

WELCOME TO www.searoundus.org: Launching our 'products' on the web

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Introducing ...
... the *Sea Around Us*
project's web products
site. The website allows us
to meet our mandate to
investigate and document
global impacts of fishing on
marine ecosystems. We
have put considerable effort
over the last four years into
gathering sources of

has been rather successful,
leading to major
publications in *Nature*,
Science and other outlets
(e.g. Watson and Pauly
2001; Pauly et al. 2002;
Pauly et al. 2003). The new
website is our attempt to
share the data upon which
these publications were
based, summarized to be

Zones (EEZ) of maritime
countries;
2) Large Marine Ecosystems
(LMEs); and
3) High Sea Areas, divided
into the 18 statistical areas
used by the Food and
Agriculture Organization
(FAO) of the United Nations
(Fig. 1).

Besides offering our catch
data globally, and separately
for each of the entities
above, the site provides 'deep
links' to related collaborating
sites such as FishBase
(www.fishbase.org) and
CephBase
(www.cephbase.utmb.edu),
thus providing a powerful
synergistic tool for
investigating the biodiversity
in EEZs, LMEs and High Sea
Areas. As well, the site offers
interactive and dynamic
maps of the catch and
distribution of many
important marine organisms,
plus a wide range of graphs
showing changes in
commercial catches since
1950.

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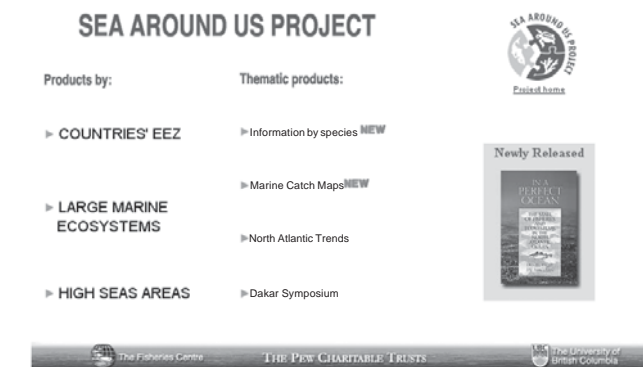


Fig. 1 The *Sea Around Us* project's web products menu, allowing choices for a range of spatial and subject areas

fisheries catch data and into
devising ways to extract
better spatial resolution
from these statistics. This
work, which is documented
in several contributions,
notably Watson *et al.* (2004),

useful to a wide range of
individuals and
organizations interested in
marine fisheries and
biodiversity. The formats we
chose for data summary are:
1) the Exclusive Economic

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The site offers access to a vast range of marine data in a simple interactive way

