and by about 3% if F/F_{MSY} is compared. Note that the greater disparity of B/B_o results is due to the fact that the B/B_o estimates from official assessments might have been calculated using varying (and thus maybe not comparable) assessment models (see Sharma *et al.* 2021).

Table 5. Example of questions submitted to experts to establish priors for CMSY analysis.

| Prior | Question to the experts |
|--|--|
| Start year for catch time series | From what year onward are catch data deemed reliable? |
| Relative start and end biomass B/B_o | What is the most likely stock status for the beginning and end of the time series: lightly fished, fully exploited, or overfished? |
| Relative intermediate biomass B/B_o | Is there an intermediate year in which biomass is considered to have been particularly low or high, e.g., exploitation changed from light to full, or where an extraordinary large year class entered the fishery? |
| Resilience prior r | What is the best guess for the range of values including natural mortality of adults (M)? Consider the empirical relationship $r \approx 2 \cdot M$. |
| Resilience prior r | What is the best guess for the range of values including maximum sustainable fishing mortality (F_{MSY})? Considering the relationship $r \approx 2 \cdot F_{MSY}$. Use this question to reinforce or change the answer to previous questions |
| Resilience prior r | Alternatively, does the prior range of r from the section “Estimates based on models” in the species summary page of FishBase (www.fishbase.org) or SeaLifeBase (www.sealifebase.org) represent the stock adequately? |

Table 6. Summary of ME-level assessments benefiting from country experts review, including assessment type, reliability, straddling type, relative biomass type, and end biomass type (in CMSY/BSM assessments). Note summary of the expert review at the bottom of the table.

| Data type | Subdata type | Number of stocks |
|------------------------------|--|-------------------------|
| Assessment type | CMSY | 940 |
| | Official | 691 |
| | Other | 11 |
| Reliability | 2 | 384 |
| | 3 | 567 |
| | 4 | 691 |
| Straddling type | Straddling | 377 |
| | Non-straddling | 1265 |
| Relative biomass type | Abundance | 26 |
| | B/B_o | 1 |
| | B/B_{MSY} | 24 |
| | Averaged/standardized CPUE | 35 |
| | Biomass Index | 146 |
| | CPUE | 315 |
| | Spawning Stock Biomass | 84 |
| | Total Biomass | 90 |
| | Y/R (yield per recruit) | 10 |
| | None (includes official assessments) | 911 |
| End biomass type | Expert | 457 |
| | Expert and Literature | 2 |
| | LBB | 20 |
| | Literature | 186 |
| | None | 977 |
| Expert review | # experts contacted | 68 |
| | # experts engaged with positive response | 33 |
| | # countries reviewed with SAU experts | 51 |
| | # stocks rerun with expert information | 875 |
| | # stocks reliability improved | 308 |

Table 7. Comparison of 20 stocks with official assessments available from national or international assessment organizations and BSM assessment results obtained from the CMSY model with added relative biomass time series trends (CPUE or spawning stock biomass). Reference points (MSY , B_{MSY} , B_{end}) are expressed in thousands of tonnes. The parameter B_{end} refers to the biomass of the last year of the times series.

| | Official assessment results | | | | | | | BSM analysis results | | | | | | |
|-----------------------------------|-----------------------------|-----------|-------------|-----------|-------------|-----------|---------|----------------------|-----------|-------------|-----------|-----------|-------------|---------|
| Stock name ¹ | MSY | F_{MSY} | F/F_{MSY} | B_{MSY} | B/B_{MSY} | B_{end} | B/B_o | MSY | F_{MSY} | F/F_{MSY} | B_{MSY} | B_{end} | B/B_{MSY} | B/B_o |
| arri_tru_e | | | | | | | 0.36 | 3 | 0.22 | 0.49 | 13 | 16 | 1.23 | 0.62 |
| Clup_har_NorthSeaNorwayBarents | | 0.16 | 0.82 | 6368 | 0.62 | 3965 | 0.31 | 1788 | 0.22 | 0.34 | 8245 | 11384 | 1.38 | 0.69 |
| Euth_aff_Indian | 152 | 0.56 | 0.98 | 202 | 1.15 | | 0.58 | 63 | 0.27 | 1.21 | 231 | 227 | 0.99 | 0.49 |
| Kats_pel_EAtlantic | | | 1.00 | | 0.90 | 282 | 0.45 | 136 | 0.33 | 1.54 | 413 | 374 | 0.91 | 0.46 |
| Maka_nig_Atlantic | 3 | | 1.03 | | 0.69 | | 0.35 | 6 | 0.17 | 3.01 | 33 | 14 | 0.42 | 0.21 |
| Mela_aeg_NorthSea | | 0.19 | 1.13 | 264 | 0.90 | 237 | 0.45 | 311 | 0.16 | 0.27 | 1668 | 731 | 0.43 | 0.22 |
| Merl_pro_USCanadaPacific | | | | 594 | 3.58 | 1312 | 0.64 | 287 | 0.30 | 0.88 | 945 | 1070 | 1.13 | 0.57 |
| panu_cyg | | | | | | | 0.80 | 13 | 0.48 | 0.33 | 25 | 42 | 1.68 | 0.84 |
| Poll_vir_Maine | | 0.27 | 0.14 | 125 | 1.70 | 212 | 0.85 | 14 | 0.23 | 0.19 | 60 | 90 | 1.50 | 0.75 |
| Sard_pil_SEuroAtlanticShelf | | 0.12 | 1.43 | 893 | 0.17 | 149 | 0.08 | 208 | 0.19 | 0.95 | 836 | 324 | 0.39 | 0.19 |
| Scom_cav_CarolinianVirginianMaine | | 0.15 | 0.29 | 2 | 1.74 | 4 | 0.52 | 6 | 0.25 | 0.45 | 24 | 33 | 1.37 | 0.69 |
| scom_com_goc | | | | | | | 0.32 | 0 | 0.34 | 1.32 | 1 | 1 | 0.75 | 0.37 |
| Scom_com_Indian | 131 | 0.35 | 1.28 | 371 | 0.89 | | 0.44 | 172 | 0.38 | 1.03 | 456 | 469 | 1.03 | 0.52 |
| Scom_sco_NEAtlantic | | 0.23 | 1.04 | 5000 | 0.88 | 4390 | 0.44 | 748 | 0.30 | 1.48 | 2544 | 2394 | 0.94 | 0.47 |
| Ther_cha_EBering | | | 0.65 | 2147 | 1.30 | 2781 | 0.60 | 1584 | 0.23 | 0.32 | 6981 | 11108 | 1.60 | 0.80 |
| Thun_ala_Indian | 39 | 0.07 | 0.85 | 30 | 1.80 | | 0.37 | 43 | 0.28 | 0.67 | 156 | 209 | 1.35 | 0.67 |
| Thun_ala_NCAtlantic | 37 | 0.10 | 0.54 | 407 | 1.36 | 27 | 0.68 | 36 | 0.27 | 0.46 | 133 | 198 | 1.49 | 0.75 |
| Thun_obe_Atlantic | 76 | | 1.63 | | 0.59 | 73 | 0.30 | 86 | 0.30 | 1.84 | 282 | 153 | 0.55 | 0.27 |
| Xiph_gla_Indian | 31 | 0.17 | 0.76 | 44 | 1.50 | | 0.75 | 33 | 0.29 | 0.48 | 113 | 161 | 1.43 | 0.72 |
| Xiph_gla_NCAtlantic | 13 | 0.17 | 0.78 | 83 | 1.04 | 11 | 0.52 | 17 | 0.26 | 0.30 | 66 | 114 | 1.71 | 0.86 |

¹ Note that we use stock names here and not scientific names because the purpose is to draw attention to the assessment results and not to the species themselves.

The CMSY database

The CMSY database consists of the priors used in the CMSY++ input files (ID and Catch files) and the results of the CMSY++ routine (Output file). This database is curated at Quantitative Aquatics and provided with a version stamp, i.e., each run cycle associated with the reconstructed catch data used (e.g., 2014, 2016 and 2018) is kept in the database. Figure 3 provides a schematic representation of the CMSY database. This database also collates relative biomass time series from official stock assessments or scientific biomass surveys and/or biomass window priors as described in Tables 1-4. It is designed to accommodate new data for stocks that will be added as new species appear in the underlying FAO database updates. For the 2018 update, this database contains data for 2,978 stocks representing 939 exploited species of which 20% are invertebrates and 80% fish stocks (see Appendix G) and of which 75% passed a quality control process¹⁴. It will be made available via the *Sea Around Us* website. The remaining 25% of these stocks that did not pass quality control will undergo further investigation and will be added as new stocks for CMSY analyses in the next update¹⁵.

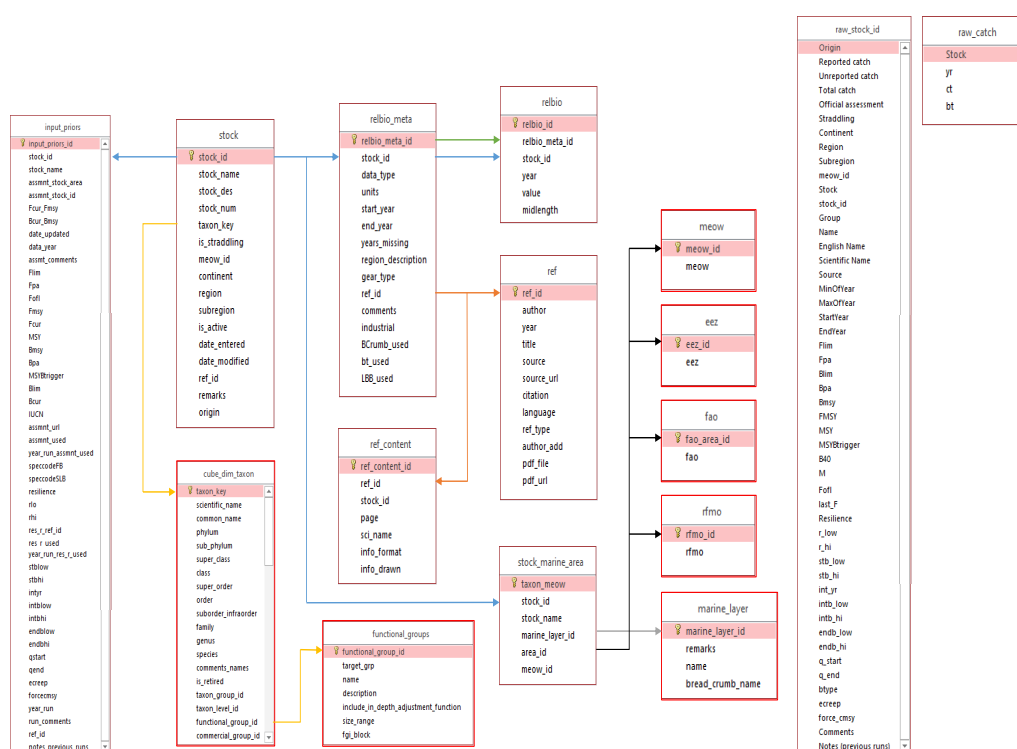


Figure 3. Schematic representation of the CMSY database. Tables with red thick border are existing tables in the *Sea Around Us* database web schema, included here to illustrate the relationship and how the information from those tables are linked to the CMSY schema tables. The ID and Catch input files (i.e., raw_stock_id and raw_catch tables) are raw files based on the provided information from the CMSY schema tables.

¹⁴ This quality control run, the fourth in this long process, verified that the CMSY analyses, notably for stocks run only with catch and resilience data, resulted in logical biomass trends with reasonable default biomass windows.

¹⁵ Meaning when the catch data is updated to the 2019 FAO data.

Applying official assessments for countries or areas with management bodies

Estimating B/B_o for Australia¹⁶

The identification of Australian stocks to be included for assessments followed a systematic approach based on the contribution of each species to the total fisheries catch in the country. First, we utilized the reported component of the Australian catch reconstruction developed by *Sea Around Us*, which compiles the catches reported by the Australian Commonwealth and the various state/territory fisheries authorities, to generate a list of species ranked by total catch. To account for inter-annual variation in catches and trends in recent years, we ranked the species based on the average catches over the entire catch time series available in the catch reconstruction, i.e., reported catches from 1950 to 2018. For each species, we used the individual Status of Australian Fish Stock Reports (SAFS Reports) to identify the number of existing stocks, relative catch by stock (within the species catch), stock distributions and assessments that were available. We obtained the published official stock assessments, i.e., either conducted, commissioned or published by the federal or state/territory fisheries authorities, through online searches, and we extracted the relative biomass values, i.e., B/B_o , when available (Figure 4). Furthermore, we searched for more recent stock assessments and scientific reports published since release of the SAFS reports (2018). We performed this procedure for the species ranked from the highest to the lowest average catch volumes in our species list, aiming to include all species that contributed at least 1% or more of the total Australian catch over the full time series. Our final dataset included a total of 137 stock assessments.

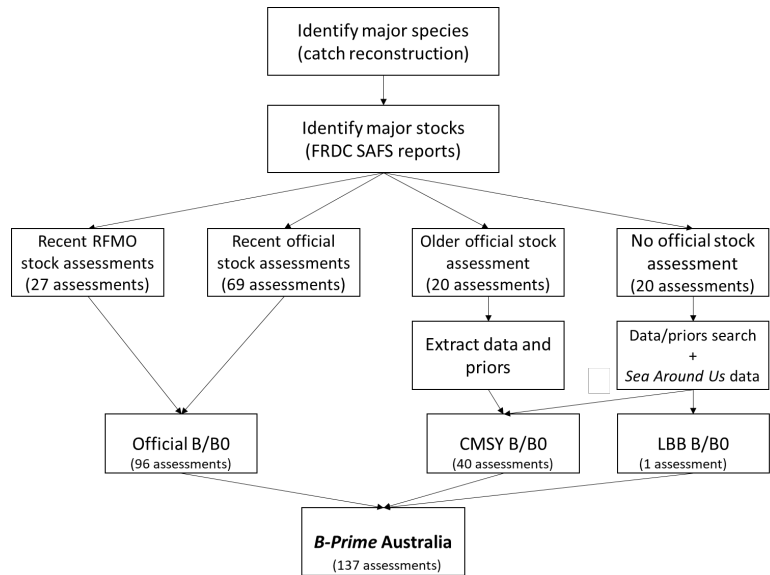


Figure 4. Decision tree for selection of stocks and assessments for B-prime for Australia. CMSY: most recent version of CMSY stock assessment method; LBB: Length-Based Bayesian stock assessment method.

When recent stocks assessments were available, i.e., assessments with time series up to 2016 or more recent, we accepted the values of B/B_o (when available) as the most recent relative biomass estimate of the stock. These provided estimates of B/B_o for 69 stocks included in B-prime (Figure 4). We also accepted the most recent relative biomass estimates of straddling stocks exploited by Australian fisheries but managed and assessed by the RFMOs. These accounted for 27 stock assessments, dating as far back as 2015 (data year).

For stocks without recent official assessment, i.e., assessments prior to 2016, or assessments with no information that allowed for estimates of B/B_o , we extracted the time series of catch and relative abundance, e.g., CPUE, from the most recent stock assessment or scientific report available and conducted independent stock assessments using the most recent version of CMSY. When necessary, we complemented the stock catch time series with the catch data reported in the SAFS reports to account for the most recent years and provide time series to at least

¹⁶ Prepared by Gabriel M.S. Vianna, Amy McAlpine, Rachel White, Dirk Zeller, *Sea Around Us* - Indian Ocean, University of Western Australia, Perth, Australia.

2016 (or more recent). When available, we also extracted from the reports qualitative, e.g., categorical stock status classification, and quantitative, e.g., estimate of relative biomass, information regarding the stocks at the start and intermediate points of the catch time series. Further, we also obtained indicators of the stock's final year relative biomass if clear qualitative information about the stock status at the end of the time series was available. This information was converted to biomass prior ranges, which were used in the CMSY stock assessments according to the methods recommended by Froese *et al.* (2017). This category accounted for 40 additional stock assessments (Figure 4), of which 20 were conducted with relative abundance time series, i.e., BSM stock assessments. We also conducted 20 assessments with *Sea Around Us* reconstructed data and relative biomass priors derived from the literature.

We also conducted Length-Based Bayesian stock assessments (LBB, Froese *et al.* 2018) for species for which no index of abundance was available in the literature, but for which length frequency data could be found. Estimates of B/B_0 obtained from LBB were used as relative biomass priors in the CMSY stock assessments. For one stock, the estimate of B/B_0 provided by LBB for 2016 was accepted as the current B/B_0 , given the poor quality of the catch data available for a CMSY assessment.

Estimating B/B_0 for Canada¹⁷

The federal Department of Fisheries and Oceans (DFO) is the lead authority responsible for conservation and management of Canada's aquatic resources. The Canadian Scientific Advisory Secretariat (CSAS) is responsible for publishing peer-reviewed stock assessments and status reports for targeted species. All existing official Canadian stocks were identified through the CSAS¹⁸ database of stock assessments.

Stocks were defined based on the area specified in the official report, and the corresponding ME was identified. In cases where there were multiple stocks of the same species managed in a single ME, these were treated as 'sub-stocks'. Total catches (for 1990-2018, 1950-2018) derived from SAU reconstructions were then assigned to each sub-stock based on the percentage that a sub-stock contributed to the total catches in the ME.

Reference points and stock status for major stocks were available in the most recent Sustainability Survey for Fisheries (DFO 2018). Where a direct estimate of B/B_{MSY} was missing in the official report, available Limit Reference Points (LRPs) and Upper Reference Points (URPs) were used to determine B/B_{MSY} according to the Precautionary Approach (DFO 2009) (Figure 5).

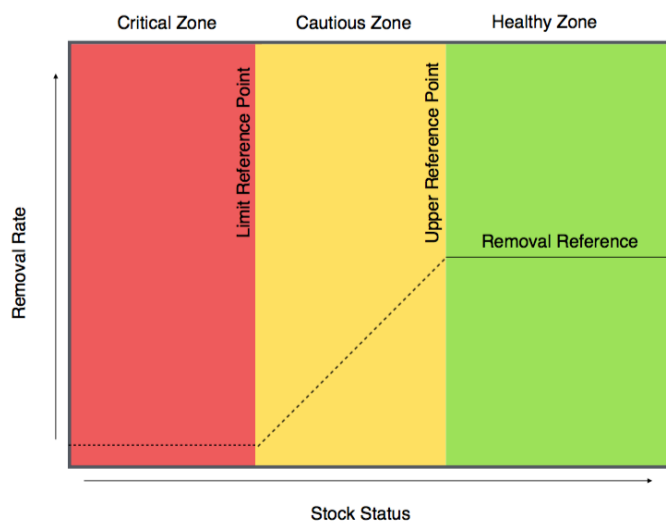


Figure 5. Fisheries management framework with a precautionary approach adapted from DFO (2009). Zones are defined as healthy (biomass $\geq 80\%$ B_{MSY}), cautious (40% $B_{MSY} < \text{biomass} < 80\%$ B_{MSY}), or critical (biomass $\leq 40\%$ B_{MSY}).

¹⁷ Prepared by Rebecca Schijns, *Sea Around Us*, Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada.

¹⁸ CSAS database available at <http://www.isdm-gdsi.gc.ca/csas-sccs/applications/Publications/search-recherche-eng.asp>

For stocks available in the CSAS database for which no recent official assessment or assessments with no information that could lead to an estimate of B/B_0 could be found, we extracted the time series of catch and relative biomass (e.g., CPUE) from the most recent stock assessment or scientific report available and conducted independent stock assessments using the CMSY++ package. Where only time series of relative biomass were available in official reports, catches were extracted from the *Sea Around Us* reconstruction for the stock in a given EEZ. Since the assessments had an index of abundance available, the BSM results were used for reference points. In cases where qualitative biomass information was available but catch and abundance time series were not available, a CMSY assessment was conducted using SAU reconstructed catches and expert-informed biomass ranges. When the official stock description was based on a smaller area (e.g., based on a group of NAFO zones), then the reported subarea (e.g., NAFO zone) catches were used and the associated Marine Ecoregion was defined to reflect the official management description. The procedure for extracting qualitative and quantitative priors to inform the CMSY++ analysis was the same as the procedure detailed in the Australian methods section shown in Figure 6 for Canada. Our final dataset included a total of 240 stock assessments.

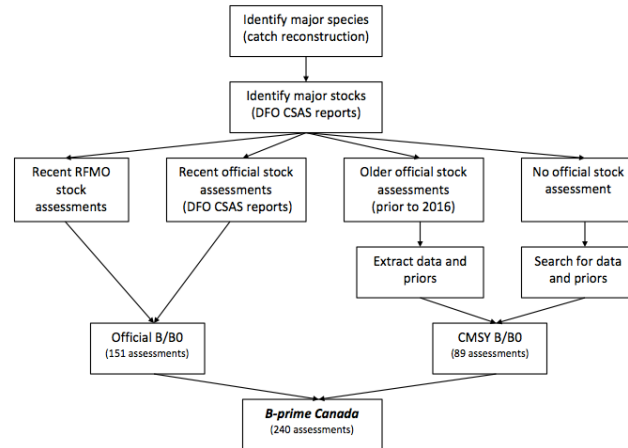


Figure 6. Decision tree for selection stocks and assessments for B-prime in Canada. CMSY: most recent CMSY stock assessment method.

Estimating B/B_0 for New Zealand¹⁹

The identification of New Zealand's stocks for analysis followed a systematic approach based on the contribution of each stock to the total fisheries catch in the country. The Ministry for Primary Industries of New Zealand provides a comprehensive list of the total annual catches reported at the stock level²⁰. We utilized the 2020 data to generate a list of the most important stocks ranked by total catches. To account for inter-annual variation in catches and trends in recent years, we compared these data with the time series of catch data in the historical catches compiled by the *Sea Around Us*, i.e., reported catch from 1950 to 2018, to identify stocks with large historical catches

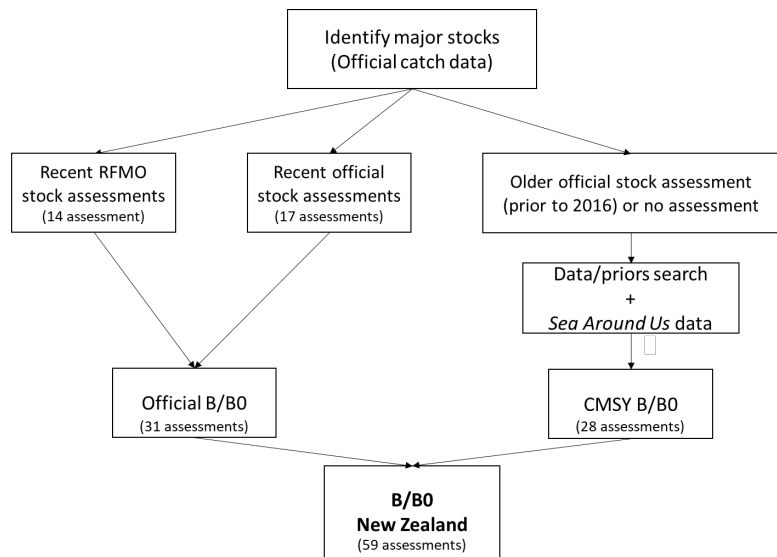


Figure 7. Decision tree for selection of stocks and assessments for B-prime in New Zealand. CMSY: most recent CMSY stock assessment method

¹⁹ Prepared by Gabriel M.S. Vianna, Amy McAlpine, Rachel White, Dirk Zeller, *Sea Around Us* - Indian Ocean, University of Western Australia, Perth, Australia

²⁰ <https://fs.fish.govt.nz/Page.aspx?pk=16&tk=114>

that should be included in our analysis. Our final dataset included a total of 59 stock assessments.

For each stock included in our list, we searched the 2019 and 2020 Fisheries Plenary Assessment reports, e.g., Fisheries New Zealand (2020), to obtain the most up-to-date information on stock status and stocks assessments available. We then sourced the published official stock assessments identified in the plenary reports through online search and extracted the relative biomass values, i.e., B/B_o , when available (Figure 7). We performed this procedure for the species ranked from the highest to the lowest catch in our species list, aiming to include all the stocks that contributed at least 1% or more of the total national catch over the time series. We further searched for stock assessments published by the regional RFMO for pelagic straddling stocks exploited by New Zealand. When recent stocks assessments were available, i.e., stock assessments with time series up to at least 2016, we accepted the values of B/B_o (when available) as the most recent relative biomass estimate of the stock. These resulted in estimates of B/B_o for 17 stocks (Figure 7). We also accepted the most recent relative biomass estimates of straddling stocks exploited by fisheries in New Zealand but managed and assessed by the RFMOs, which accounted for 14 stock assessments (Figure 7).

For stocks without recent official assessments, i.e., no later than 2015, or assessments with no information that allowed for estimates of B/B_o , we extracted the time series of catch and relative abundance (e.g., CPUE) from the most recent stock assessment or scientific report available and conducted independent stock assessments using the most recent version of CMSY. When necessary, we complemented the stock catch time series with the catches reported in the Fisheries Plenary Assessment to account for the most recent years and provide updated time series for the assessments, i.e., for 2016 or more recent, or used the *Sea Around Us* reconstructed data for stocks we found no time series for. Furthermore, we extracted from technical reports qualitative and quantitative information, e.g., estimate of relative biomass, regarding the stocks at the start and intermediate points of the catch time series. We also obtained indicators of the stock's final year relative biomass if clear qualitative information about the stock status at the end of the time series was available. This information was converted to conservative biomass prior ranges, which were used in the CMSY stock assessments according to the methods recommended by Froese *et al.* (2017). This category accounted for 28 additional stock assessments (Figure 7), all of which were conducted with relative abundance time series, i.e., BSM stock assessments.

Estimating B/B_o for the USA²¹

The National Oceanic and Atmospheric Administration (NOAA) within the U.S. Department of Commerce is the central government agency responsible for managing fisheries and providing scientific information on the state of the nation's oceans. After passing the Magnuson-Stevens Fishery Conservation and Management Act in 1976, eight regional fishery management councils were created and required to provide fishery management plans, develop rebuilding plans, and set catch limits. As well, three Interstate Marine Fisheries Commissions coordinate data collections and fisheries management with NOAA. NOAA publishes Fisheries' Stock Status, Management, Assessment, and Resource Trends online through the Stock SMART web tool. Therefore, the majority of stock assessments and supporting information were sourced from the NOAA publication database and associated councils and commissions for each USA EEZ (Table 8).

Territories and islands were included in the search for official assessments. However, the majority did not have information available for non-RFMO managed stocks. Thus, they were assessed using CMSY (Figure 8). Our final dataset included a total of 339 stock assessments.

²¹ Prepared by Emmalai Page and Rebecca Schijns, *Sea Around Us*, Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada

Table 8. Source of stock assessments and fishery management advice for each USA EEZ including islands and territories. For EEZs where the source is ‘Not available’, the stocks were assessed using reconstructed catches and CMSY.

| EEZ | Source |
|------------------------------------|---------------------------|
| American Samoa | NOAA |
| Guam (USA) | NOAA |
| Hawaii Main Islands (USA) | NOAA |
| Hawaii Northwest Islands (USA) | Not available |
| Howland & Baker Isl. (USA) | Not available |
| Jarvis Isl. (USA) | Not available |
| Johnston Atoll (USA) | Not available |
| Palmyra Atoll & Kingman Reef (USA) | Not available |
| Puerto Rico (USA) | Not available |
| US Virgin Isl. | Not available |
| USA (Alaska, Arctic) | Not available |
| USA (Alaska, Subarctic) | NOAA, PFMC |
| USA (East Coast) | NOAA, SEDAR, ASMFC, NEFSC |
| USA (Gulf of Mexico) | SEDAR, GSMFC |
| USA (West Coast) | NOAA, PFMC |
| Wake Isl. (USA) | Not available |

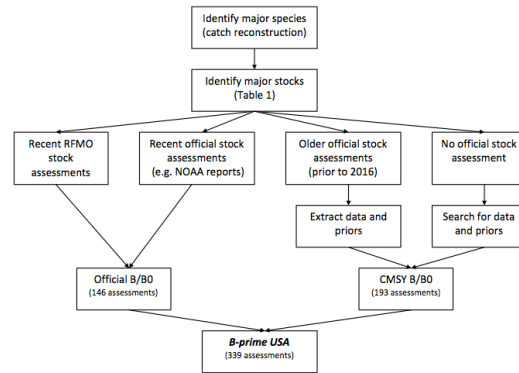


Figure 8. Decision tree for selection stocks and assessments for B-prime in USA, including territories and islands. CMSY: most recent CMSY stock assessment method

Special case I: Assessing the marine resources of China and neighboring countries²²

While the marine fisheries of the People’s Republic of China (henceforth: China) generate by far the highest catch in the world (FAO 2020), China’s fisheries statistics are rather problematic. Thus, a large fraction of China’s domestic catch is reported on in national statistics as ‘miscellaneous fish’ category with only a few fishes (e.g., hairtail *Trichiurus haumela*) reported at the level of species (China Fishery Statistical Yearbook 2018).

Therefore, the catch provided for China by *Sea Around Us* is a hybrid: the annual total and the catches of a few identified species are reported unchanged while the remaining ‘miscellaneous fish’ – representing about 80% of the total – is interpolated from the detailed composition of marine catches in Taiwan and South Korea (Pauly and Le Manach 2015, Tsui *et al.* 2021; see www.seaaroundus.org).

This procedure allowed for the production of catch maps and similar products for the East and Southeast Asian regions (see e.g., Pauly and Liang 2019). However, this procedure could not generate the reliable catch time series required for stock assessments using the CMSY/BSM method as provided by the *Sea Around U* for other data-sparse regions, e.g., West Africa (see Palomares *et al.* 2020).

We therefore decided to (1) create a Special Topic issue of the peer-reviewed journal *Frontiers in Marine Science* devoted to the "Status of Fisheries in East Asia," and (2) teach a stock assessment course in China to generate enough publishable assessments of Chinese marine stocks so that the status of China's domestic exploited stock would be reliably assessed.

²² Prepared by Daniel Pauly, *Sea Around Us*, Institute for the Fisheries and Oceans, University of British Columbia, Vancouver, Canada and Cui ‘Elsa’ Liang, Key Laboratory of Marine Ecology and Environmental Sciences, Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China.

The course, held in Qingdao, Shandong Province, China from June 18 to 20, 2019, was taught by Drs Maria-Lourdes Palomares, Daniel Pauly, and Rainer Froese²³ with Drs Weiwei Xian and Cui ‘Elsa’ Liang of the Key Laboratory of Marine Ecology and Environmental Sciences, Institute of Oceanology, Chinese Academy of Sciences serving as co-instructors, facilitators, and hosts. The course, which was attended by about 20 participants from research institutions along the Chinese coast, was very successful in that it led to 15 contributions that were, after thorough peer-review, accepted for publication in the Special Topic issue of *Frontiers in Marine Research*, of which 14 contained stock assessments (see Table 9 and 10). Overall, these contributions, which are summarized in Pauly et al. (2021), present 161 original stock assessments covering numerous fish and invertebrate species in China and neighboring countries. The stock assessment approach used in the majority of cases was the CMSY method (Table 9), based on locally available time-series and usually complemented with catch-per-effort data that allowed the analyses to be extended to the BSM method. These, and assessments using other methods yielded 161 estimates of the fraction of biomass remaining relative to carrying capacity (B/B_o).

Despite the well-known inadequacies of fisheries statistics in China, the over-exploited status of its domestic fisheries could be reliably inferred from the many converging analyses of a large number of stocks (Table 11). Also, this exercise contributed numerous assessments of stocks in adjacent countries and/or countries with which China share stocks, notably South Korea and Japan.

Table 9. Number of stocks (or populations) assessed, by method; the numbers after the plus sign (if any) refer to invertebrates (mainly squids), the others to fishes.

| Location | CMSY/BSM | LBB | Y/R | Sum | Studies |
|------------------|----------|-------|-----|--------|---|
| Chinese Mainland | 19 | 28+15 | 21 | 68+15 | Liang <i>et al.</i> , (2020a ; 2020b); Wang <i>et al.</i> (2020a, 2021); Zhai and Pauly (2019); Zhai <i>et al.</i> (2020); Zhang <i>et al.</i> (2020a). |
| Taiwan | 17 | 5 | -- | 22 | Ju <i>et al.</i> (2020a, 2020b); Liang <i>et al.</i> (2020b). |
| South Korea | 5+1 | -- | -- | 5+1 | Liang <i>et al.</i> (2020b) |
| Japan | 37+13 | -- | -- | 37+13 | Liang <i>et al.</i> , (2020b); Ren and Liu (2020); Wang <i>et al.</i> (2020b, 2020c; Zhang <i>et al.</i> (2020b). |
| Sum | 78+14 | 33+15 | 21 | 132+29 | This ‘Research Topic’ |

Table 10. Number of stocks (or populations) assessed, by location, with the mean fraction of ‘biomass left’ in recent years (B_{end}) relative to the unexploited biomass (B_o), and its standard deviation. No. = number of stocks; SE = standard error.

| Location | No. | Mean B_{end}/B_o | SE | Studies |
|--------------------|-----|--------------------|-------|---|
| Chinese Mainland | 83 | 0.254 | 0.023 | Liang <i>et al.</i> (2020a, 2020b; Wang <i>et al.</i> (2020a, 2021); Zhai and Pauly (2019); Zhai <i>et al.</i> (2020); Zhang <i>et al.</i> (2020a). |
| Taiwan | 22 | 0.163 | 0.038 | Ju <i>et al.</i> (2020a, 2020b); Liang <i>et al.</i> (2020b). |
| South Korea | 6 | 0.257 | 0.021 | Liang <i>et al.</i> (2020b) |
| Japan | 50 | 0.297 | 0.021 | Liang <i>et al.</i> (2020b); Ren and Liu (2020); Wang <i>et al.</i> (2020b, 2020c); Zhang <i>et al.</i> (2020b). |
| Sum or mean | 161 | 0.255 | 0.015 | --- |

²³ Dr Rainer Froese participated remotely.

Special case II: Assessing the marine fish and invertebrate stocks in Northwest Africa²⁴

In West Africa, one often hears “there are no data” with which to perform stock assessments, but this is not the case. This was demonstrated in a training course titled “*Utilisation de la méthode CMSY pour l'évaluation des stocks ouest-africains*” held from September 23-27 2019 in Dakar, Senegal. The course was hosted by the Regional Sub-Commission for Fisheries (*Commission Sous-Régionale des Pêches, CSRP*) with the support of the MAVA Foundation for participants from Cape Verde, The Gambia, Guinea, Guinea-Bissau, Liberia, Mauritania, Senegal, and Sierra Leone. The stock assessment methods that were taught, CMSY and LBB, requiring a minimum amount of data to provide estimates of B/B_{MSY} , i.e., the current biomass of an exploited stock relative to the biomass that generates maximum sustainable yield (MSY).

The course was successful in that delegates from each of the participating countries contributed applications of the CMSY and/or LBB method based on data that they brought along. However, a number of these applications should be considered to be very preliminary. In the LBB case, the length-frequency (L/F) data that were analyzed did not necessarily reflect the wealth of L/F data available in the CSRP countries. In the CMSY cases, the national data used did not generally reflect the fact that the stock in question (e.g., of sardinella) may range over the Exclusive Economic Zones (EEZ) of two or more CSRP countries.

The short contributions presented in Palomares *et al.* (2020a) should therefore be seen as tentative in terms of their specific results. However, what they certainly do express is that the CMSY and LBB methods are well-suited for use in the CRSP region and that the course participants will be using these methods in the future.

To illustrate the power of international cooperation and to obtain reliable assessments of small pelagic stocks in the CSRP area, a chapter was added detailing how national data can and should be pooled into (sub-)national assessments of 14 shared stocks of small pelagic fishes (Palomares *et al.* 2020b). Table 11 present its key results. The general conclusions from the training course and the stock assessments it generated were:

- There are enough L/F and catch data series in the CRSP region for stock assessments to be performed, i.e., it is no longer the case that “there are no data”; and
- Policymakers in the CRSP region must face up to the fact that the assessment of the major stocks in the region indicates overexploitation, and in order to maintain abundant catches, a reduction of fishing effort is necessary.

²⁴ Prepared by Maria L.D. Palomares and Jessika Woroniak, *Sea Around Us*, Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada.

Table 11. List of small pelagic species assessed by Palomares *et al.* (2020b) in Northwest Africa. The catches (in thousands of tonnes) and B/B_{MSY} values are annual averages for the EEZ listed and the period 2012–2016.

| Scientific name | English name | EEZ occurrence | Catch | B/B_{MSY} | Stock status |
|-------------------------------|-------------------------|--|-------|-------------|---------------------|
| <i>Caranx rhonchus</i> | False scad | Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone | 14.0 | 0.59 | Overfished |
| <i>Decapterus macarellus</i> | Mackerel scad | Mauritania, Cape Verde Senegal, Gambia, G.-B, Guinea, Sierra Leone | 2.92 | 0.41 | Grossly overfished |
| <i>Engraulis encrasicolus</i> | European anchovy | Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone | 139 | 0.46 | Grossly overfished |
| <i>Ethmalosa fimbriata</i> | Bonga shad | Mauritania, Senegal, and Gambia | 85 | 0.91 | Slightly overfished |
| <i>Ethmalosa fimbriata</i> | Bonga shad | Guinea-Bissau, Guinea, and Sierra Leone | 157 | 0.90 | Slightly overfished |
| <i>Ilisha africana</i> | West African ilisha | Guinea-Bissau, Guinea, and Sierra Leone | 9.21 | 1.5 | Healthy |
| <i>Mugil cephalus</i> | Flathead grey mullet | Mauritania, Senegal, and Gambia | 12.1 | 1.3 | Healthy |
| <i>Sardinella aurita</i> | Round sardinella | Mauritania, Senegal, and Gambia | 312 | 0.74 | Overfished |
| <i>Sardinella aurita</i> | Round sardinella | Guinea-Bissau, Guinea, and Sierra Leone | 87.2 | 0.38 | Grossly overfished |
| <i>Sardinella maderensis</i> | Madeiran sardinella | Mauritania, Senegal, and Gambia | 199 | 0.74 | Overfished |
| <i>Sardinella maderensis</i> | Madeiran sardinella | Guinea-Bissau, Guinea, and Sierra Leone | 53.3 | 0.79 | Overfished |
| <i>Sardina pilchardus</i> | European pilchard | Mauritania, Senegal, and Gambia | 1025 | 0.88 | Slightly overfished |
| <i>Trachurus trachurus</i> | Atlantic horse mackerel | Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone | 105 | 0.92 | Slightly overfished |
| <i>Trachurus trecae</i> | Cunene horse mackerel | Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone | 124 | 1.1 | Healthy |

Special case III: Assessing the marine fish and invertebrate stocks in the waters of India²⁵

One of the earlier stock assessment training courses applying the CMSY method was conducted with experts from the Central Marine Fisheries Research Institute (CMFRI) in Kochi (Kerala, India) in October 2017 with support from the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ). This workshop introduced Indian fisheries scientists at the CMFRI to the then very new CMSY method and the use of resilience and related estimates from FishBase (see Palomares and Froese 2017). The participants identified 7 commercially exploited species (see Table 12) with data from the CMFRI database of catch time series by gear, fishing area (state) and species, and also where real-time fisheries abundance data from multistage stratified

²⁵ Prepared by Gabriel Vianna, *Sea Around Us* - Indian Ocean, University of Western Australia, Perth, Australia.

random sampling (Banerji and Chakraborty 1973; Devaraj and Vivekanandan 1999; Mohan Joseph and Jayaprakash 2003; Srinath *et al.* 2006) was available.

Table 12. Preliminary assessments of 7 commercially important stocks in the waters of India resulting from the CMSY workshop in Kochi, India (see Palomares and Froese, 2017).

| Species | Locality | Year range | Gear | B_{end}/B_{MSY} | Source |
|-------------------------------|--------------|------------|-----------------------------|-------------------|-----------------------------------|
| <i>Nemipterus japonicus</i> | Chennai | 1979-2003 | Not available | 0.5 | Dash <i>et al.</i> (2017) |
| <i>Rastrelliger kanagurta</i> | South Kerala | 1991-2014 | Seines, gillnets and trawls | 0.3 | Sathianandan <i>et al.</i> (2017) |
| <i>Sardinella longiceps</i> | India | 2000-2015 | Seines | 0.5 | Ganga <i>et al.</i> (2017) |
| <i>Saurida undosquamis</i> | Chennai | 1987-2009 | Trawl | 0.3 | Kizhakudan <i>et al.</i> (2017) |
| <i>Tenualosa ilisha</i> | Bangladesh | 1987-2016 | All gears | 1.0 | Al-Mamun <i>et al.</i> (2017) |
| <i>Thunnus albacares</i> | Indian Ocean | 1950-2016 | All gears | 0.7 | Vivekanandan <i>et al.</i> (2017) |
| <i>Trichiurus lepturus</i> | Karnataka | 2005-2015 | Trawlers | 0.8 | Dineshbabu <i>et al.</i> (2017) |

This early workshop showed that it is possible to provide stock status reference points for data-limited stocks. More importantly, it illustrated the need to publish information on the life history traits and fisheries-related data of a country's exploited stocks. This need has since been fulfilled for India by Mohamed *et al.* (2021) and Sathianandan *et al.* (2021); the results of the latter were used to inform the CMSY analyses of 62 Indian species-level stocks representing 11 species (see Table 13).