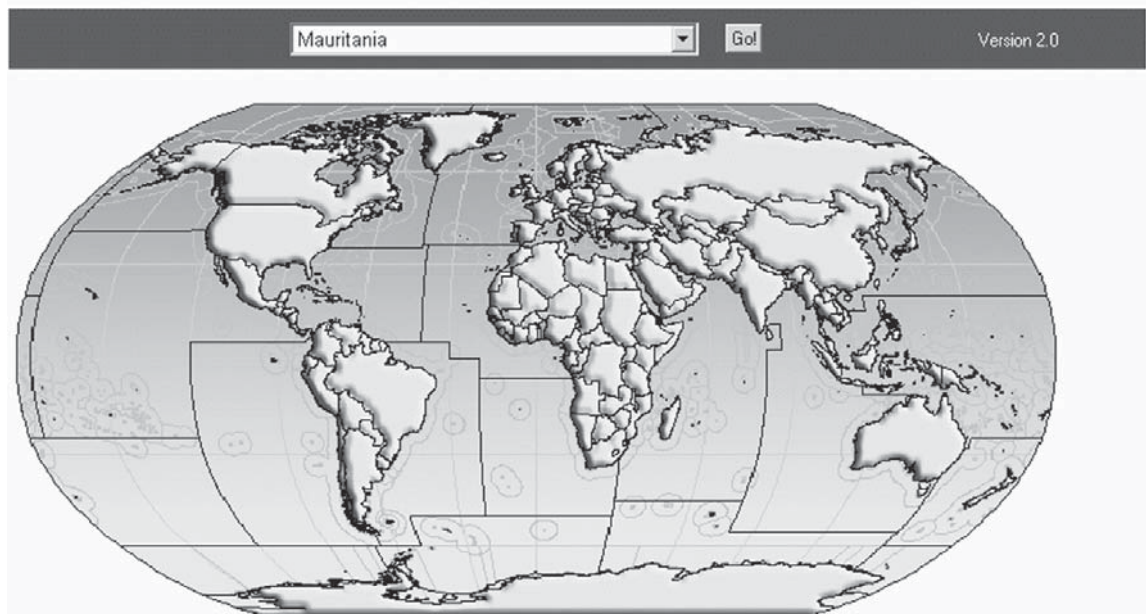


Fig. 2. Interactive map and list offering information on any coastal country.

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The site, which Cindy Young of Mousetrap Media helped us design, offers access to a vast range of marine data in a simple

interactive way, and actually has two components: The first (www.seararoundus.org) offers direct access to the web products our project has generated. The second (www.seararoundus.org/project.htm) offers information about the *Sea Around Us* project (SAUP) itself: its aims, personnel, publications, media coverage and contact information. The sites can be accessed directly or via the Fisheries Centre's web site (www.fisheries.ubc.ca).

In the following sections, we introduce some of the key features of our 'web products'.

Countries' EEZ

This choice allows access to an interactive map and drop-down

list of coastal countries (Fig. 2). Many countries fall within more than one of FAO's statistical areas. For each country, information is available on 'Catches', 'Biodiversity', 'Ecosystems' and 'Governance' (Fig. 3). Catches are available, for each country and section of its EEZ from 1950 to the present (Fig. 4; see Boxes 1 & 2).

These graphs are available for many different groupings of commercial catch and can include common as well as scientific names.

One important aspect of the catches in these graphs (and of the corresponding data tables, which can be downloaded into a

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The *Sea Around Us* website may be found at saup.fisheries.ubc.ca and contains up-to-date information on the project.

The *Sea Around Us* project is a Fisheries Centre partnership with the Pew Charitable Trusts of Philadelphia, USA. The Trusts support nonprofit activities in the areas of culture, education, the environment, health and human services, public policy and religion. Based in Philadelphia, the Trusts make strategic investments to help organisations and citizens develop practical solutions to difficult problems. In 2000, with approximately \$4.8 billion in assets, the Trusts committed over \$235 million to 302 nonprofit organisations.