Table 13. List of species-level stocks with biological reference points from Sathianandan *et al.* (2021) used in CMSY assessments to inform stocks from Indian Ocean MEs.

| Scientific name | Andhra Pradesh | Gujarat and Daman Diu | Karnataka | Kerala | Maharashtra | Odisha | Puducherry | Tamil Nadu | Goa | West Bengal | Sub stocks |
|--------------------------------|----------------|-----------------------|-----------|----------|-------------|-----------|------------|------------|----------|-------------|------------|
| <i>Euthynnus affinis</i> | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 8 |
| <i>Harpadon nehereus</i> | 1 | | 1 | | | 1 | 1 | | | | 4 |
| <i>Katsuwonus pelamis</i> | 1 | | | | 1 | | | | 1 | | 3 |
| <i>Megalaspis cordyla</i> | 1 | | | 1 | 1 | 1 | 1 | | | | 5 |
| <i>Parastromateus niger</i> | 1 | 1 | | 1 | 1 | 1 | | | 1 | | 6 |
| <i>Rastrelliger kanagurta</i> | 1 | | | 1 | 1 | 1 | 1 | | 1 | | 6 |
| <i>Sardinella longiceps</i> | | 1 | | 1 | 1 | 1 | | 1 | 1 | | 6 |
| <i>Scomberomorus commerson</i> | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 7 |
| <i>Scomberomorus guttatus</i> | 1 | | 1 | 1 | 1 | 1 | | | 1 | 1 | 7 |
| <i>Scylla serrata</i> | | | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 7 |
| <i>Tenualosa ilisha</i> | | | 1 | | | 1 | | | | 1 | 3 |
| | 7 | 2 | 6 | 8 | 9 | 10 | 6 | 3 | 8 | 3 | 62 |

Special case IV: Assessing the marine fish stocks in Philippine waters²⁶

Two stock assessment workshops were conducted in the Philippines, a preliminary workshop in January 2017 hosted at Quantitative Aquatics in Los Baños, and a follow-up workshop in March 2019 hosted by the National Fisheries Research and Development Institute (NFRDI) in Quezon City, Philippines. Participants of both workshops were from the National Stock Assessment Program (NSAP) and are involved in the collection of statistics data for fisheries management.

The first workshop's goal was to introduce and demonstrate the application of an earlier version of CMSY on *Sea Around Us* reconstructed catches for the Philippines in a 6-hour session to a handful of NSAP participants. The demonstration assessments were informed by independent estimates of CPUE data used in Palomares and Pauly (2014) for *Decapterus macrosoma*, *Katsuwonus pelamis*, *Rastrelliger kanagurta* and *Sardinella fimbriata*. The NSAP participants subsequently practiced CMSY analyses on *Decapterus macrosoma*, *Encrasicholina punctifer*, *Katsuwonus pelamis*, and *Sardinella tawilis* catch data with varying time series lengths covering 1998-2015.

The second workshop aimed to provide a complete set of instructions and hands-on analyses of Philippine stocks from the 12 marine Philippine Fisheries Management Areas (FMA)²⁷ and some freshwater regions. Time series of catch data originally reported by fishing region were obtained from the NSAP database and aggregated by FMAs during the workshop. Some regional L/F data collected from commercial fleets in 2014-2016 were used to estimate end biomass windows for some of these stocks. Unfortunately, CPUE time series were lacking for most of the species analyzed. Although most of the data brought by participants did not meet the requirements for CMSY analysis, some of the results for better studied stocks presented in Table 14 can be used to propose preliminary management schemes. The lack of open-access data also prompted the workshop participants to submit their work to the Philippine Journal of Fisheries, some of which are now in the review process.

Table 14. Preliminary results of stock assessments in some Philippine marine and freshwater regions presented at the *Workshop on the Use of the CMSY Tool for the Assessment of Philippine Stocks*, 4-8 March 2019, Quezon City, Philippines. FMA = Fisheries Management Area.

| FMA | Region | Stocks | Years | B_{end}/B_{MSY} | Source |
|-----|--|--------------------------------|----------|-------------------|---------------------------------|
| 1 | Batanes, Babuyan Channel, Isabela, Aurora, Benham Rise, Lagonoy Gulf, Lamon Bay. | <i>Trichiurus lepturus</i> | 2008-'18 | 0.3 | Villarao <i>et al.</i> (2019) |
| 3 | Zamboanga Peninsula, Autonomous Region in Muslim Mindanao | <i>Decapterus macarellus</i> , | 2008-'17 | 0.15 | Cecilio <i>et al.</i> (2019) |
| | | <i>Selar crumenophthalmus</i> | 2008-'17 | 0.67 | |
| 4 | Sulu Sea | <i>Sardinella lemuru</i> | 2008-'17 | 0.60 | Ignacio <i>et al.</i> (2019) |
| 5 | Palawan, Mindoro, Antique | <i>Decapterus macrosoma</i> | 2008-'17 | 0.61 | Candelario <i>et al.</i> (2019) |
| 6 | West Philippine Sea, Manilla Bay | <i>Decapterus macarellus</i> | 2003-'16 | 0.6 | Gaerlan <i>et al.</i> (2019) |

²⁶ Prepared by Maria L.D. Palomares, *Sea Around Us*, Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada

²⁷ FMAs were defined in the Bureau of Fisheries and Aquatic Resources (BFAR) Fisheries Administrative Order 263 dated January 28 2019. The reorganization of the 20 fishing regions into 12 FMAs is an attempt by the BFAR to restructure stock assessment according to ecosystems. At the time of the workshop, the organization of fishing regions into FMAs was just being finalized, and thus catch data organized by FMA was still not available.

| | | | | | |
|----|--|---------------------------------|--------------|------|----------------------------------|
| | | <i>Selar crumenophthalmus</i> , | 2003- '16 | 0.52 | |
| | | <i>Sardinella gibbosa</i> | 2003- '16 | 0.5 | |
| 8 | Samar and Leyte Isl., Panaon Isl., NE Mandanao Isl., Dinagat Isl. | <i>Photopectoraliss bindus</i> | 2001- '17 | 0.20 | Alcantara and Amigo (2019) |
| 9 | Bohol Sea | <i>Sardinella lemuru</i> | 2002- '11 | 0.55 | Casinillo <i>et al.</i> (2019) |
| 11 | Visayan Sea | <i>Decapterus macrosoma</i> | 2008- '17 | 0.51 | Abrenica <i>et al.</i> (2019) |
| 11 | Visayan Sea | <i>Sardinella gibbosa</i> | 1998- '17 | 0.2 | Mesa <i>et al.</i> (2019) |
| 12 | Tayabas Bay, Calatgan Bay, Balayan Bay, Tablas Strait, Sibuyan Sea | <i>Sardinella lemuru</i> | 2004- '17 | 0.51 | Ramos <i>et al.</i> (2019) |

Selection of stocks and stock assessments for RFMOs²⁸

Regional Fisheries Management Organizations (RFMOs) are international bodies made up of many countries that have a shared interest in managing and conserving tunas and other large pelagic fishes covering wide oceanic distributions. These stocks are fished within EEZs and primarily in the high seas. There are 17 established RFMOs that cover various areas, sometimes with overlapping areas. There are five main RFMOs managing commercially important tunas and other large pelagic fisheries, altogether covering around 91% of the world's oceans (Pew Charitable Trusts 2012; Figure 9).

Recent, official stock assessments were available for the majority of RFMO-managed tunas and large pelagic species such as swordfishes, marlins and sharks. Ten stocks with Pacific-wide distributions are co-managed by IATTC and WCPFC and noted as joint IATTC-WCPFC stocks in the database. Catch time series were extracted from figures or tables available in the stock assessment or supporting documents. In addition, catch time series for three stocks were extracted from the RAM Legacy Stock Assessment Database by filtering for the stock identification and most recent TC-Best time series. These catch time series were used to fill the 'total catch in ME/RFMO over period assessed' column in the main B' output parameters template.

Overall, 47 individual stocks were included with official RFMO estimates (Table 15). The list of official stock advice used in the RFMO assessments is in Appendix B.

Catch distribution to EEZ-level

Each RFMO stock was assigned EEZ-level rows corresponding to the FAO areas that the stock was distributed within. Specific areas were noted in the 'comments' section. The total catches for 1950-2018, 1990-2018, and 2018 for each stock in each EEZ was provided from the *Sea Around Us* catch database. This database was preferred because of its inclusion of unreported estimates, spatial resolution of catches assigned to half-degree by half-degree cells, and time series covering 1950-2018. In some cases, the EEZ was blank, thus in order to include the EEZ in the overall weighing score, a routine to fill the blanks was applied.

The routine used the %EEZ within RFMO area for all RFMOs included by the official stock assessments. Blank catch totals were calculated by using the official catch time series total (for 1950-2018, 1990-2018, and 2018), the

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fraction each EEZ is covered by the RFMO, summing the total fraction and redistributing the ratio across all the EEZs that are covered by the RFMO area.

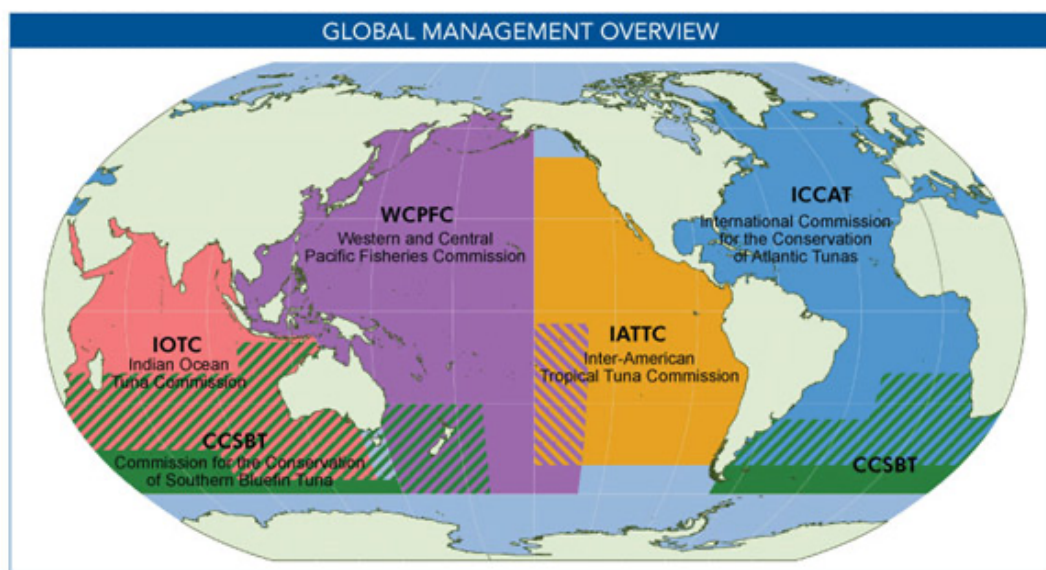


Figure 9. Five main RFMOs covering 91% of the world's oceans. Image adapted from Pew Charitable Trusts (2012).

Table 15. The number of stocks that had official stock assessments available by 6 RFMOs and corresponding webpage. A number of tunas and large pelagic species with a Pacific-wide distribution are co-managed by IATTC and WCPFC and noted in the bottom row.

| RFMO | Stocks w/ assessments | Website |
|---|--------------------------|---|
| CCBST – Commission for the Conservation of Southern Bluefin Tuna | 1 | https://www.ccsbt.org/en/content/latest-stock-assessment |
| IATTC – Inter-American Tropical Tuna Commission | 3 | https://www.iattp.org/StockAssessmentReportsENG.htm |
| ICCAT – International Commission for the Conservation of Atlantic Tunas | 13 | https://www.iccat.int/en/assess.html |
| IOTC – Indian Ocean Tuna Commission | 14 | https://www.iotc.org/science/status-summary-species-tuna-and-tuna-species-under-iotc-mandate-well-other-species-impacted-iotc |
| SPRFMO – South Pacific Regional Fisheries Management Organisation | 1 | https://www.sprfmo.int/science/species-profiles/ |
| WCPFC – Western and Central Pacific Fisheries Commission | 5 | https://www.wcpfc.int/current-stock-status-and-advice |
| WCPFC – IATTC (co-managed Pacific stocks) | 10 | http://isc.fra.go.jp/reports/stock_assessments.html ; https://swfsc-publications.fisheries.noaa.gov/publications/ ; https://www.wcpfc.int/current-stock-status-and-advice |

ICES Stock Assessments²⁹

The International Council for the Exploration of the Sea (ICES) is an intergovernmental marine science organization that aims to advance and share scientific understanding of marine ecosystems and the services they provide and to use this knowledge to generate state-of-the-art advice for meeting conservation, management, and sustainability goals (ICES, n.d. a).

There are 20 ICES member countries (Table 16): Belgium, Canada, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Latvia, Lithuania, The Netherlands, Norway, Poland, Portugal, Russian Federation, Spain, Sweden, United Kingdom, United States of America (ICES, n.d. b). As Canada and the United States of America are treated separately in this report, they are excluded here. On the other hand, Greenland and the Faeroe Islands were included in the ICES stock assessment, despite not being listed as member countries.

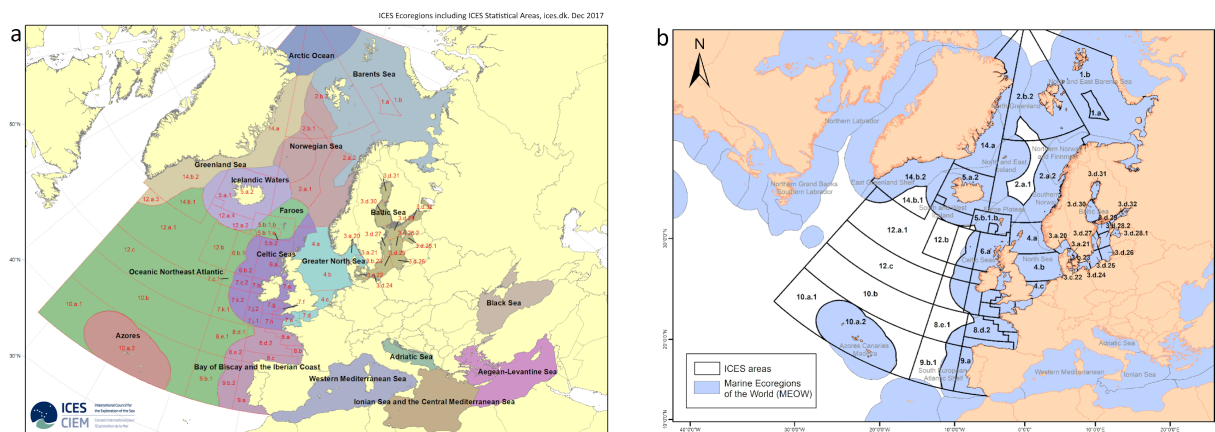


Figure 10. ICES fishing areas with (a) ICES ecoregions and (b) Sea Around Us Marine Ecoregions. (Adapted from <http://www.ices.dk/data/Documents/Maps/ICES-Ecoregions-hybrid-statistical-areas.png>)

The ICES fishing areas and ecoregions all occur within FAO Major Fishing Area 27 (Figure 10). The ICES fishing areas were developed for the collection of fisheries statistics, as opposed to the ICES ecoregions, which were developed to provide more ecosystem-based advice on fishing opportunities and management. Both ICES (Figure 10a) and *Sea Around Us* ecoregions (Figure 10b) are biogeographical and oceanographical boundaries used to demarcate the distribution of pelagic and benthic species and communities. ICES ecoregions are additionally adapted in response to changes in management areas and input from policy developers since it covers all the ICES fishing areas that provide catch data. All fish stocks in the ICES stock assessment are associated with the relevant ecoregion or collection of ecoregions, while the ICES areas in the stock name indicate where the catch data was collected (ICES 2020).

²⁹ Prepared by Maria Selina Conchitina A. De Leon, Luisa R. Abucay, Vina Angelica A. Parducho and Maria Lourdes D. Palomares, Quantitative Aquatics, Inc., IRRI Khush Hall, College, Los Baños, Laguna, Philippines

ICES data used

Two main sources of data from ICES were used to fill up the B' output parameters template: official ICES stock advice and catch data. Official ICES stock advice is centered on a precautionary approach within an MSY framework in the context of an ecosystem-based approach. It functions to inform policies for high-yield sustainable fisheries (ICES 2012). ICES assessments used in the official stock advice involves a relationship between fishing mortality rates, average catches, and average stock size. Depending on the available data and characteristics of stocks, ICES uses different biomass reference points to estimate the desired fishing mortality rate and total allowable catch that will give maximum yields but will not negatively impact recruitment. The list of official stock advice used in the ICES assessments is listed in Appendix C. On the other hand, three different sets of catch data (Table 17) were downloaded to account for the different year ranges of the available datasets.

Table 16. Countries included in the ICES stock assessments with the corresponding EEZ and ISO3 code used in the B' output parameters table.

| Country | EEZ | ISO3 Code |
|--------------------|---|------------|
| Iceland | Iceland | ISL |
| Greenland | Greenland (Denmark) | GRL |
| Portugal | Portugal (mainland) | PRT |
| Spain | Spain (Northwest) | ESP |
| United Kingdom | United Kingdom (UK) | GBR |
| Russian Federation | Russia (Barents Sea) | RUS |
| France | France (Atlantic Coast) | FRA |
| Norway | Norway | NOR |
| Ireland | Ireland | IRL |
| Belgium | Belgium | BEL |
| Faeroe Islands | Faeroe Isl. (Denmark) | FRO |
| Netherlands | Netherlands | NLD |
| Germany | Germany (Baltic Sea) Germany (North Sea) | DEU DEU |
| Denmark | Denmark (North Sea) Denmark (Baltic Sea) | DNK DNK |
| Poland | Poland | POL |
| Sweden | Sweden (West Coast) Sweden (Baltic) | SWE SWE |
| Lithuania | Lithuania | LTU |
| Finland | Finland | FIN |
| Estonia | Estonia | EST |
| Latvia | Latvia | LVA |

Table 17. ICES catch data used in the Sea Around Us assessments. Since ICES stocks and statistical areas are well defined, we treated ICES in the same manner as we treated RFMOs, although each country reported national catch per stock.

| Dataset | Filename | Description | Source URL |
|--------------------------------------|---|---|---|
| Official Nominal Catches 2006-2018 | ICESCatchDataset2006-2018 (in .xls and .csv format) | Catches in FAO area 27 by country (2 letters country code), species (3 letters Species/FAO code), area (presented as numbers instead of Roman Numerals) and year as provided by the national authorities for 2006 to 2018 only. | https://www.ices.dk/data/Documents/CatchStats/OfficialNominalCatches.zip |
| Historical Nominal Catches 1950-2010 | ICES_1950-2010 (in .xls and .csv format) | Catches in FAO area 27 by country (full country name), species (FAO name), area (Division code presented as Roman Numerals) and year for 1950 to 2010 only. | https://www.ices.dk/data/Documents/CatchStats/HistoricalLandings1950-2010.zip |
| ICES Historical Landings 1903-1949 | 1903-1949_Landings (in .xls and .csv format) | Catches in FAO area 27 by country (3 letters country code), year, area (FAO_Area presented as Roman Numerals) and species (combination of 3 letters FAO species code, species name and scientific name) for 1903 to 1949 only. | https://www.ices.dk/data/Documents/CatchStats/ICES1903-49.zip |

Data harmonization

Data from the official stock advice was extracted using an R script. Note that the catches from different stocks were calculated separately so that they could be properly disaggregated into the catch of the respective countries. A proxy B_{MSY} was estimated per stock as $2 \cdot B_{pa}$ (i.e., precautionary reference point for the spawning stock biomass; see ICES 2012). The start year was obtained from the Stock Assessment Graphs (ICES, n.d. c) or via the Official ICES Advice reports presented in Appendix C.

Catch data per stock per country were downloaded from ICES (n.d. d), which included catch statistics for the: 1) 1903-1949; 2) 1950-2010; and 3) 2006-2018 in different formats. These data files had varying formats for ICES areas names, species name/FAO name had different species code, and country names also had different country codes. The 1950-2010 dataset was harmonized with the 2006-2018 dataset by matching the FAO species name with the combination of FAO species name, scientific names and species code used in the latter, and renaming the 1950-2010 dataset ICES areas with the corresponding current ICES areas. These were done to match the format of stock names used in the CMSY analyses. Only data for the period 1950-2005 was used of dataset (2).

Substocks for each ICES stock with multiple ICES fishing areas were identified. For instance, her.27.6a7bc is a herring stock with different catch levels in ICES areas 27.6.a, 27.7.b, 27.7.c.1, and with thus three substocks for each area. Catch extraction was done by matching the parameters, e.g., country, species code, ICES area, year with the reference files. Note that in the 1950-2005 catch dataset, Germany is listed as: Germany, Germany, Fed. Rep. of, and Germany, New Länder while the UK is listed as: UK - Eng+Wales+N.Irl. and UK - Scotland. Catch of stocks assigned to the USSR (1951-1991) was disaggregated to the former country members included in the assessment (Russia, Lithuania, Latvia) by applying the 2006-2018 percent catch of stock each country had for the stock concerned to the USSR catch.

Discussion

The work documented in this report establishes that it is possible to perform assessments for the bulk of the stocks exploited by marine fisheries throughout the world given two conditions: 1) one has a team willing and capable of performing an immense amount of work; and 2) one has access to a versatile stock assessment tool, capable of generating good results when data are very scarce, but also of incorporating ancillary data where available.

The *Sea Around Us* team accomplished this task because of the support of many colleagues worldwide, many of whom had earlier contributed to the catch reconstructions that enabled us to produce the long catch time series, currently ranging from 1950 to 2018. Additionally, the close collaboration of the *Sea Around Us* with the Philippine-based team that maintains FishBase and SeaLifeBase facilitated the identification of priors for numerous applications.

Also, our close collaboration with Dr. Rainer Froese (and his colleagues), the developer(s) of the CMSY and related methods, allowed us to complete this massive task. The CMSY++ software tool we used is singular in its ability to provide reasonable results in very data-sparse situations – such as prevail in some tropical developing countries – and to smartly accommodate additional data sets where available, which reduced the uncertainty associated with the results.

We made ample use of the latter property and used all of the official assessments we could find to constrain the CMSY outputs. This included most of the contents of the well-known RAM Legacy Stock Assessment Database, the assessments of countries with numerous stocks that are regularly evaluated (USA, Australia, Canada, New

Zealand, etc.), and from the RFMOs and other supranational bodies such as the E.U. and FAO. Thus, it will not be possible to contrast our assessments with those of other entities because, in many cases, we built on the previous assessments of these other entities.

We paid particular attention to countries and regions often overlooked in global assessments, supposedly because they have ‘no data.’ We have emphasized Asia - particularly China - and West Africa, both with massive fisheries catches, but commonly ignored in ‘global’ analyses.

For most of our assessments, we used the CMSY++, a complete description of which is presently under peer-review (Froese *et al.*, manuscript). This version addresses the issues some colleagues identified as problematic in the earlier CMSY version.

In other publications, we used CMSY++ to assess a 500-year time series of Northern cod in Canada (Schijns *et al.* 2021). We also demonstrated the pernicious effect of truncating the time series of catches used for stock assessments (Schijns and Pauly, 2021), a practice commonly used in official stock assessment and which usually generates over-optimistic results. For this reason, as many as possible of our assessments were based on catch reconstructed back to 1950. Therefore, we are confident that the stock assessments presented in the present report represent the state-of-the-art in terms of their methodology. As a whole, they will reflect the major trend of the biomass exploited by commercial fisheries in the world.

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APPENDICES

Appendix A: List of publications applying and improving on the CMSY method.

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Appendix B: List of stock assessments used for RFMO B-prime estimation

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Appendix C: Stock assessments used for ICES areas

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- ICES. 2018. Spurdog (*Squalus acanthias*) in the Northeast Atlantic. Report of the ICES Advisory Committee, 2018. ICES Advice 2018, dgs.27.nea, doi.org/10.17895/ices.pub.4543
- ICES. 2019. Anchovy (*Engraulis encrasicolus*) in division 9.a (Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ane.27.9a, doi.org/10.17895/ices.advice.4852
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- ICES. 2019. Brill (*Scophthalmus rhombus*) in subarea 4 and divisions 3.a and 7.d–e (North Sea, Skagerrak and Kattegat, English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, blt.27.3a47de, doi.org/10.17895/ices.advice.4858
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- ICES. 2019. Four-spot megrim (*Lepidorhombus boscii*) in divisions 8.c and 9.a (southern Bay of Biscay and Atlantic Iberian waters East). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ldb.27.8c9a, doi.org/10.17895/ices.advice.4762
- ICES. 2019. Golden redfish (*Sebastes norvegicus*) in subareas 5, 6, 12, and 14 (Iceland and Faroes grounds, West of Scotland, North of Azores, East of Greenland). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, reg.27.561214, doi.org/10.17895/ices.advice.4741
- ICES. 2019. Greater silver smelt (*Argentina silus*) in divisions 5.b and 6.a (Faroes grounds and west of Scotland). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, aru.27.5b6a, doi.org/10.17895/ices.advice.4810
- ICES. 2019. Greater silver smelt (*Argentina silus*) in subarea 14 and division 5.a (East Greenland and Iceland grounds). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, aru.27.5a14, doi.org/10.17895/ices.advice.4809
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- ICES. 2019. Haddock (*Melanogrammus aeglefinus*) in divisions 7.b-k (southern Celtic Seas and English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, had.27.7b-k, doi.org/10.17895/ices.advice.4785
- ICES. 2019. Haddock (*Melanogrammus aeglefinus*) in subarea 4, division 6.a, and subdivision 20 (North Sea, West of Scotland, Skagerrak). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, had.27.46a20, doi.org/10.17895/ices.advice.5637
- ICES. 2019. Haddock (*Melanogrammus aeglefinus*) in subareas 1 and 2 (Northeast Arctic). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, had.27.1-2, doi.org/10.17895/ices.advice.4713
- ICES. 2019. Hake (*Merluccius merluccius*) in divisions 8.c and 9.a, Southern stock (Cantabrian Sea and Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, hke.27.8c9a, doi.org/10.17895/ices.advice.4760
- ICES. 2019. Hake (*Merluccius merluccius*) in subareas 4, 6, and 7, and divisions 3.a, 8.a-b, and 8.d, Northern stock (Greater North Sea, Celtic Seas, and the northern Bay of Biscay). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, hke.27.3a46-8abd, doi.org/10.17895/ices.advice.4759
- ICES. 2019. Herring (*Clupea harengus*) in division 5.a, summer-spawning herring (Iceland grounds). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, her.27.5a, doi.org/10.17895/ices.advice.4736
- ICES. 2019. Herring (*Clupea harengus*) in division 7.a North of 52°30'N (Irish Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, her.27.nirs, doi.org/10.17895/ices.advice.4719
- ICES. 2019. Herring (*Clupea harengus*) in divisions 6.a and 7.b-c (West of Scotland, West of Ireland). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, her.27.6a7bc doi.org/10.17895/ices.advice.4717
- ICES. 2019. Herring (*Clupea harengus*) in divisions 7.a South of 52°30'N, 7.g-h, and 7.j-k (Irish Sea, Celtic Sea, and southwest of Ireland). Report of the ICES Advisory Committee, 2019, her.27.irls, doi.org/10.17895/ices.advice.4718
- ICES. 2019. Herring (*Clupea harengus*) in subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, her.27.3a47d, doi.org/10.17895/ices.advice.4716
- ICES. 2019. Herring (*Clupea harengus*) in subdivision 28.1 (Gulf of Riga). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, her.27.28, doi.org/10.17895/ices.advice.4749
- ICES. 2019. Herring (*Clupea harengus*) in subdivisions 20-24, spring spawners (Skagerrak, Kattegat, and western Baltic). Report of the ICES Advisory Committee, 2019, her.27.20-24, doi.org/10.17895/ices.advice.4715

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- ICES. 2019. Herring (*Clupea harengus*) in subdivisions 30 and 31 (Gulf of Bothnia). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, her.27.3031, doi.org/10.17895/ices.advice.4750
- ICES. 2019. Horse mackerel (*Trachurus trachurus*) in division 9.a (Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, hom.27.9a, doi.org/10.17895/ices.advice.4853
- ICES. 2019. Lemon sole (*Microstomus kitt*) in subarea 4 and divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, lem.27.3a47d, doi.org/10.17895/ices.advice.4862
- ICES. 2019. Ling (*Molva molva*) in division 5.a (Iceland grounds). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, lin.27.5a, doi.org/10.17895/ices.advice.4816
- ICES. 2019. Ling (*Molva molva*) in division 5.b (Faroes grounds). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, lin.27.5b, doi.org/10.17895/ices.advice.4817
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- ICES. 2019. Ling (*Molva molva*) in subareas 6–9, 12, and 14, and divisions 3.a and 4.a (Northeast Atlantic and Arctic Ocean). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, lin.27.3a4a6–91214, doi.org/10.17895/ices.advice.4815
- ICES. 2019. Megrin (*Lepidorhombus* spp.) in divisions 4.a and 6.a (northern North Sea, West of Scotland). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, lez.27.4a6a, doi.org/10.17895/ices.advice.4786
- ICES. 2019. Megrin (*Lepidorhombus whiffiagonis*) in divisions 7.b–k, 8.a–b, and 8.d (west and southwest of Ireland, Bay of Biscay). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, meg.27.7bk8abd, doi.org/10.17895/ices.advice.4763
- ICES. 2019. Megrin (*Lepidorhombus whiffiagonis*) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019 meg.27.8c9a, doi.org/10.17895/ices.advice.4764
- ICES. 2019. Northern shrimp (*Pandalus borealis*) in divisions 3.a and 4.a East (Skagerrak and Kattegat and northern North Sea in the Norwegian Deep). Report of the ICES Advisory Committee, 2019. ICES Advice, pra.27.3a4a, doi.org/10.17895/ices.advice.4892
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 3.a, functional units 3 and 4 (Skagerrak and Kattegat). Report of the ICES Advisory Committee. ICES Advice 2019, 2019, nep.fu.3-4, doi.org/10.17895/ices.advice.4864
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 4.a, functional unit 7 (northern North Sea, Fladen Ground). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, nep.fu.7, doi.org/10.17895/ices.advice.5639
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 4.a, functional unit 9 (central North Sea, Moray Firth). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, nep.fu.9, doi.org/10.17895/ices.advice.4868
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 4.b, functional unit 33 (central North Sea, Horn's Reef). Report of the ICES Advisory Committee, 2019. ICES Advice 2019. ICES Advice 2019, nep.fu.33, 7 pp. doi.org/10.17895/ices.advice.5459
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 4.b, functional unit 6 (central North Sea, Farn Deep). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, nep.fu.6, doi.org/10.17895/ices.advice.5638
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 4.b, functional unit 8 (central North Sea, Firth of Forth). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, nep.fu.8, doi.org/10.17895/ices.advice.5643
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 8.c, functional unit 25 (southern Bay of Biscay and northern Galicia). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, nep.fu.25, doi.org/10.17895/ices.advice.4768
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 8.c, functional unit 31 (southern Bay of Biscay and Cantabrian Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, nep.fu.31, doi.org/10.17895/ices.advice.4772
- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 9.a, functional units 26–27 (Atlantic Iberian waters East, western Galicia, and northern Portugal). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, nep.fu.2627, doi.org/10.17895/ices.advice.4769

- ICES. 2019. Norway lobster (*Nephrops norvegicus*) in division 9.a, functional units 28–29 (Atlantic Iberian waters East and southwestern and southern Portugal). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, nep.fu.2829, doi.org/10.17895/ices.advice.4770
- ICES. 2019. Norway special request for revised 2019 advice on mackerel (*Scomber scombrus*) in subareas 1–8 and 14, and in division 9.a (the Northeast Atlantic and adjacent waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sr.2019.09, doi.org/10.17895/ices.advice.5252
- ICES. 2019. Plaice (*Pleuronectes platessa*) in division 7.a (Irish Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ple.27.7a, doi.org/10.17895/ices.advice.4798
- ICES. 2019. Plaice (*Pleuronectes platessa*) in division 7.d (eastern English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ple.27.7d, doi.org/10.17895/ices.advice.4871
- ICES. 2019. Plaice (*Pleuronectes platessa*) in division 7.e (western English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ple.27.7e, doi.org/10.17895/ices.advice.4799
- ICES. 2019. Plaice (*Pleuronectes platessa*) in divisions 7.f and 7.g (Bristol Channel, Celtic Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ple.27.7fg, doi.org/10.17895/ices.advice.4800
- ICES. 2019. Plaice (*Pleuronectes platessa*) in divisions 7.h-k (Celtic Sea South, southwest of Ireland). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ple.27.7h-k, doi.org/10.17895/ices.advice.4801
- ICES. 2019. Plaice (*Pleuronectes platessa*) in subarea 4 (North Sea) and subdivision 20 (Skagerrak). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ple.27.420, doi.org/10.17895/ices.advice.5644
- ICES. 2019. Plaice (*Pleuronectes platessa*) in subarea 8 and division 9.a (Bay of Biscay and Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ple.27.89a, doi.org/10.17895/ices.advice.4773
- ICES. 2019. Plaice (*Pleuronectes platessa*) in subdivisions 21–23 (Kattegat, Belt Seas, and the Sound). Report of the ICES Advisory Committee, 2019, ple.27.21-23, doi.org/10.17895/ices.advice.4751
- ICES. 2019. Plaice (*Pleuronectes platessa*) in subdivisions 24-32 (Baltic Sea, excluding the Sound and Belt Seas). Report of the ICES Advisory Committee, 2019, ple.27.24-32, doi.org/10.17895/ices.advice.4752
- ICES. 2019. Pollack (*Pollachius pollachius*) in subarea 8 and division 9.a (Bay of Biscay and Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, pol.27.89a, doi.org/10.17895/ices.advice.4774
- ICES. 2019. Pollack (*Pollachius pollachius*) in subareas 6–7 (Celtic Seas and the English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, pol.27.6.7, doi.org/10.17895/ices.advice.4802
- ICES. 2019. Roundnose grenadier (*Coryphaenoides rupestris*) in divisions 10.b and 12.c, and subdivisions 12.a.1, 14.b.1, and 5.a.1 (Oceanic Northeast Atlantic and northern Reykjanes Ridge). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, rng.27.5a10b12ac14b, doi.org/10.17895/ices.advice.4819
- ICES. 2019. Roundnose grenadier (*Coryphaenoides rupestris*) in subareas 1, 2, 4, 8, and 9, division 14.a, and in subdivisions 14.b.2 and 5.a.2 (Northeast Atlantic and Arctic Ocean). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, rng.27.1245a8914ab, doi.org/10.17895/ices.advice.4818
- ICES. 2019. Saithe (*Pollachius virens*) in division 5.a (Iceland grounds). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, pok.27.5a, doi.org/10.17895/ices.advice.4736
- ICES. 2019. Saithe (*Pollachius virens*) in subareas 1 and 2 (Northeast Arctic). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, pok.27.1-2, doi.org/10.17895/ices.advice.4714
- ICES. 2019. Saithe (*Pollachius virens*) in subareas 4 and 6, and in division 3.a (North Sea, Rockall and West of Scotland, Skagerrak and Kattegat). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, pok.27.3a46, doi.org/10.17895/ices.advice.4898
- ICES. 2019. Salmon (*Salmo salar*) in subdivision 32 (Gulf of Finland). Report of the ICES Advisory Committee, 2019, sal.27.32, doi.org/10.17895/ices.advice.4743
- ICES. 2019. Salmon (*Salmo salar*) in subdivisions 22–31 (Baltic Sea, excluding the Gulf of Finland). Report of the ICES Advisory Committee, 2019, ICES Advice 2019, sal.27.22–31, doi.org/10.17895/ices.advice.4742
- ICES. 2019. Sandeel (*Ammodytes* spp.) in division 4.a, Sandeel Area 5r (Northern North Sea, Viking and Bergen banks). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, san.sa.5r, doi.org/10.17895/ices.advice.4724
- ICES. 2019. Sandeel (*Ammodytes* spp.) in division 4.a, Sandeel Area 7r (northern North Sea, Shetland). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, san.sa.7r, doi.org/10.17895/ices.advice.4726
- ICES. 2019. Sandeel (*Ammodytes* spp.) in divisions 4.a–b and subdivision 20, Sandeel Area 3r (northern and central North Sea, Skagerrak). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, san.sa.3r, doi.org/10.17895/ices.advice.4722

- ICES. 2019. Sandeel (*Ammodytes* spp.) in divisions 4.a–b, Sandeel Area 4 (northern and central North Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, san.sa.4, doi.org/10.17895/ices.advice.4723
- ICES. 2019. Sandeel (*Ammodytes* spp.) in divisions 4.b and 4.c, Sandeel Area 1r (central and southern North Sea, Dogger Bank). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, san.sa.1r, doi.org/10.17895/ices.advice.4720
- ICES. 2019. Sandeel (*Ammodytes* spp.) in divisions 4.b–c and subdivision 20, Sandeel Area 2r (central and southern North Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, san.sa.2r, doi.org/10.17895/ices.advice.4721
- ICES. 2019. Sandeel (*Ammodytes* spp.) in subdivisions 20–22, Sandeel Area 6 (Skagerrak, Kattegat, and Belt Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, san.sa.6, doi.org/10.17895/ices.advice.4725
- ICES. 2019. Sea bass (*Dicentrarchus labrax*) in divisions 4.b–c, 7.a, and 7.d–h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea). Report of the ICES Advisory Committee, 2019, bss.27.4bc7ad-h, doi.org/10.17895/ices.advice.4779
- ICES. 2019. Sea trout (*Salmo trutta*) in subdivisions 22–32 (Baltic Sea). Report of the ICES Advisory Committee, 2019, trs.27.22–32, doi.org/10.17895/ices.advice.4744
- ICES. 2019. Seabass (*Dicentrarchus labrax*) in divisions 8.a–b (northern and central Bay of Biscay). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, bss.27.8ab, doi.org/10.17895/ices.advice.4757
- ICES. 2019. Seabass (*Dicentrarchus labrax*) in divisions 8.c and 9.a (southern Bay of Biscay and Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, bss.27.8c9a, doi.org/10.17895/ices.advice.4758
- ICES. 2019. Sole (*Solea solea*) in division 7.a (Irish Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sol.27.7a, doi.org/10.17895/ices.advice.4803
- ICES. 2019. Sole (*Solea solea*) in division 7.e (western English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sol.27.7e, doi.org/10.17895/ices.advice.4804
- ICES. 2019. Sole (*Solea solea*) in divisions 7.f and 7.g (Bristol Channel, Celtic Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sol.27.7fg, doi.org/10.17895/ices.advice.4805
- ICES. 2019. Sole (*Solea solea*) in divisions 7.h–k (Celtic Sea South, southwest of Ireland). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sol.27.7h–k, doi.org/10.17895/ices.advice.4806
- ICES. 2019. Sole (*Solea solea*) in divisions 8.a–b (northern and central Bay of Biscay). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sol.27.8ab, doi.org/10.17895/ices.advice.4775
- ICES. 2019. Sole (*Solea solea*) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sol.27.8c9a, doi.org/10.17895/ices.advice.4776
- ICES. 2019. Sole (*Solea solea*) in subarea 4 (North Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sol.27.4, doi.org/10.17895/ices.advice.5642
- ICES. 2019. Sole (*Solea solea*) in subdivisions 20–24 (Skagerrak and Kattegat, western Baltic Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sol.27.20–24, doi.org/10.17895/ices.advice.4753
- ICES. 2019. Sprat (*Sprattus sprattus*) in division 3.a and subarea 4 (Skagerrak, Kattegat, and North Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, spr.27.3a4, doi.org/10.17895/ices.advice.4727
- ICES. 2019. Sprat (*Sprattus sprattus*) in divisions 7.d and 7.e (English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, spr.27.7de, doi.org/10.17895/ices.advice.4729
- ICES. 2019. Sprat (*Sprattus sprattus*) in subarea 6 and divisions 7.a–c and 7.f–k (West of Scotland, southern Celtic Seas). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, spr.27.67a–cf–k, doi.org/10.17895/ices.advice.4728
- ICES. 2019. Sprat (*Sprattus sprattus*) in subdivisions 22–32 (Baltic Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, spr.27.22–32, doi.org/10.17895/ices.advice.4754
- ICES. 2019. Striped red mullet (*Mullus surmuletus*) in subarea 4 and divisions 7.d and 3.a (North Sea, eastern English Channel, Skagerrak and Kattegat). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, mur.27.3a47d, doi.org/10.17895/ices.advice.4863
- ICES. 2019. Turbot (*Scophthalmus maximus*) in division 3.a (Skagerrak and Kattegat). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, tur.27.3a, doi.org/10.17895/ices.advice.4875
- ICES. 2019. Turbot (*Scophthalmus maximus*) in subarea 4 (North Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, tur.27.4, doi.org/10.17895/ices.advice.4876
- ICES. 2019. Tusk (*Brosme brosme*) in subarea 14 and division 5.a (East Greenland, and Iceland grounds). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, usk.27.5a14, doi.org/10.17895/ices.advice.4824