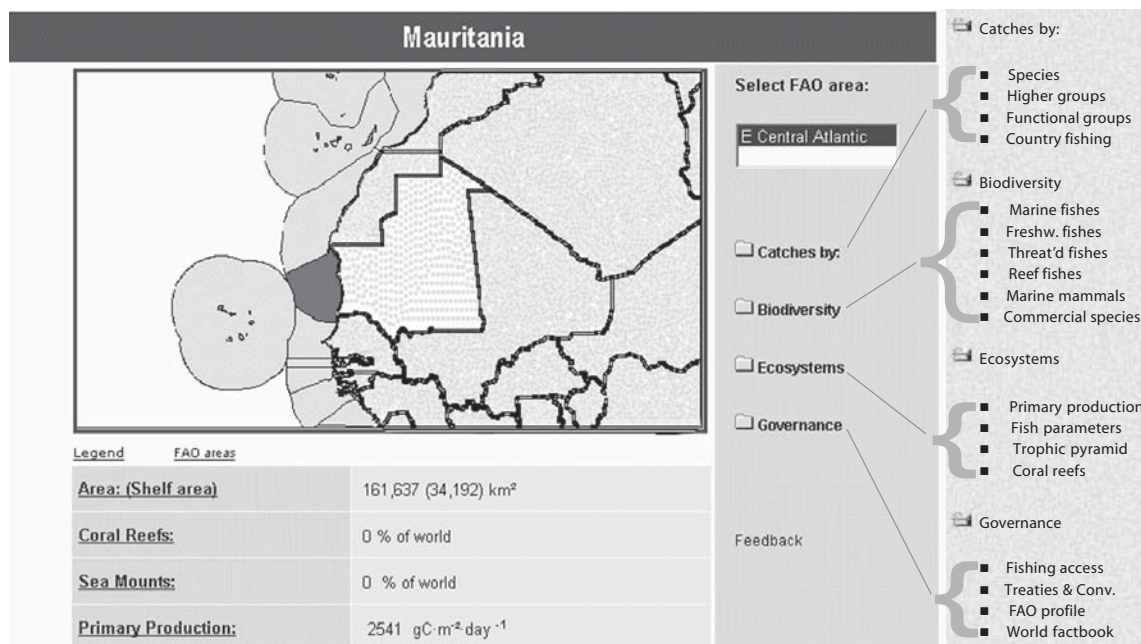


Fig. 3. An example of (a) Mauritania showing a variety of quick statistics (with links), and (b) choices for presentations of commercial catches, as well as biodiversity, ecosystem and governance links.

Continued from page 2 spreadsheet) is that they refer to the EEZ of the country in question. Here, catches by EEZ include catches taken by ALL countries in this particular area

and may therefore reflect the amount of fisheries resources extracted from this area much more closely than standard fisheries statistics. Catch series from a given EEZ can also be

viewed 'by country', a unique feature of the site, not emulated by any other site with fisheries information (Fig. 5). This is made possible by a built-in database of 'Access Agreements', which builds on a list (FARISIS) kindly supplied by FAO, and which we tripled in size, in an attempt to cover all the international fisheries access agreements so far documented (see Box 3). The site makes these access agreements available by country and year, and each is documented by a reference (though some are still incomplete).

Note that because of the spatially explicit nature of the catch data presented here, they are bound to differ from those available from FAO, even though this dataset served as our starting point. Moreover, we are now gradually replacing catch data known to be erroneous, for countries whose time series we have examined in some detail - e.g. China (Watson and Pauly 2001) and many Caribbean states (Zeller and Mohammed, 2002; Zeller *et al.* 2003).

... catches may therefore reflect the amount of fisheries resources extracted much more closely than standard fisheries statistics

Box 1. Disaggregating landings by Reg Watson

Having fisheries catch data at a suitable spatial scale for most of the world is problematic. Where fisheries landing records exist (and they do exist in some form for most of the fisheries of the world) these statistics usually suffer from a number of deficiencies. Ignoring typical problems of missing/incomplete data and inconsistent units of measure, one of their most common weaknesses is that they are often quite vague. They can be vague in two ways: i) they can be very uncertain as to the identity of the harvested taxa (*i.e.* what was it?); and ii) very often, the catch location is not well defined or has poor spatial resolution (*i.e.* where was it?). To overcome this problem, over the past four years the SAUP has developed a spatial allocation process that relies on supporting databases and rule-based procedures to map existing coarse-scale reported landings from large statistical areas into the most probable distribution amongst a global system of approximately 180,000 water cells, each measuring 30 minutes latitude by 30 minutes of longitude. There are two main types of databases involved. The first relates to the global distributions of the reported taxa (See Box 2). The second, more challenging supporting database, describes the access of fishing nations to the fisheries resources of other coastal countries based on agreements and observations (see main text and Box 3). The intersection of these databases guides the allocation of fine-scale fisheries catches.