- ICES. 2019. Tusk (*Brosme brosme*) in subareas 1 and 2 (Northeast Arctic). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, usk.27.1-2, doi.org/10.17895/ices.advice.4821
- ICES. 2019. Tusk (*Brosme brosme*) in subareas 4 and 7–9, and in divisions 3.a, 5.b, 6.a, and 12.b (Northeast Atlantic). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, usk.27.3a45b6a7-912b, doi.org/10.17895/ices.advice.4823
- ICES. 2019. White anglerfish (*Lophius piscatorius*) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, mon.27.8c9a, doi.org/10.17895/ices.advice.4766
- ICES. 2019. White anglerfish (*Lophius piscatorius*) in subarea 7 and divisions 8.a–b and 8.d (Celtic Seas, Bay of Biscay). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, mon.27.78abd, doi.org/10.17895/ices.advice.4765
- ICES. 2019. Whiting (*Merlangius merlangus*) in division 7.a (Irish Sea). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, whg.27.7a, doi.org/10.17895/ices.advice.5224
- ICES. 2019. Whiting (*Merlangius merlangus*) in divisions 7.b–c and 7.e–k (southern Celtic Seas and eastern English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, whg.27.7b–ce–k, doi.org/10.17895/ices.advice.4807
- ICES. 2019. Whiting (*Merlangius merlangus*) in subarea 4 and division 7.d (North Sea and eastern English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, whg.27.47d, doi.org/10.17895/ices.advice.4878
- ICES. 2019. Witch (*Glyptocephalus cynoglossus*) in subarea 4 and divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel). Report of the ICES Advisory Committee, 2019. ICES Advice 2019, wit.27.3a47d, doi.org/10.17895/ices.advice.4879

Appendix D: Marine ecoregion and EEZ pairing used in the Sea Around Us

This table provides the area of overlap of an EEZ with an ME. In the Intersect area column, zero values mean that the overlapping area is <1 Km². In such cases and in cases where the intersect area are negligible, the ME is not assigned to that EEZ.

| EEZ ID | EEZ name | ME ID | ME | Intersect area Km ² | ME area Km ² | EEZ area Km ² |
|--------|--------------------------------|-------|---|-----------------------------------|----------------------------|-----------------------------|
| 8 | Albania | 221 | Adriatic Sea | 12156 | 135271 | 12164 |
| 8 | Albania | 104 | Ionian Sea | 8 | 347361 | 12164 |
| 12 | Algeria | 80 | Alboran Sea | 20829 | 84149 | 131037 |
| 12 | Algeria | 144 | Western Mediterranean | 110208 | 757567 | 131037 |
| 16 | American Samoa | 78 | Phoenix/Tokelau/Northern Cook Islands | 86034 | 2539942 | 404367 |
| 16 | American Samoa | 79 | Samoa Islands | 318286 | 849376 | 404367 |
| 16 | American Samoa | 156 | Southern Cook/Austral Islands | 0 | 1742006 | 404367 |
| 16 | American Samoa | 129 | Tonga Islands | 1 | 840051 | 404367 |
| 357 | Andaman & Nicobar Isl. (India) | 137 | Andaman and Nicobar Islands | 659574 | 734098 | 659575 |
| 24 | Angola | 101 | Angolan | 393820 | 393820 | 493989 |
| 24 | Angola | 102 | Gulf of Guinea South | 15484 | 229164 | 493989 |
| 24 | Angola | 179 | Namib | 84569 | 437193 | 493989 |
| 660 | Anguilla (UK) | 116 | Eastern Caribbean | 89819 | 868768 | 89969 |
| 976 | Antarctica, 200 nm zone | 22 | Amundsen/Bellingshausen Sea | 1076902 | 1076902 | 9243195 |
| 976 | Antarctica, 200 nm zone | 4 | Antarctic Peninsula | 445949 | 445949 | 9243195 |
| 976 | Antarctica, 200 nm zone | 11 | East Antarctic Dronning Maud Land | 715892 | 724799 | 9243195 |
| 976 | Antarctica, 200 nm zone | 12 | East Antarctic Enderby Land | 233944 | 233944 | 9243195 |
| 976 | Antarctica, 200 nm zone | 13 | East Antarctic Wilkes Land | 2234867 | 2248790 | 9243195 |
| 976 | Antarctica, 200 nm zone | 213 | Peter the First Island | 122812 | 122812 | 9243195 |
| 976 | Antarctica, 200 nm zone | 23 | Ross Sea | 971191 | 971192 | 9243195 |
| 976 | Antarctica, 200 nm zone | 28 | South Shetland Islands | 326374 | 341593 | 9243195 |
| 976 | Antarctica, 200 nm zone | 33 | Weddell Sea | 1353596 | 1354746 | 9243195 |
| 28 | Antigua & Barbuda | 116 | Eastern Caribbean | 110750 | 868768 | 111334 |
| 32 | Argentina | 125 | Channels and Fjords of Southern Chile | 171674 | 899871 | 1092595 |
| 32 | Argentina | 198 | North Patagonian Gulfs | 208483 | 208480 | 1092595 |
| 32 | Argentina | 21 | Patagonian Shelf | 402973 | 416585 | 1092595 |
| 32 | Argentina | 130 | Rio de la Plata | 15962 | 31666 | 1092595 |
| 32 | Argentina | 131 | Uruguay-Buenos Aires Shelf | 293454 | 400686 | 1092595 |
| 967 | Aruba (Netherlands) | 143 | Greater Antilles | 0 | 1157222 | 31028 |
| 967 | Aruba (Netherlands) | 127 | Southern Caribbean | 31027 | 584596 | 31028 |
| 855 | Ascension Isl. (UK) | 218 | St. Helena and Ascension Islands | 441642 | 886540 | 441641 |
| 36 | Australia | 109 | Arnhem Coast to Gulf of Carpentaria | 571768 | 571787 | 6333687 |
| 36 | Australia | 5 | Banda Sea | 41 | 941189 | 6333687 |
| 36 | Australia | 110 | Bassian | 549221 | 549221 | 6333687 |
| 36 | Australia | 108 | Bonaparte Coast | 291040 | 291172 | 6333687 |
| 36 | Australia | 6 | Cape Howe | 286961 | 286961 | 6333687 |
| 36 | Australia | 95 | Central and Southern Great Barrier Reef | 208601 | 208601 | 6333687 |
| 36 | Australia | 91 | Coral Sea | 967629 | 968505 | 6333687 |
| 36 | Australia | 147 | Exmouth to Broome | 710626 | 710626 | 6333687 |
| 36 | Australia | 225 | Great Australian Bight | 326079 | 326079 | 6333687 |

| | | | | | | |
|-----|--------------------------|-----|---|--------|---------|---------|
| 36 | Australia | 117 | Houtman | 203931 | 203931 | 6333687 |
| 36 | Australia | 224 | Leeuwin | 605944 | 605948 | 6333687 |
| 36 | Australia | 128 | Lesser Sunda | 38 | 717561 | 6333687 |
| 36 | Australia | 66 | Manning-Hawkesbury | 210319 | 210319 | 6333687 |
| 36 | Australia | 133 | New Caledonia | 250 | 1252156 | 6333687 |
| 36 | Australia | 189 | Ningaloo | 163389 | 163389 | 6333687 |
| 36 | Australia | 58 | Shark Bay | 205872 | 205872 | 6333687 |
| 36 | Australia | 27 | South Australian Gulfs | 205555 | 205555 | 6333687 |
| 36 | Australia | 154 | Southeast Papua New Guinea | 6 | 209228 | 6333687 |
| 36 | Australia | 38 | Torres Strait Northern Great Barrier Reef | 193104 | 193124 | 6333687 |
| 36 | Australia | 90 | Tweed-Moreton | 279695 | 279696 | 6333687 |
| 36 | Australia | 36 | Western Bassian | 353862 | 353862 | 6333687 |
| 622 | Azores Isl. (Portugal) | 82 | Azores Canaries Madeira | 953084 | 1865442 | 958740 |
| 44 | Bahamas | 161 | Bahamian | 597347 | 923316 | 618924 |
| 44 | Bahamas | 173 | Carolinian | 0 | 370086 | 618924 |
| 44 | Bahamas | 75 | Floridian | 1195 | 229441 | 618924 |
| 44 | Bahamas | 143 | Greater Antilles | 18557 | 1157222 | 618924 |
| 48 | Bahrain | 136 | Arabian (Persian) Gulf | 7568 | 238347 | 7568 |
| 903 | Balearic Islands (Spain) | 144 | Western Mediterranean | 129060 | 757567 | 129060 |
| 50 | Bangladesh | 53 | Northern Bay of Bengal | 110891 | 485565 | 110970 |
| 52 | Barbados | 116 | Eastern Caribbean | 183511 | 868768 | 184252 |
| 52 | Barbados | 226 | Guianan | 544 | 453298 | 184252 |
| 52 | Barbados | 127 | Southern Caribbean | 110 | 584596 | 184252 |
| 56 | Belgium | 41 | North Sea | 3479 | 680979 | 3479 |
| 84 | Belize | 160 | Western Caribbean | 34299 | 242364 | 34299 |
| 204 | Benin | 16 | Gulf of Guinea Central | 35253 | 382239 | 35253 |
| 60 | Bermuda (UK) | 201 | Bermuda | 450347 | 450347 | 450347 |
| 907 | Bonaire (Netherlands) | 127 | Southern Caribbean | 12811 | 584596 | 12811 |
| 70 | Bosnia & Herzegovina | 221 | Adriatic Sea | 13 | 135271 | 13 |
| 74 | Bouvet Isl. (Norway) | 202 | Bouvet Island | 441176 | 441265 | 441176 |
| 76 | Brazil (mainland) | 118 | Amazonia | 565109 | 565120 | 2411248 |
| 76 | Brazil (mainland) | 52 | Eastern Brazil | 494956 | 674995 | 2411248 |
| 76 | Brazil (mainland) | 226 | Guianan | 18 | 453298 | 2411248 |
| 76 | Brazil (mainland) | 119 | Northeastern Brazil | 665966 | 665966 | 2411248 |
| 76 | Brazil (mainland) | 132 | Rio Grande | 283141 | 283176 | 2411248 |
| 76 | Brazil (mainland) | 86 | Southeastern Brazil | 391714 | 391723 | 2411248 |
| 76 | Brazil (mainland) | 131 | Uruguay-Buenos Aires Shelf | 1589 | 400686 | 2411248 |
| 92 | British Virgin Isl. (UK) | 161 | Bahamian | 0 | 923316 | 81071 |
| 92 | British Virgin Isl. (UK) | 116 | Eastern Caribbean | 80953 | 868768 | 81071 |
| 96 | Brunei Darussalam | 123 | Palawan/North Borneo | 25350 | 572946 | 43056 |
| 96 | Brunei Darussalam | 146 | South China Sea Oceanic Islands | 17708 | 1255398 | 43056 |
| 100 | Bulgaria | 155 | Black Sea | 34768 | 460086 | 34768 |
| 116 | Cambodia | 56 | Gulf of Thailand | 48589 | 266482 | 48589 |
| 120 | Cameroon | 16 | Gulf of Guinea Central | 14892 | 382239 | 14892 |
| 924 | Canada (Arctic) | 45 | Baffin Bay - Davis Strait | 2104 | 321290 | 3049738 |

| | | | | | | |
|-----|----------------------------|-----|--|---------|---------|---------|
| 924 | Canada (Arctic) | 47 | Beaufort Sea - continental coast and shelf | 298809 | 503059 | 3049738 |
| 924 | Canada (Arctic) | 46 | Beaufort-Amundsen-Viscount Melville-Queen Maud | 514609 | 514609 | 3049738 |
| 924 | Canada (Arctic) | 63 | High Arctic Archipelago | 722370 | 722370 | 3049738 |
| 924 | Canada (Arctic) | 77 | Hudson Complex | 1243260 | 1243260 | 3049738 |
| 924 | Canada (Arctic) | 64 | Lancaster Sound | 240195 | 246108 | 3049738 |
| 924 | Canada (Arctic) | 69 | North Greenland | 1531 | 675764 | 3049738 |
| 924 | Canada (Arctic) | 59 | Northern Labrador | 6 | 447235 | 3049738 |
| 926 | Canada (East Coast) | 45 | Baffin Bay - Davis Strait | 319162 | 321290 | 2273430 |
| 926 | Canada (East Coast) | 55 | Gulf of Maine/Bay of Fundy | 60616 | 198833 | 2273430 |
| 926 | Canada (East Coast) | 87 | Gulf of St. Lawrence - Eastern Scotian Shelf | 435237 | 439219 | 2273430 |
| 926 | Canada (East Coast) | 77 | Hudson Complex | 0 | 1243260 | 2273430 |
| 926 | Canada (East Coast) | 64 | Lancaster Sound | 5913 | 246108 | 2273430 |
| 926 | Canada (East Coast) | 76 | Northern Grand Banks - Southern Labrador | 522749 | 527223 | 2273430 |
| 926 | Canada (East Coast) | 59 | Northern Labrador | 446623 | 447235 | 2273430 |
| 926 | Canada (East Coast) | 229 | Scotian Shelf | 269570 | 269570 | 2273430 |
| 926 | Canada (East Coast) | 121 | Southern Grand Banks - South Newfoundland | 211037 | 337376 | 2273430 |
| 926 | Canada (East Coast) | 115 | West Greenland Shelf | 3 | 764650 | 2273430 |
| 925 | Canada (Pacific) | 166 | North American Pacific Fjordland | 318642 | 478070 | 451437 |
| 925 | Canada (Pacific) | 142 | Oregon, Washington, Vancouver Coast and Shelf | 123176 | 437987 | 451437 |
| 925 | Canada (Pacific) | 181 | Puget Trough/Georgia Basin | 9313 | 15770 | 451437 |
| 723 | Canary Isl. (Spain) | 82 | Azores Canaries Madeira | 444667 | 1865442 | 444714 |
| 723 | Canary Isl. (Spain) | 81 | Saharan Upwelling | 47 | 558772 | 444714 |
| 132 | Cape Verde | 188 | Cape Verde | 796551 | 796555 | 796624 |
| 132 | Cape Verde | 103 | Sahelian Upwelling | 0 | 335699 | 796624 |
| 136 | Cayman Isl. (UK) | 143 | Greater Antilles | 118414 | 1157222 | 120490 |
| 136 | Cayman Isl. (UK) | 32 | Southwestern Caribbean | 0 | 741578 | 120490 |
| 136 | Cayman Isl. (UK) | 160 | Western Caribbean | 2076 | 242364 | 120490 |
| 86 | Chagos Archipelago (UK) | 114 | Chagos | 638556 | 638556 | 638556 |
| 830 | Channel Isl. (UK) | 85 | Celtic Seas | 8810 | 879067 | 8810 |
| 152 | Chile (mainland) | 10 | Araucanian | 376291 | 376291 | 1955640 |
| 152 | Chile (mainland) | 107 | Central Chile | 344002 | 344002 | 1955640 |
| 152 | Chile (mainland) | 125 | Channels and Fjords of Southern Chile | 694622 | 899871 | 1955640 |
| 152 | Chile (mainland) | 9 | Chiloense | 278065 | 278065 | 1955640 |
| 152 | Chile (mainland) | 111 | Humboldtian | 262094 | 691032 | 1955640 |
| 152 | Chile (mainland) | 21 | Patagonian Shelf | 30 | 416585 | 1955640 |
| 156 | China | 49 | East China Sea | 376270 | 686453 | 2611739 |
| 156 | China | 176 | Gulf of Tonkin | 143810 | 289433 | 2611739 |
| 156 | China | 123 | Palawan/North Borneo | 79250 | 572946 | 2611739 |
| 156 | China | 146 | South China Sea Oceanic Islands | 1239846 | 1255398 | 2611739 |
| 156 | China | 145 | South Kuroshio | 57129 | 1461400 | 2611739 |
| 156 | China | 184 | Southern China | 281606 | 283612 | 2611739 |
| 156 | China | 57 | Sunda Shelf/Java Sea | 155895 | 1386854 | 2611739 |
| 156 | China | 148 | Yellow Sea | 277923 | 435845 | 2611739 |
| 162 | Christmas Isl. (Australia) | 191 | Cocos-Keeling/Christmas Island | 327992 | 795233 | 327993 |
| 898 | Clipperton Isl. (France) | 203 | Clipperton | 431274 | 431274 | 431274 |

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| 166 | Cocos (Keeling) Isl. (Australia) | 191 | Cocos-Keeling/Christmas Island | 467229 | 795233 | 467229 |
| 927 | Colombia (Caribbean) | 143 | Greater Antilles | 7398 | 1157222 | 423139 |
| 927 | Colombia (Caribbean) | 127 | Southern Caribbean | 111499 | 584596 | 423139 |
| 927 | Colombia (Caribbean) | 32 | Southwestern Caribbean | 304248 | 741578 | 423139 |
| 928 | Colombia (Pacific) | 232 | Cocos Islands | 0 | 335960 | 326661 |
| 928 | Colombia (Pacific) | 141 | Nicoya | 5 | 288802 | 326661 |
| 928 | Colombia (Pacific) | 180 | Panama Bight | 326656 | 525331 | 326661 |
| 174 | Comoros Isl. | 89 | East African Coral Coast | 2284 | 478916 | 231695 |
| 174 | Comoros Isl. | 182 | Seychelles | 323 | 1334015 | 231695 |
| 174 | Comoros Isl. | 35 | Western and Northern Madagascar | 228694 | 1334065 | 231695 |
| 180 | Congo (ex-Zaire) | 101 | Angolan | 0 | 393820 | 13139 |
| 180 | Congo (ex-Zaire) | 102 | Gulf of Guinea South | 13139 | 229164 | 13139 |
| 178 | Congo, R. of | 102 | Gulf of Guinea South | 33975 | 229164 | 33975 |
| 184 | Cook Islands | 78 | Phoenix/Tokelau/Northern Cook Islands | 956849 | 2539942 | 1960013 |
| 184 | Cook Islands | 79 | Samoa Islands | 0 | 849376 | 1960013 |
| 184 | Cook Islands | 156 | Southern Cook/Austral Islands | 1003164 | 1742006 | 1960013 |
| 899 | Corsica (France) | 144 | Western Mediterranean | 23539 | 757567 | 23539 |
| 929 | Costa Rica (Caribbean) | 32 | Southwestern Caribbean | 20231 | 741578 | 20231 |
| 930 | Costa Rica (Pacific) | 223 | Chiapas-Nicaragua | 0 | 376906 | 545199 |
| 930 | Costa Rica (Pacific) | 232 | Cocos Islands | 335918 | 335960 | 545199 |
| 930 | Costa Rica (Pacific) | 141 | Nicoya | 209193 | 288802 | 545199 |
| 384 | Côte d'Ivoire | 1 | Gulf of Guinea Upwelling | 169562 | 343204 | 169654 |
| 384 | Côte d'Ivoire | 174 | Gulf of Guinea West | 0 | 620646 | 169654 |
| 900 | Crete (Greece) | 105 | Aegean Sea | 96353 | 375812 | 96529 |
| 900 | Crete (Greece) | 106 | Levantine Sea | 134 | 421745 | 96529 |
| 900 | Crete (Greece) | 138 | Tunisian Plateau/Gulf of Sidra | 47 | 402162 | 96529 |
| 191 | Croatia | 221 | Adriatic Sea | 55920 | 135271 | 55920 |
| 896 | Crozet Isl. (France) | 204 | Crozet Islands | 574541 | 574713 | 574542 |
| 192 | Cuba | 161 | Bahamian | 164 | 923316 | 351485 |
| 192 | Cuba | 75 | Floridian | 330 | 229441 | 351485 |
| 192 | Cuba | 143 | Greater Antilles | 346037 | 1157222 | 351485 |
| 192 | Cuba | 122 | Southern Gulf of Mexico | 12 | 688764 | 351485 |
| 192 | Cuba | 160 | Western Caribbean | 4940 | 242364 | 351485 |
| 906 | Curaçao (Netherlands) | 143 | Greater Antilles | 0 | 1157222 | 25599 |
| 906 | Curaçao (Netherlands) | 127 | Southern Caribbean | 25599 | 584596 | 25599 |
| 197 | Cyprus (North) | 106 | Levantine Sea | 17677 | 421745 | 17677 |
| 198 | Cyprus (South) | 105 | Aegean Sea | 240 | 375812 | 80782 |
| 198 | Cyprus (South) | 106 | Levantine Sea | 80538 | 421745 | 80782 |
| 931 | Denmark (Baltic Sea) | 97 | Baltic Sea | 16564 | 376537 | 29369 |
| 931 | Denmark (Baltic Sea) | 41 | North Sea | 12805 | 680979 | 29369 |
| 932 | Denmark (North Sea) | 41 | North Sea | 75714 | 680979 | 75714 |
| 154 | Desventuradas Isl. (Chile) | 209 | Juan Fernandez and Desventuradas | 449836 | 952841 | 449836 |
| 262 | Djibouti | 151 | Gulf of Aden | 7502 | 560060 | 7502 |
| 212 | Dominica | 116 | Eastern Caribbean | 28599 | 868768 | 28599 |
| 214 | Dominican Republic | 161 | Bahamian | 156028 | 923316 | 377748 |

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|-----|------------------------------|-----|---|---------|---------|---------|
| 214 | Dominican Republic | 116 | Eastern Caribbean | 0 | 868768 | 377748 |
| 214 | Dominican Republic | 143 | Greater Antilles | 192064 | 1157222 | 377748 |
| 214 | Dominican Republic | 127 | Southern Caribbean | 7888 | 584596 | 377748 |
| 153 | Easter Isl. (Chile) | 205 | Easter Island | 720412 | 721018 | 720412 |
| 218 | Ecuador (mainland) | 169 | Guayaquil | 145078 | 258565 | 234767 |
| 218 | Ecuador (mainland) | 180 | Panama Bight | 89684 | 525331 | 234767 |
| 933 | Egypt (Mediterranean) | 105 | Aegean Sea | 599 | 375812 | 170371 |
| 933 | Egypt (Mediterranean) | 106 | Levantine Sea | 169773 | 421745 | 170371 |
| 934 | Egypt (Red Sea) | 30 | Northern and Central Red Sea | 91527 | 228824 | 91527 |
| 222 | El Salvador | 223 | Chiapas-Nicaragua | 94499 | 376906 | 94504 |
| 226 | Equatorial Guinea | 16 | Gulf of Guinea Central | 53794 | 382239 | 302995 |
| 226 | Equatorial Guinea | 206 | Gulf of Guinea Islands | 249019 | 417522 | 302995 |
| 226 | Equatorial Guinea | 102 | Gulf of Guinea South | 5 | 229164 | 302995 |
| 111 | Eritrea | 151 | Gulf of Aden | 2302 | 560060 | 78325 |
| 111 | Eritrea | 31 | Southern Red Sea | 76023 | 225930 | 78325 |
| 233 | Estonia | 97 | Baltic Sea | 36432 | 376537 | 36432 |
| 234 | Faeroe Isl. (Denmark) | 85 | Celtic Seas | 6651 | 879067 | 272210 |
| 234 | Faeroe Isl. (Denmark) | 39 | Faroe Plateau | 265032 | 267926 | 272210 |
| 234 | Faeroe Isl. (Denmark) | 228 | North and East Iceland | 7 | 568491 | 272210 |
| 238 | Falkland Isl. (UK) | 199 | Malvinas/Falklands | 549981 | 549981 | 549974 |
| 969 | Fernando de Noronha (Brazil) | 14 | Fernando de Naronha and Atoll das Rocas | 363359 | 363359 | 363362 |
| 242 | Fiji | 68 | Fiji Islands | 786034 | 786024 | 1280793 |
| 242 | Fiji | 15 | Gilbert/Ellis Islands | 273906 | 2396454 | 1280793 |
| 242 | Fiji | 129 | Tonga Islands | 0 | 840051 | 1280793 |
| 242 | Fiji | 126 | Vanuatu | 220589 | 1662460 | 1280793 |
| 246 | Finland | 97 | Baltic Sea | 82365 | 376537 | 82365 |
| 919 | France (Atlantic Coast) | 85 | Celtic Seas | 50363 | 879067 | 258312 |
| 919 | France (Atlantic Coast) | 41 | North Sea | 21421 | 680979 | 258312 |
| 919 | France (Atlantic Coast) | 84 | South European Atlantic Shelf | 186190 | 800447 | 258312 |
| 918 | France (Mediterranean) | 144 | Western Mediterranean | 63984 | 757567 | 63984 |
| 254 | French Guiana | 226 | Guianan | 130099 | 453298 | 131341 |
| 258 | French Polynesia | 220 | Marquesas | 749098 | 749101 | 4769854 |
| 258 | French Polynesia | 222 | Rapa-Pitcairn | 465703 | 1305423 | 4769854 |
| 258 | French Polynesia | 194 | Society Islands | 644569 | 644569 | 4769854 |
| 258 | French Polynesia | 156 | Southern Cook/Austral Islands | 738834 | 1742006 | 4769854 |
| 258 | French Polynesia | 18 | Tuamotus | 2169292 | 2739979 | 4769854 |
| 266 | Gabon | 16 | Gulf of Guinea Central | 29153 | 382239 | 199897 |
| 266 | Gabon | 206 | Gulf of Guinea Islands | 3178 | 417522 | 199897 |
| 266 | Gabon | 102 | Gulf of Guinea South | 166525 | 229164 | 199897 |
| 219 | Galapagos Isl. (Ecuador) | 73 | Eastern Galapagos Islands | 390488 | 390488 | 835538 |
| 219 | Galapagos Isl. (Ecuador) | 149 | Northern Galapagos Islands | 213088 | 213094 | 835538 |
| 219 | Galapagos Isl. (Ecuador) | 193 | Western Galapagos Islands | 231964 | 231959 | 835538 |
| 270 | Gambia | 188 | Cape Verde | 4 | 796555 | 22906 |
| 270 | Gambia | 103 | Sahelian Upwelling | 22651 | 335699 | 22906 |
| 274 | Gaza Strip | 106 | Levantine Sea | 2339 | 421745 | 2339 |

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|-----|-----------------------------------|-----|---------------------------------------|---------|---------|---------|
| 268 | Georgia | 155 | Black Sea | 22948 | 460086 | 22948 |
| 278 | Germany (Baltic Sea) | 97 | Baltic Sea | 10421 | 376537 | 15397 |
| 278 | Germany (Baltic Sea) | 41 | North Sea | 4976 | 680979 | 15397 |
| 277 | Germany (North Sea) | 41 | North Sea | 41000 | 680979 | 41000 |
| 288 | Ghana | 16 | Gulf of Guinea Central | 56225 | 382239 | 226087 |
| 288 | Ghana | 1 | Gulf of Guinea Upwelling | 169439 | 343204 | 226087 |
| 972 | Glorieuse Islands (France) | 35 | Western and Northern Madagascar | 43138 | 1334065 | 43139 |
| 300 | Greece (without Crete) | 221 | Adriatic Sea | 4 | 135271 | 387656 |
| 300 | Greece (without Crete) | 105 | Aegean Sea | 237108 | 375812 | 387656 |
| 300 | Greece (without Crete) | 104 | Ionian Sea | 150488 | 347361 | 387656 |
| 300 | Greece (without Crete) | 106 | Levantine Sea | 21 | 421745 | 387656 |
| 300 | Greece (without Crete) | 138 | Tunisian Plateau/Gulf of Sidra | 11 | 402162 | 387656 |
| 304 | Greenland (Denmark) | 227 | East Greenland Shelf | 837276 | 837468 | 2275652 |
| 304 | Greenland (Denmark) | 69 | North Greenland | 674233 | 675764 | 2275652 |
| 304 | Greenland (Denmark) | 115 | West Greenland Shelf | 763643 | 764650 | 2275652 |
| 308 | Grenada | 116 | Eastern Caribbean | 25120 | 868768 | 25582 |
| 308 | Grenada | 127 | Southern Caribbean | 462 | 584596 | 25582 |
| 312 | Guadeloupe (France) | 116 | Eastern Caribbean | 90581 | 868768 | 90581 |
| 316 | Guam (USA) | 67 | East Caroline Islands | 16 | 2462658 | 207876 |
| 316 | Guam (USA) | 195 | Mariana Islands | 207875 | 970769 | 207876 |
| 316 | Guam (USA) | 186 | West Caroline Islands | 113 | 1134134 | 207876 |
| 935 | Guatemala (Caribbean) | 160 | Western Caribbean | 1495 | 242364 | 1495 |
| 936 | Guatemala (Pacific) | 223 | Chiapas-Nicaragua | 107560 | 376906 | 107582 |
| 324 | Guinea | 174 | Gulf of Guinea West | 101521 | 620646 | 101521 |
| 624 | Guinea-Bissau | 174 | Gulf of Guinea West | 105841 | 620646 | 140456 |
| 624 | Guinea-Bissau | 103 | Sahelian Upwelling | 34368 | 335699 | 140456 |
| 328 | Guyana | 226 | Guianan | 138170 | 453298 | 138434 |
| 332 | Haiti | 161 | Bahamian | 31 | 923316 | 117245 |
| 332 | Haiti | 143 | Greater Antilles | 117214 | 1157222 | 117245 |
| 842 | Hawaii Main Islands (USA) | 207 | Hawaii | 895895 | 2917340 | 895895 |
| 488 | Hawaii Northwest Islands (USA) | 207 | Hawaii | 1578813 | 2917340 | 1578813 |
| 334 | Heard & McDonald Isl. (Australia) | 208 | Heard and Macdonald Islands | 417015 | 417222 | 417040 |
| 921 | Honduras (Caribbean) | 143 | Greater Antilles | 1 | 1157222 | 209546 |
| 921 | Honduras (Caribbean) | 32 | Southwestern Caribbean | 101980 | 741578 | 209546 |
| 921 | Honduras (Caribbean) | 160 | Western Caribbean | 107567 | 242364 | 209546 |
| 920 | Honduras (Pacific) | 223 | Chiapas-Nicaragua | 770 | 376906 | 770 |
| 344 | Hong Kong (China) | 184 | Southern China | 2008 | 283612 | 2008 |
| 846 | Howland & Baker Isl. (USA) | 78 | Phoenix/Tokelau/Northern Cook Islands | 434922 | 2539942 | 434922 |
| 352 | Iceland | 39 | Faroe Plateau | 2832 | 267926 | 795358 |
| 352 | Iceland | 228 | North and East Iceland | 308633 | 568491 | 795358 |
| 352 | Iceland | 40 | South and West Iceland | 480052 | 480052 | 795358 |
| 356 | India (mainland) | 54 | Eastern India | 420755 | 420761 | 1655691 |
| 356 | India (mainland) | 113 | Maldives | 402806 | 1318816 | 1655691 |
| 356 | India (mainland) | 53 | Northern Bay of Bengal | 116890 | 485565 | 1655691 |
| 356 | India (mainland) | 162 | South India and Sri Lanka | 130501 | 661444 | 1655691 |

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| 356 | India (mainland) | 175 | Western India | 546180 | 640184 | 1655691 |
| 937 | Indonesia (Central) | 128 | Lesser Sunda | 0 | 717561 | 1002277 |
| 937 | Indonesia (Central) | 230 | Malacca Strait | 13635 | 168385 | 1002277 |
| 937 | Indonesia (Central) | 96 | Southern Java | 26682 | 604753 | 1002277 |
| 937 | Indonesia (Central) | 124 | Sulawesi Sea/Makassar Strait | 0 | 740991 | 1002277 |
| 937 | Indonesia (Central) | 57 | Sunda Shelf/Java Sea | 961960 | 1386854 | 1002277 |
| 361 | Indonesia (Eastern) | 37 | Arafura Sea | 343193 | 370338 | 3598502 |
| 361 | Indonesia (Eastern) | 109 | Arnhem Coast to Gulf of Carpentaria | 9 | 571787 | 3598502 |
| 361 | Indonesia (Eastern) | 5 | Banda Sea | 938144 | 941189 | 3598502 |
| 361 | Indonesia (Eastern) | 153 | Bismarck Sea | 93 | 757742 | 3598502 |
| 361 | Indonesia (Eastern) | 108 | Bonaparte Coast | 37 | 291172 | 3598502 |
| 361 | Indonesia (Eastern) | 163 | Eastern Philippines | 69304 | 922014 | 3598502 |
| 361 | Indonesia (Eastern) | 147 | Exmouth to Broome | 0 | 710626 | 3598502 |
| 361 | Indonesia (Eastern) | 157 | Halmahera | 254764 | 254860 | 3598502 |
| 361 | Indonesia (Eastern) | 128 | Lesser Sunda | 642392 | 717561 | 3598502 |
| 361 | Indonesia (Eastern) | 187 | Northeast Sulawesi | 69981 | 69981 | 3598502 |
| 361 | Indonesia (Eastern) | 123 | Palawan/North Borneo | 44085 | 572946 | 3598502 |
| 361 | Indonesia (Eastern) | 231 | Papua | 639546 | 641475 | 3598502 |
| 361 | Indonesia (Eastern) | 124 | Sulawesi Sea/Makassar Strait | 596924 | 740991 | 3598502 |
| 361 | Indonesia (Eastern) | 57 | Sunda Shelf/Java Sea | 0 | 1386854 | 3598502 |
| 361 | Indonesia (Eastern) | 186 | West Caroline Islands | 14 | 1134134 | 3598502 |
| 938 | Indonesia (Indian Ocean) | 191 | Cocos-Keeling/Christmas Island | 0 | 795233 | 1410214 |
| 938 | Indonesia (Indian Ocean) | 230 | Malacca Strait | 84925 | 168385 | 1410214 |
| 938 | Indonesia (Indian Ocean) | 96 | Southern Java | 578038 | 604753 | 1410214 |
| 938 | Indonesia (Indian Ocean) | 94 | Western Sumatra | 747253 | 747253 | 1410214 |
| 922 | Iran (Persian Gulf) | 136 | Arabian (Persian) Gulf | 98727 | 238347 | 98727 |
| 923 | Iran (Sea of Oman) | 136 | Arabian (Persian) Gulf | 2003 | 238347 | 64475 |
| 923 | Iran (Sea of Oman) | 93 | Gulf of Oman | 62472 | 275487 | 64475 |
| 368 | Iraq | 136 | Arabian (Persian) Gulf | 1148 | 238347 | 1148 |
| 372 | Ireland | 85 | Celtic Seas | 427735 | 879067 | 427734 |
| 939 | Israel (Mediterranean) | 106 | Levantine Sea | 25805 | 421745 | 25807 |
| 940 | Israel (Red Sea) | 30 | Northern and Central Red Sea | 31 | 228824 | 31 |
| 380 | Italy (mainland) | 221 | Adriatic Sea | 60679 | 135271 | 314331 |
| 380 | Italy (mainland) | 104 | Ionian Sea | 116290 | 347361 | 314331 |
| 380 | Italy (mainland) | 144 | Western Mediterranean | 137362 | 757567 | 314331 |
| 388 | Jamaica | 143 | Greater Antilles | 265059 | 1157222 | 286159 |
| 388 | Jamaica | 32 | Southwestern Caribbean | 21089 | 741578 | 286159 |
| 579 | Jan Mayen Isl. (Norway) | 228 | North and East Iceland | 305230 | 568491 | 304996 |
| 393 | Japan (Daito Islands) | 7 | Central Kuroshio Current | 0 | 601291 | 792308 |
| 393 | Japan (Daito Islands) | 168 | Ogasawara Islands | 0 | 1261469 | 792308 |
| 393 | Japan (Daito Islands) | 145 | South Kuroshio | 792251 | 1461400 | 792308 |
| 390 | Japan (main islands) | 7 | Central Kuroshio Current | 601286 | 601291 | 2584333 |
| 390 | Japan (main islands) | 49 | East China Sea | 295632 | 686453 | 2584333 |
| 390 | Japan (main islands) | 70 | Northeastern Honshu | 277141 | 277151 | 2584333 |
| 390 | Japan (main islands) | 168 | Ogasawara Islands | 175310 | 1261469 | 2584333 |

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|-----|--------------------------------|-----|---------------------------------------|---------|---------|---------|
| 390 | Japan (main islands) | 60 | Oyashio Current | 348269 | 973047 | 2584333 |
| 390 | Japan (main islands) | 25 | Sea of Japan/East Sea | 493627 | 989381 | 2584333 |
| 390 | Japan (main islands) | 83 | Sea of Okhotsk | 124 | 1236094 | 2584333 |
| 390 | Japan (main islands) | 145 | South Kuroshio | 391840 | 1461400 | 2584333 |
| 971 | Japan (Ogasawara Islands) | 168 | Ogasawara Islands | 1082503 | 1261469 | 1082628 |
| 971 | Japan (Ogasawara Islands) | 145 | South Kuroshio | 10 | 1461400 | 1082628 |
| 845 | Jarvis Isl. (USA) | 65 | Line Islands | 324239 | 1743769 | 324239 |
| 396 | Johnston Atoll (USA) | 207 | Hawaii | 442630 | 2917340 | 442630 |
| 400 | Jordan | 30 | Northern and Central Red Sea | 97 | 228824 | 97 |
| 155 | Juan Fernandez Islands (Chile) | 209 | Juan Fernandez and Desventuradas | 503005 | 952841 | 502524 |
| 404 | Kenya | 89 | East African Coral Coast | 111470 | 478916 | 162794 |
| 404 | Kenya | 88 | Northern Monsoon Current Coast | 51324 | 260802 | 162794 |
| 897 | Kerguelen Isl. (France) | 210 | Kerguelen Islands | 567655 | 567655 | 567630 |
| 555 | Kermadec Isl. (New Zealand) | 211 | Kermadec Island | 621762 | 621797 | 621785 |
| 941 | Kiribati (Gilbert Islands) | 15 | Gilbert/Ellis Islands | 1048864 | 2396454 | 1050679 |
| 941 | Kiribati (Gilbert Islands) | 19 | Marshall Islands | 0 | 2399284 | 1050679 |
| 942 | Kiribati (Line Islands) | 65 | Line Islands | 1066997 | 1743769 | 1637683 |
| 942 | Kiribati (Line Islands) | 194 | Society Islands | 0 | 644569 | 1637683 |
| 942 | Kiribati (Line Islands) | 18 | Tuamotus | 570687 | 2739979 | 1637683 |
| 943 | Kiribati (Phoenix Islands) | 78 | Phoenix/Tokelau/Northern Cook Islands | 743053 | 2539942 | 743052 |
| 974 | Korea (North, Sea of Japan) | 25 | Sea of Japan/East Sea | 89058 | 989381 | 89058 |
| 973 | Korea (North, Yellow Sea) | 148 | Yellow Sea | 24841 | 435845 | 24845 |
| 410 | Korea (South) | 49 | East China Sea | 170587 | 686453 | 453289 |
| 410 | Korea (South) | 25 | Sea of Japan/East Sea | 149620 | 989381 | 453289 |
| 410 | Korea (South) | 148 | Yellow Sea | 133082 | 435845 | 453289 |
| 414 | Kuwait | 136 | Arabian (Persian) Gulf | 11162 | 238347 | 11162 |
| 428 | Latvia | 97 | Baltic Sea | 28298 | 376537 | 28298 |
| 422 | Lebanon | 106 | Levantine Sea | 20172 | 421745 | 20172 |
| 430 | Liberia | 1 | Gulf of Guinea Upwelling | 4201 | 343204 | 250311 |
| 430 | Liberia | 174 | Gulf of Guinea West | 246093 | 620646 | 250311 |
| 434 | Libya | 105 | Aegean Sea | 463 | 375812 | 363895 |
| 434 | Libya | 104 | Ionian Sea | 6969 | 347361 | 363895 |
| 434 | Libya | 106 | Levantine Sea | 48646 | 421745 | 363895 |
| 434 | Libya | 138 | Tunisian Plateau/Gulf of Sidra | 307789 | 402162 | 363895 |
| 440 | Lithuania | 97 | Baltic Sea | 6837 | 376537 | 6837 |
| 38 | Lord Howe Isl. (Australia) | 212 | Lord Howe and Norfolk Islands | 542369 | 981995 | 542849 |
| 37 | Macquarie Isl. (Australia) | 167 | Macquarie Island | 477351 | 477352 | 477361 |
| 450 | Madagascar | 34 | Cargados Carajos/Tromelin Island | 197 | 930174 | 1237966 |
| 450 | Madagascar | 89 | East African Coral Coast | 66 | 478916 | 1237966 |
| 450 | Madagascar | 134 | Mascarene Islands | 957 | 1058073 | 1237966 |
| 450 | Madagascar | 182 | Seychelles | 293 | 1334015 | 1237966 |
| 450 | Madagascar | 183 | Southeast Madagascar | 446036 | 446163 | 1237966 |
| 450 | Madagascar | 35 | Western and Northern Madagascar | 790396 | 1334065 | 1237966 |
| 621 | Madeira Isl. (Portugal) | 82 | Azores Canaries Madeira | 459608 | 1865442 | 459608 |
| 460 | Malaysia (Peninsula East) | 230 | Malacca Strait | 645 | 168385 | 132144 |

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| 460 | Malaysia (Peninsula East) | 57 | Sunda Shelf/Java Sea | 131499 | 1386854 | 132144 |
| 459 | Malaysia (Peninsula West) | 139 | Andaman Sea Coral Coast | 1 | 283433 | 68386 |
| 459 | Malaysia (Peninsula West) | 230 | Malacca Strait | 68385 | 168385 | 68386 |
| 461 | Malaysia (Sabah) | 123 | Palawan/North Borneo | 78793 | 572946 | 137211 |
| 461 | Malaysia (Sabah) | 146 | South China Sea Oceanic Islands | 55692 | 1255398 | 137211 |
| 461 | Malaysia (Sabah) | 124 | Sulawesi Sea/Makassar Strait | 2652 | 740991 | 137211 |
| 463 | Malaysia (Sarawak) | 123 | Palawan/North Borneo | 27226 | 572946 | 172530 |
| 463 | Malaysia (Sarawak) | 146 | South China Sea Oceanic Islands | 10099 | 1255398 | 172530 |
| 463 | Malaysia (Sarawak) | 57 | Sunda Shelf/Java Sea | 135242 | 1386854 | 172530 |
| 462 | Maldives | 113 | Maldives | 915486 | 1318816 | 924951 |
| 470 | Malta | 104 | Ionian Sea | 26663 | 347361 | 52869 |
| 470 | Malta | 138 | Tunisian Plateau/Gulf of Sidra | 26210 | 402162 | 52869 |
| 584 | Marshall Isl. | 19 | Marshall Islands | 1992020 | 2399284 | 1992021 |
| 474 | Martinique (France) | 116 | Eastern Caribbean | 47520 | 868768 | 47532 |
| 478 | Mauritania | 188 | Cape Verde | 0 | 796555 | 173189 |
| 478 | Mauritania | 81 | Saharan Upwelling | 17536 | 558772 | 173189 |
| 478 | Mauritania | 103 | Sahelian Upwelling | 155313 | 335699 | 173189 |
| 480 | Mauritius | 34 | Cargados Carajos/Tromelin Island | 800427 | 930174 | 2184726 |
| 480 | Mauritius | 114 | Chagos | 637742 | 638556 | 2184726 |
| 480 | Mauritius | 113 | Maldives | 168 | 1318816 | 2184726 |
| 480 | Mauritius | 134 | Mascarene Islands | 744426 | 1058073 | 2184726 |
| 480 | Mauritius | 35 | Western and Northern Madagascar | 1375 | 1334065 | 2184726 |
| 175 | Mayotte (France) | 35 | Western and Northern Madagascar | 66685 | 1334065 | 66685 |
| 944 | Mexico (Atlantic) | 143 | Greater Antilles | 48 | 1157222 | 831791 |
| 944 | Mexico (Atlantic) | 74 | Northern Gulf of Mexico | 84487 | 598106 | 831791 |
| 944 | Mexico (Atlantic) | 122 | Southern Gulf of Mexico | 653184 | 688764 | 831791 |
| 944 | Mexico (Atlantic) | 160 | Western Caribbean | 94064 | 242364 | 831791 |
| 945 | Mexico (Pacific) | 223 | Chiapas-Nicaragua | 112653 | 376906 | 2350734 |
| 945 | Mexico (Pacific) | 171 | Cortezian | 263522 | 263522 | 2350734 |
| 945 | Mexico (Pacific) | 165 | Magdalena Transition | 187113 | 227781 | 2350734 |
| 945 | Mexico (Pacific) | 164 | Mexican Tropical Pacific | 654372 | 654372 | 2350734 |
| 945 | Mexico (Pacific) | 190 | Revillagigedos | 652065 | 652265 | 2350734 |
| 945 | Mexico (Pacific) | 72 | Southern California Bight | 454895 | 642335 | 2350734 |
| 583 | Micronesia (Federated States of) | 67 | East Caroline Islands | 2462205 | 2462658 | 2993056 |
| 583 | Micronesia (Federated States of) | 195 | Mariana Islands | 0 | 970769 | 2993056 |
| 583 | Micronesia (Federated States of) | 19 | Marshall Islands | 0 | 2399284 | 2993056 |
| 583 | Micronesia (Federated States of) | 2 | Solomon Archipelago | 471 | 1656641 | 2993056 |
| 583 | Micronesia (Federated States of) | 186 | West Caroline Islands | 528542 | 1134134 | 2993056 |
| 891 | Montenegro | 221 | Adriatic Sea | 6352 | 135271 | 6352 |
| 500 | Montserrat (UK) | 116 | Eastern Caribbean | 7210 | 868768 | 7210 |
| 946 | Morocco (Central) | 82 | Azores Canaries Madeira | 5440 | 1865442 | 262154 |
| 946 | Morocco (Central) | 81 | Saharan Upwelling | 256590 | 558772 | 262154 |
| 946 | Morocco (Central) | 84 | South European Atlantic Shelf | 116 | 800447 | 262154 |
| 947 | Morocco (Mediterranean) | 80 | Alboran Sea | 18155 | 84149 | 18357 |
| 947 | Morocco (Mediterranean) | 81 | Saharan Upwelling | 193 | 558772 | 18357 |

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| 947 | Morocco (Mediterranean) | 84 | South European Atlantic Shelf | 6 | 800447 | 18357 |
| 948 | Morocco (South) | 82 | Azores Canaries Madeira | 4 | 1865442 | 283883 |
| 948 | Morocco (South) | 81 | Saharan Upwelling | 283858 | 558772 | 283883 |
| 948 | Morocco (South) | 103 | Sahelian Upwelling | 0 | 335699 | 283883 |
| 508 | Mozambique | 185 | Bight of Sofala/Swamp Coast | 199413 | 199437 | 565466 |
| 508 | Mozambique | 51 | Delagoa | 241344 | 319072 | 565466 |
| 508 | Mozambique | 89 | East African Coral Coast | 124129 | 478916 | 565466 |
| 508 | Mozambique | 35 | Western and Northern Madagascar | 612 | 1334065 | 565466 |
| 251 | Mozambique Channel Isl. (France) | 185 | Bight of Sofala/Swamp Coast | 25 | 199437 | 310450 |
| 251 | Mozambique Channel Isl. (France) | 51 | Delagoa | 746 | 319072 | 310450 |
| 251 | Mozambique Channel Isl. (France) | 89 | East African Coral Coast | 31 | 478916 | 310450 |
| 251 | Mozambique Channel Isl. (France) | 35 | Western and Northern Madagascar | 308723 | 1334065 | 310450 |
| 104 | Myanmar | 137 | Andaman and Nicobar Islands | 74522 | 734098 | 496873 |
| 104 | Myanmar | 139 | Andaman Sea Coral Coast | 164756 | 283433 | 496873 |
| 104 | Myanmar | 53 | Northern Bay of Bengal | 256686 | 485565 | 496873 |
| 516 | Namibia | 178 | Namaqua | 207477 | 477564 | 560094 |
| 516 | Namibia | 179 | Namib | 352616 | 437193 | 560094 |
| 520 | Nauru | 15 | Gilbert/Ellis Islands | 308505 | 2396454 | 308505 |
| 528 | Netherlands | 41 | North Sea | 61856 | 680979 | 61856 |
| 540 | New Caledonia (France) | 91 | Coral Sea | 37 | 968505 | 1364871 |
| 540 | New Caledonia (France) | 212 | Lord Howe and Norfolk Islands | 2 | 981995 | 1364871 |
| 540 | New Caledonia (France) | 133 | New Caledonia | 1161563 | 1252156 | 1364871 |
| 540 | New Caledonia (France) | 90 | Tweed-Moreton | 1 | 279696 | 1364871 |
| 540 | New Caledonia (France) | 126 | Vanuatu | 203299 | 1662460 | 1364871 |
| 554 | New Zealand | 43 | Auckland Island | 230538 | 230538 | 3478372 |
| 554 | New Zealand | 8 | Bounty and Antipodes Islands | 518613 | 519062 | 3478372 |
| 554 | New Zealand | 44 | Campbell Island | 309505 | 309505 | 3478372 |
| 554 | New Zealand | 158 | Central New Zealand | 800465 | 801460 | 3478372 |
| 554 | New Zealand | 120 | Chatham Island | 463690 | 463690 | 3478372 |
| 554 | New Zealand | 20 | Northeastern New Zealand | 413798 | 413798 | 3478372 |
| 554 | New Zealand | 26 | Snares Island | 122951 | 122951 | 3478372 |
| 554 | New Zealand | 29 | South New Zealand | 336666 | 336666 | 3478372 |
| 554 | New Zealand | 159 | Three Kings-North Cape | 282117 | 282117 | 3478372 |
| 949 | Nicaragua (Caribbean) | 32 | Southwestern Caribbean | 167053 | 741578 | 167053 |
| 950 | Nicaragua (Pacific) | 223 | Chiapas-Nicaragua | 61424 | 376906 | 61424 |
| 566 | Nigeria | 16 | Gulf of Guinea Central | 177446 | 382239 | 211984 |
| 566 | Nigeria | 206 | Gulf of Guinea Islands | 34538 | 417522 | 211984 |
| 570 | Niue (New Zealand) | 129 | Tonga Islands | 316588 | 840051 | 316587 |
| 574 | Norfolk Isl. (Australia) | 212 | Lord Howe and Norfolk Islands | 430812 | 981995 | 430775 |
| 574 | Norfolk Isl. (Australia) | 159 | Three Kings-North Cape | 0 | 282117 | 430775 |
| 580 | Northern Marianas (USA) | 195 | Mariana Islands | 762892 | 970769 | 762893 |
| 580 | Northern Marianas (USA) | 168 | Ogasawara Islands | 0 | 1261469 | 762893 |
| 578 | Norway | 100 | North and East Barents Sea | 130953 | 2083243 | 935066 |
| 578 | Norway | 41 | North Sea | 99190 | 680979 | 935066 |
| 578 | Norway | 140 | Northern Norway and Finnmark | 319042 | 352393 | 935066 |

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| 578 | Norway | 98 | Southern Norway | 385583 | 385594 | 935066 |
| 512 | Oman | 151 | Gulf of Aden | 12098 | 560060 | 548073 |
| 512 | Oman | 93 | Gulf of Oman | 76769 | 275487 | 548073 |
| 512 | Oman | 135 | Western Arabian Sea | 459185 | 549923 | 548073 |
| 911 | Oman (Musandam) | 136 | Arabian (Persian) Gulf | 4782 | 238347 | 7018 |
| 911 | Oman (Musandam) | 93 | Gulf of Oman | 2235 | 275487 | 7018 |
| 586 | Pakistan | 93 | Gulf of Oman | 129573 | 275487 | 223772 |
| 586 | Pakistan | 175 | Western India | 94018 | 640184 | 223772 |
| 585 | Palau | 157 | Halmahera | 96 | 254860 | 615115 |
| 585 | Palau | 231 | Papua | 1273 | 641475 | 615115 |
| 585 | Palau | 186 | West Caroline Islands | 605076 | 1134134 | 615115 |
| 844 | Palmyra Atoll & Kingman Reef (USA) | 65 | Line Islands | 352528 | 1743769 | 352528 |
| 951 | Panama (Caribbean) | 32 | Southwestern Caribbean | 142158 | 741578 | 142158 |
| 952 | Panama (Pacific) | 141 | Nicoya | 79604 | 288802 | 188596 |
| 952 | Panama (Pacific) | 180 | Panama Bight | 108991 | 525331 | 188596 |
| 598 | Papua New Guinea | 37 | Arafura Sea | 27144 | 370338 | 2396283 |
| 598 | Papua New Guinea | 109 | Arnhem Coast to Gulf of Carpentaria | 10 | 571787 | 2396283 |
| 598 | Papua New Guinea | 153 | Bismarck Sea | 757490 | 757742 | 2396283 |
| 598 | Papua New Guinea | 91 | Coral Sea | 624 | 968505 | 2396283 |
| 598 | Papua New Guinea | 67 | East Caroline Islands | 354 | 2462658 | 2396283 |
| 598 | Papua New Guinea | 152 | Gulf of Papua | 68638 | 68648 | 2396283 |
| 598 | Papua New Guinea | 231 | Papua | 656 | 641475 | 2396283 |
| 598 | Papua New Guinea | 2 | Solomon Archipelago | 673210 | 1656641 | 2396283 |
| 598 | Papua New Guinea | 3 | Solomon Sea | 655131 | 655151 | 2396283 |
| 598 | Papua New Guinea | 154 | Southeast Papua New Guinea | 209218 | 209228 | 2396283 |
| 598 | Papua New Guinea | 38 | Torres Strait Northern Great Barrier Reef | 3757 | 193124 | 2396283 |
| 604 | Peru | 170 | Central Peru | 313711 | 313711 | 852405 |
| 604 | Peru | 169 | Guayaquil | 111697 | 258565 | 852405 |
| 604 | Peru | 111 | Humboldtian | 426880 | 691032 | 852405 |
| 608 | Philippines | 163 | Eastern Philippines | 852709 | 922014 | 2324649 |
| 608 | Philippines | 123 | Palawan/North Borneo | 397500 | 572946 | 2324649 |
| 608 | Philippines | 146 | South China Sea Oceanic Islands | 723755 | 1255398 | 2324649 |
| 608 | Philippines | 145 | South Kuroshio | 208886 | 1461400 | 2324649 |
| 608 | Philippines | 124 | Sulawesi Sea/Makassar Strait | 141417 | 740991 | 2324649 |
| 608 | Philippines | 186 | West Caroline Islands | 354 | 1134134 | 2324649 |
| 612 | Pitcairn (UK) | 222 | Rapa-Pitcairn | 836107 | 1305423 | 836115 |
| 616 | Poland | 97 | Baltic Sea | 29797 | 376537 | 29797 |
| 620 | Portugal (mainland) | 81 | Saharan Upwelling | 325 | 558772 | 314704 |
| 620 | Portugal (mainland) | 84 | South European Atlantic Shelf | 314309 | 800447 | 314704 |
| 711 | Prince Edward Isl. (South Africa) | 214 | Prince Edward Islands | 473368 | 473515 | 473369 |
| 630 | Puerto Rico (USA) | 161 | Bahamian | 63387 | 923316 | 172818 |
| 630 | Puerto Rico (USA) | 116 | Eastern Caribbean | 242 | 868768 | 172818 |
| 630 | Puerto Rico (USA) | 143 | Greater Antilles | 109187 | 1157222 | 172818 |
| 630 | Puerto Rico (USA) | 127 | Southern Caribbean | 8 | 584596 | 172818 |
| 634 | Qatar | 136 | Arabian (Persian) Gulf | 30637 | 238347 | 30637 |

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| 638 | Réunion (France) | 134 | Mascarene Islands | 312661 | 1058073 | 315186 |
| 638 | Réunion (France) | 183 | Southeast Madagascar | 128 | 446163 | 315186 |
| 642 | Romania | 155 | Black Sea | 30223 | 460086 | 30223 |
| 648 | Russia (Baltic Sea) | 97 | Baltic Sea | 23182 | 376537 | 23210 |
| 645 | Russia (Barents Sea) | 100 | North and East Barents Sea | 1076875 | 2083243 | 1197010 |
| 645 | Russia (Barents Sea) | 140 | Northern Norway and Finnmark | 33377 | 352393 | 1197010 |
| 645 | Russia (Barents Sea) | 99 | White Sea | 87058 | 87058 | 1197010 |
| 647 | Russia (Black Sea) | 155 | Black Sea | 156573 | 460086 | 157960 |
| 649 | Russia (Far East) | 177 | Aleutian Islands | 0 | 1258111 | 3396076 |
| 649 | Russia (Far East) | 48 | Chukchi Sea | 0 | 646109 | 3396076 |
| 649 | Russia (Far East) | 17 | Eastern Bering Sea | 147775 | 1049507 | 3396076 |
| 649 | Russia (Far East) | 61 | Kamchatka Shelf and Coast | 901272 | 929205 | 3396076 |
| 649 | Russia (Far East) | 60 | Oyashio Current | 836960 | 973047 | 3396076 |
| 649 | Russia (Far East) | 25 | Sea of Japan/East Sea | 317516 | 989381 | 3396076 |
| 649 | Russia (Far East) | 83 | Sea of Okhotsk | 1190198 | 1236094 | 3396076 |
| 912 | Russia (Kara Sea) | 62 | Kara Sea | 1058126 | 1058152 | 1058125 |
| 912 | Russia (Kara Sea) | 100 | North and East Barents Sea | 0 | 2083243 | 1058125 |
| 913 | Russia (Laptev to Chukchi Sea) | 48 | Chukchi Sea | 329217 | 646109 | 2087448 |
| 913 | Russia (Laptev to Chukchi Sea) | 50 | East Siberian Sea | 966523 | 1007529 | 2087448 |
| 913 | Russia (Laptev to Chukchi Sea) | 62 | Kara Sea | 0 | 1058152 | 2087448 |
| 913 | Russia (Laptev to Chukchi Sea) | 192 | Laptev Sea | 791574 | 791610 | 2087448 |
| 908 | Saba and Sint Eustatius (Netherlands) | 116 | Eastern Caribbean | 11645 | 868768 | 11645 |
| 654 | Saint Helena (UK) | 218 | St. Helena and Ascension Islands | 444898 | 886540 | 444898 |
| 659 | Saint Kitts & Nevis | 116 | Eastern Caribbean | 9494 | 868768 | 9494 |
| 662 | Saint Lucia | 116 | Eastern Caribbean | 15448 | 868768 | 15448 |
| 666 | Saint Pierre & Miquelon (France) | 87 | Gulf of St. Lawrence - Eastern Scotian Shelf | 3984 | 439219 | 12353 |
| 666 | Saint Pierre & Miquelon (France) | 121 | Southern Grand Banks - South Newfoundland | 8369 | 337376 | 12353 |
| 670 | Saint Vincent & the Grenadines | 116 | Eastern Caribbean | 36195 | 868768 | 36204 |
| 670 | Saint Vincent & the Grenadines | 127 | Southern Caribbean | 9 | 584596 | 36204 |
| 882 | Samoa | 78 | Phoenix/Tokelau/Northern Cook Islands | 20 | 2539942 | 131534 |
| 882 | Samoa | 79 | Samoa Islands | 131490 | 849376 | 131534 |
| 678 | Sao Tome & Principe | 16 | Gulf of Guinea Central | 25 | 382239 | 165347 |
| 678 | Sao Tome & Principe | 206 | Gulf of Guinea Islands | 165322 | 417522 | 165347 |
| 902 | Sardinia (Italy) | 144 | Western Mediterranean | 116735 | 757567 | 116735 |
| 684 | Saudi Arabia (Persian Gulf) | 136 | Arabian (Persian) Gulf | 34039 | 238347 | 34039 |
| 683 | Saudi Arabia (Red Sea) | 30 | Northern and Central Red Sea | 108009 | 228824 | 190190 |
| 683 | Saudi Arabia (Red Sea) | 31 | Southern Red Sea | 82180 | 225930 | 190190 |
| 686 | Senegal | 188 | Cape Verde | 0 | 796555 | 186962 |
| 686 | Senegal | 174 | Gulf of Guinea West | 29053 | 620646 | 186962 |
| 686 | Senegal | 103 | Sahelian Upwelling | 157715 | 335699 | 186962 |
| 690 | Seychelles | 34 | Cargados Carajos/Tromelin Island | 645 | 930174 | 1336041 |
| 690 | Seychelles | 182 | Seychelles | 1331327 | 1334015 | 1336041 |
| 690 | Seychelles | 35 | Western and Northern Madagascar | 4072 | 1334065 | 1336041 |
| 901 | Sicily (Italy) | 104 | Ionian Sea | 46872 | 347361 | 105350 |
| 901 | Sicily (Italy) | 138 | Tunisian Plateau/Gulf of Sidra | 837 | 402162 | 105350 |

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| 901 | Sicily (Italy) | 144 | Western Mediterranean | 57672 | 757567 | 105350 |
| 694 | Sierra Leone | 174 | Gulf of Guinea West | 159301 | 620646 | 159301 |
| 702 | Singapore | 230 | Malacca Strait | 745 | 168385 | 745 |
| 909 | Sint Maarten (Netherlands) | 116 | Eastern Caribbean | 469 | 868768 | 469 |
| 705 | Slovenia | 221 | Adriatic Sea | 147 | 135271 | 147 |
| 90 | Solomon Isl. | 91 | Coral Sea | 215 | 279696 | 1597930 |
| 90 | Solomon Isl. | 133 | New Caledonia | 64 | 1252156 | 1597930 |
| 90 | Solomon Isl. | 2 | Solomon Archipelago | 982846 | 1656641 | 1597930 |
| 90 | Solomon Isl. | 3 | Solomon Sea | 6 | 655151 | 1597930 |
| 90 | Solomon Isl. | 126 | Vanuatu | 614899 | 1662460 | 1597930 |
| 706 | Somalia | 112 | Central Somali Coast | 434019 | 434019 | 831067 |
| 706 | Somalia | 151 | Gulf of Aden | 136246 | 560060 | 831067 |
| 706 | Somalia | 88 | Northern Monsoon Current Coast | 260803 | 260802 | 831067 |
| 953 | South Africa (Atlantic and Cape) | 196 | Agulhas Bank | 369595 | 369595 | 748154 |
| 953 | South Africa (Atlantic and Cape) | 178 | Namaqua | 270087 | 477564 | 748154 |
| 953 | South Africa (Atlantic and Cape) | 197 | Natal | 108096 | 352882 | 748154 |
| 954 | South Africa (Indian Ocean Coast) | 51 | Delagoa | 76934 | 319072 | 321752 |
| 954 | South Africa (Indian Ocean Coast) | 197 | Natal | 244787 | 352882 | 321752 |
| 239 | South Georgia & Sandwich Isl. (UK) | 215 | South Georgia | 521636 | 521723 | 1277822 |
| 239 | South Georgia & Sandwich Isl. (UK) | 217 | South Sandwich Islands | 680268 | 681753 | 1277822 |
| 910 | South Orkney Islands (UK) | 216 | South Orkney Islands | 390278 | 390278 | 497521 |
| 910 | South Orkney Islands (UK) | 28 | South Shetland Islands | 15213 | 341593 | 497521 |
| 962 | Spain (mainland, Med and Gulf of Cadiz) | 80 | Alboran Sea | 45198 | 84149 | 146291 |
| 962 | Spain (mainland, Med and Gulf of Cadiz) | 81 | Saharan Upwelling | 2 | 558772 | 146291 |
| 962 | Spain (mainland, Med and Gulf of Cadiz) | 84 | South European Atlantic Shelf | 14657 | 800447 | 146291 |
| 962 | Spain (mainland, Med and Gulf of Cadiz) | 144 | Western Mediterranean | 86432 | 757567 | 146291 |
| 963 | Spain (Northwest) | 84 | South European Atlantic Shelf | 288027 | 800447 | 288258 |
| 144 | Sri Lanka | 54 | Eastern India | 0 | 420761 | 530943 |
| 144 | Sri Lanka | 162 | South India and Sri Lanka | 530943 | 661444 | 530943 |
| 904 | St Barthelémy (France) | 116 | Eastern Caribbean | 4188 | 868768 | 4188 |
| 905 | St Martin (France) | 116 | Eastern Caribbean | 1098 | 868768 | 1098 |
| 895 | St Paul & Amsterdam Isl. (France) | 200 | Amsterdam-St Paul | 509012 | 509182 | 509012 |
| 970 | St Paul and St. Peter Archipelago (Brazil) | 24 | Sao Pedro and Sao Paulo Islands | 413640 | 413640 | 413636 |
| 736 | Sudan | 30 | Northern and Central Red Sea | 48882 | 228824 | 82542 |
| 736 | Sudan | 31 | Southern Red Sea | 33661 | 225930 | 82542 |
| 740 | Suriname | 226 | Guianan | 132278 | 453298 | 132451 |
| 744 | Svalbard Isl. (Norway) | 100 | North and East Barents Sea | 796297 | 2083243 | 796297 |
| 914 | Sweden (Baltic) | 97 | Baltic Sea | 141770 | 376537 | 141771 |
| 915 | Sweden (West Coast) | 97 | Baltic Sea | 867 | 376537 | 14548 |
| 915 | Sweden (West Coast) | 41 | North Sea | 13681 | 680979 | 14548 |
| 760 | Syria | 106 | Levantine Sea | 10288 | 421745 | 10288 |
| 157 | Taiwan | 49 | East China Sea | 129691 | 686453 | 1149435 |
| 157 | Taiwan | 176 | Gulf of Tonkin | 1 | 289433 | 1149435 |
| 157 | Taiwan | 123 | Palawan/North Borneo | 12 | 572946 | 1149435 |
| 157 | Taiwan | 146 | South China Sea Oceanic Islands | 872731 | 1255398 | 1149435 |

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| 157 | Taiwan | 145 | South Kuroshio | 67917 | 1461400 | 1149435 |
| 157 | Taiwan | 184 | Southern China | 79041 | 283612 | 1149435 |
| 834 | Tanzania | 89 | East African Coral Coast | 240936 | 478916 | 241124 |
| 834 | Tanzania | 182 | Seychelles | 0 | 1334015 | 241124 |
| 834 | Tanzania | 35 | Western and Northern Madagascar | 188 | 1334065 | 241124 |
| 956 | Thailand (Andaman Sea) | 139 | Andaman Sea Coral Coast | 118676 | 283433 | 118728 |
| 956 | Thailand (Andaman Sea) | 230 | Malacca Strait | 51 | 168385 | 118728 |
| 957 | Thailand (Gulf of Thailand) | 56 | Gulf of Thailand | 178651 | 266482 | 179155 |
| 957 | Thailand (Gulf of Thailand) | 57 | Sunda Shelf/Java Sea | 471 | 1386854 | 179155 |
| 626 | Timor Leste | 5 | Banda Sea | 3005 | 941189 | 78230 |
| 626 | Timor Leste | 108 | Bonaparte Coast | 95 | 291172 | 78230 |
| 626 | Timor Leste | 128 | Lesser Sunda | 75130 | 717561 | 78230 |
| 768 | Togo | 16 | Gulf of Guinea Central | 15450 | 382239 | 15450 |
| 772 | Tokelau (New Zealand) | 78 | Phoenix/Tokelau/Northern Cook Islands | 319054 | 2539942 | 319053 |
| 772 | Tokelau (New Zealand) | 79 | Samoa Islands | 0 | 849376 | 319053 |
| 776 | Tonga | 68 | Fiji Islands | 2 | 786024 | 664786 |
| 776 | Tonga | 79 | Samoa Islands | 141323 | 849376 | 664786 |
| 776 | Tonga | 129 | Tonga Islands | 523464 | 840051 | 664786 |
| 77 | Trindade & Martim Vaz Isl. (Brazil) | 52 | Eastern Brazil | 0 | 674995 | 468599 |
| 77 | Trindade & Martim Vaz Isl. (Brazil) | 42 | Trindade and Martin Vaz Islands | 468599 | 468608 | 468599 |
| 780 | Trinidad & Tobago | 116 | Eastern Caribbean | 1203 | 868768 | 80218 |
| 780 | Trinidad & Tobago | 226 | Guianan | 23695 | 453298 | 80218 |
| 780 | Trinidad & Tobago | 127 | Southern Caribbean | 55311 | 584596 | 80218 |
| 856 | Tristan da Cunha Isl. (UK) | 219 | Tristan Gough | 755105 | 1053047 | 813830 |
| 252 | Tromelin Isl. (France) | 34 | Cargados Carajos/Tromelin Island | 270678 | 930174 | 273520 |
| 252 | Tromelin Isl. (France) | 134 | Mascarene Islands | 1468 | 1058073 | 273520 |
| 252 | Tromelin Isl. (France) | 35 | Western and Northern Madagascar | 1375 | 1334065 | 273520 |
| 788 | Tunisia | 104 | Ionian Sea | 65 | 347361 | 99906 |
| 788 | Tunisia | 138 | Tunisian Plateau/Gulf of Sidra | 67274 | 402162 | 99906 |
| 788 | Tunisia | 144 | Western Mediterranean | 32575 | 757567 | 99906 |
| 794 | Turkey (Black Sea) | 155 | Black Sea | 172478 | 460086 | 172478 |
| 966 | Turkey (Marmara Sea) | 105 | Aegean Sea | 11653 | 375812 | 11653 |
| 793 | Turkey (Mediterranean Sea) | 105 | Aegean Sea | 29397 | 375812 | 78102 |
| 793 | Turkey (Mediterranean Sea) | 106 | Levantine Sea | 48693 | 421745 | 78102 |
| 796 | Turks & Caicos Isl. (UK) | 161 | Bahamian | 90586 | 923316 | 90838 |
| 798 | Tuvalu | 15 | Gilbert/Ellis Islands | 751419 | 2396454 | 751747 |
| 798 | Tuvalu | 79 | Samoa Islands | 1 | 849376 | 751747 |
| 804 | Ukraine | 155 | Black Sea | 133416 | 460086 | 133418 |
| 784 | United Arab Emirates | 136 | Arabian (Persian) Gulf | 54445 | 238347 | 54445 |
| 968 | United Arab Emirates (Fujairah) | 136 | Arabian (Persian) Gulf | 0 | 238347 | 4424 |
| 968 | United Arab Emirates (Fujairah) | 93 | Gulf of Oman | 4424 | 275487 | 4424 |
| 826 | United Kingdom (UK) | 85 | Celtic Seas | 383999 | 879067 | 732663 |
| 826 | United Kingdom (UK) | 39 | Faroe Plateau | 1405 | 267926 | 732663 |
| 826 | United Kingdom (UK) | 41 | North Sea | 346989 | 680979 | 732663 |
| 858 | Uruguay | 130 | Rio de la Plata | 16235 | 31666 | 162929 |

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| 858 | Uruguay | 132 | Rio Grande | 36 | 283176 | 162929 |
| 858 | Uruguay | 131 | Uruguay-Buenos Aires Shelf | 146446 | 400686 | 162929 |
| 850 | US Virgin Isl. | 161 | Bahamian | 472 | 923316 | 38259 |
| 850 | US Virgin Isl. | 116 | Eastern Caribbean | 33502 | 868768 | 38259 |
| 850 | US Virgin Isl. | 143 | Greater Antilles | 4285 | 1157222 | 38259 |
| 958 | USA (Alaska, Arctic) | 47 | Beaufort Sea - continental coast and shelf | 227695 | 503059 | 508181 |
| 958 | USA (Alaska, Arctic) | 48 | Chukchi Sea | 280486 | 646109 | 508181 |
| 959 | USA (Alaska, Subarctic) | 177 | Aleutian Islands | 1258109 | 1258111 | 3198131 |
| 959 | USA (Alaska, Subarctic) | 48 | Chukchi Sea | 0 | 646109 | 3198131 |
| 959 | USA (Alaska, Subarctic) | 17 | Eastern Bering Sea | 901747 | 1049507 | 3198131 |
| 959 | USA (Alaska, Subarctic) | 172 | Gulf of Alaska | 870831 | 870831 | 3198131 |
| 959 | USA (Alaska, Subarctic) | 61 | Kamchatka Shelf and Coast | 9636 | 929205 | 3198131 |
| 959 | USA (Alaska, Subarctic) | 166 | North American Pacific Fijordland | 155656 | 478070 | 3198131 |
| 851 | USA (East Coast) | 161 | Bahamian | 33598 | 923316 | 925167 |
| 851 | USA (East Coast) | 173 | Carolinian | 370086 | 370086 | 925167 |
| 851 | USA (East Coast) | 75 | Floridian | 45993 | 229441 | 925167 |
| 851 | USA (East Coast) | 143 | Greater Antilles | 125 | 1157222 | 925167 |
| 851 | USA (East Coast) | 55 | Gulf of Maine/Bay of Fundy | 138207 | 198833 | 925167 |
| 851 | USA (East Coast) | 92 | Virginian | 337157 | 337157 | 925167 |
| 852 | USA (Gulf of Mexico) | 75 | Floridian | 181919 | 229441 | 695619 |
| 852 | USA (Gulf of Mexico) | 143 | Greater Antilles | 33 | 1157222 | 695619 |
| 852 | USA (Gulf of Mexico) | 74 | Northern Gulf of Mexico | 513615 | 598106 | 695619 |
| 852 | USA (Gulf of Mexico) | 122 | Southern Gulf of Mexico | 53 | 688764 | 695619 |
| 848 | USA (West Coast) | 71 | Northern California | 402773 | 402773 | 822713 |
| 848 | USA (West Coast) | 142 | Oregon, Washington, Vancouver Coast and Shelf | 312818 | 437987 | 822713 |
| 848 | USA (West Coast) | 181 | Puget Trough/Georgia Basin | 6457 | 15770 | 822713 |
| 848 | USA (West Coast) | 72 | Southern California Bight | 100662 | 642335 | 822713 |
| 548 | Vanuatu | 133 | New Caledonia | 11 | 1252156 | 811151 |
| 548 | Vanuatu | 126 | Vanuatu | 811178 | 1662460 | 811151 |
| 862 | Venezuela | 116 | Eastern Caribbean | 91220 | 868768 | 472938 |
| 862 | Venezuela | 143 | Greater Antilles | 736 | 1157222 | 472938 |
| 862 | Venezuela | 226 | Guianan | 32026 | 453298 | 472938 |
| 862 | Venezuela | 127 | Southern Caribbean | 348969 | 584596 | 472938 |
| 704 | Viet Nam | 56 | Gulf of Thailand | 39234 | 266482 | 1441983 |
| 704 | Viet Nam | 176 | Gulf of Tonkin | 145622 | 289433 | 1441983 |
| 704 | Viet Nam | 123 | Palawan/North Borneo | 12 | 572946 | 1441983 |
| 704 | Viet Nam | 146 | South China Sea Oceanic Islands | 865308 | 1255398 | 1441983 |
| 704 | Viet Nam | 184 | Southern China | 0 | 283612 | 1441983 |
| 704 | Viet Nam | 150 | Southern Vietnam | 181956 | 181956 | 1441983 |
| 704 | Viet Nam | 57 | Sunda Shelf/Java Sea | 209850 | 1386854 | 1441983 |
| 872 | Wake Isl. (USA) | 19 | Marshall Islands | 407241 | 2399284 | 407241 |
| 876 | Wallis & Futuna Isl. (France) | 68 | Fiji Islands | 2 | 786024 | 261313 |
| 876 | Wallis & Futuna Isl. (France) | 15 | Gilbert/Ellis Islands | 3039 | 2396454 | 261313 |
| 876 | Wallis & Futuna Isl. (France) | 79 | Samoa Islands | 258277 | 849376 | 261313 |
| 917 | Yemen (Arabian Sea) | 151 | Gulf of Aden | 400555 | 560060 | 491292 |

| | | | | | | |
|-----|---------------------|-----|---------------------|-------|--------|--------|
| 917 | Yemen (Arabian Sea) | 135 | Western Arabian Sea | 90732 | 549923 | 491292 |
| 916 | Yemen (Red Sea) | 151 | Gulf of Aden | 1608 | 560060 | 35677 |
| 916 | Yemen (Red Sea) | 31 | Southern Red Sea | 34070 | 225930 | 35677 |

Appendix E: Sea Around Us Experts Network

The table below provides the names and institutions of fisheries experts who helped us review the assessment for countries where catch and assessment data were: 1) numerous and thus it was important that we use the correct and most recent prior; or 2) scarce and thus the input of an expert might improve the assessments. Invitations were sent to more potential reviewers in more countries than are listed here, but the table lists only colleagues who responded positively, and to whom we here express our sincerest thanks.

| Country | Sea Around Us contacts | # Contacted | # Engaged |
|---------------------|---|-------------|-----------|
| Australia | Beth Fulton (CSIRO, Canberra, Australia); Graham Edgar (University of Tasmania; Brent Wise (Department of Primary Industries & Regional Development)) | 3 | 3 |
| Bahamas | Nicola Smith (Simon Fraser University, Vancouver, Canada) | 1 | 1 |
| Bangladesh | Hadayet Ullah (WorldFish, Dhaka, Bangladesh) | 1 | 1 |
| Canada | Jeff Hutchings (Dalhousie University, Halifax, Canada) | 3 | 1 |
| Cape Verde | Nuno Vieira and Alciany da Luz (INDP, Mindelo, Cape Verde) | 2 | 2 |
| Cyprus, Republic of | Giuseppe Scarcella (CNR, Verona, Italy) | 1 | 1 |
| France (Atlantic) | Rainer Froese (GEOMAR, Kiel, Germany) | 1 | 1 |
| France (Med) | Myriam Khalfallah (IOF, Vancouver, Canada); Giuseppe Scarcella; Athanassios Tsikliras (Aristotle University of Thessaloniki, Thessaloniki, Greece) | 4 | 3 |
| Gabon | Myriam Khalfallah | 1 | 1 |
| Germany | Rainer Froese | 1 | 1 |
| Greece | Athanassios Tsikliras | 1 | 1 |
| Indonesia | Austin Humphries (University of Rhode Island, Rhode Island, USA) | 1 | 1 |
| Iran | Myriam Khalfallah | 1 | 1 |
| Ireland | Rainer Froese | 1 | 1 |
| Italy | Giuseppe Scarcella | 1 | 1 |
| Jordan | Myriam Khalfallah | 1 | 1 |
| Kenya | Paul Tuda (WIOMSA, Mombasa, Kenya) | 1 | 1 |
| Kuwait | Myriam Khalfallah | 1 | 1 |
| Malaysia | Mazlin Mokhtar (Universiti Kebangsaan, Selangor, Malaysia) | 1 | 1 |
| Malta | Athanassios Tsikliras | 1 | 1 |
| Mexico | Andres and Miguel Cisneros-Montemayor (IOF, Vancouver, Canada); Mauricio Ramirez, Francisco Arreguin (CICIMAR, La Paz, Mexico); Enrique Morales (CIBNOR, La Paz, Mexico); Hector Reyes (Universidad Autónoma de Baja California Sur, La Paz, Mexico); Alvaro Hernandez, Silvia Salas (Universidad Marista de Mérida, Mérida, Mexico); Fernando Marquez (Universidad Autónoma de Sinaloa, Sinaloa, Mexico) | 10 | 4 |
| Morocco | Myriam Khalfallah | 1 | 1 |
| Mozambique | Paul Tuda | 1 | 1 |
| Namibia | John Kathena (MFMR, Rundu, Namibia) | 2 | 1 |
| New Zealand | Barry Torkington (New Zealand Asia Institute, Auckland, New Zealand) | 1 | 1 |
| Oman | Myriam Khalfallah | 1 | 1 |

| | | | |
|------------------------------------|--|-----------|-----------|
| Pakistan | Hadayet Ullah (WorldFish, Dhaka, Bangladesh) | 1 | 1 |
| Peru | Santiago de la Puente (IOF, Vancouver, Canada) | 1 | 1 |
| Philippines | Maria Lourdes D. Palomares (IOF, Vancouver, Canada) | 1 | 1 |
| Saudi Arabia | Myriam Khalfallah | 1 | 1 |
| Senegal | Beyah Meisse (IMROP, La Batterie, Mauritania) | 2 | 1 |
| Somalia | Abdiwahid (Joar) Hersi (IGAD, Djibouti, Somalia) | 3 | 1 |
| Spain (Atlantic) | Rainer Froese | 1 | 1 |
| Spain (Med) | Myriam Khalfallah, Giuseppe Scarcella, Athanassios Tsikliras | 4 | 3 |
| Sweden | Rainer Froese | 1 | 1 |
| Tanzania, United Republic of | Paul Tuda | 1 | 1 |
| Tunisia | Myriam Khalfallah | 1 | 1 |
| Turkey | Nazli Demirel (Istanbul University, Istanbul, Turkey) | 1 | 1 |
| Total | | 62 | 48 |

The Commonwealth Scientific and Industrial Research Organisation (CSIRO); National Institute of Fisheries Development (INDP); National Research Council (CNR); Research Center for Marine Geosciences (GEOMAR); Institute for the Oceans and Fisheries (IOF); The Western Indian Ocean Marine Science Association (WIOMSA); The Interdisciplinary Center for Marine Sciences (CICIMAR); Northeast Biological Research Center (CIBNOR); Ministry of Fisheries and Marine Resources (MFMR); Mauritanian Institute for Oceanographic Research and Fisheries (IMROP); Intergovernmental Authority on Development (IGAD).