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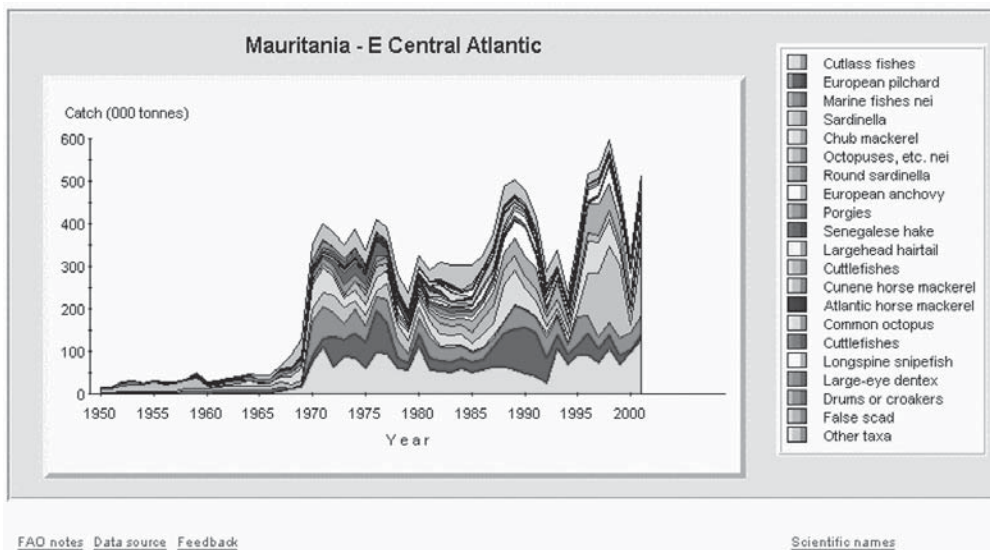


Fig. 4. Graph of commercial catches of fishes, crustacean and mollusks taken from Mauritanian EEZ waters since 1950 (common names serve as defaults, but the scientific names can also be accessed).

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Links are available for many species to databases such as FishBase. Maps of the global distribution of species are also available (see Information by Species).

Biodiversity, Ecosystem and Governance Information

In addition to catches for every EEZ, the website provides information and/or links to databases with further material about that EEZ. For example: its biodiversity, in the form of lists of

fish and cephalopods (through FishBase and CephBase, respectively) and marine mammals. More taxonomic groups will follow (initially marine reptiles, echinoderms and marine plants, followed by others).

The coverage of the 'Ecosystems' of an EEZ presently includes an animated map and related information on primary production in that area (Fig. 6), links to FishBase accessing ecosystem-related parameters of fish (as required for

construction of trophic models using *Ecopath with Ecosim*; see www.ecopath.org), a simple trophic pyramid, and for countries with coral reefs, a deep link to ReefBase (www.reefbase.org). We will add marine ecosystem indicators to

Box 2. You couldn't have caught that there!

by Reg Watson, Adrian Kitchingman & Daniel Pauly

It is obvious that landings cannot occur where the reported species do not occur. The distribution of a species (or higher taxa) is therefore a very useful tool to limit the available areas where catches can be made. We developed and used a global database of the distributions of commercial species in our process of assigning landings statistics to spatial cells. Information for this database was sourced from published global distributions (where available) or by using other sources of information to help restrict the range. These include water depth (for non-pelagic species) and latitudinal limits. In addition, a species' distribution may be limited by proximity to critical habitats. Several of these were identified and sources of mapped distributions found. These include coral reefs, mangrove, and seagrass (World Conservation Monitoring Centre, Cambridge, England), seamounts (NOAA National Geophysical Data Centre) and estuaries (Alder 2003). Conversely, it is highly unlikely that commercial quantities of fish will be landed from ocean areas permanently covered by ice. Ice coverage was received from the U.S. National Snow and Ice Data Center, Boulder, Colorado (www.nsidc.org). Many commercial species have been recorded and collected by scientific expeditions for centuries, and have been well documented by museum records (see Box 5). FishBase is an excellent on-line database, and records the presence or absence of taxa by country and by FAO statistical area. CephBase has similar records for cephalopods. Using these sources we can further restrict the possible locations of catches to those known to be within the range of recorded specimens.

this, notably trends in mean trophic levels and related indices, and databases of various critical habitats, such as estuaries (Alder 2003).

The coverage of 'Governance' of a given EEZ presently consists of the fishing access agreements involving the country in question (see above and Box 3), treaties and conventions to which that country is signatory (from FishBase) and links to profiles of that country.

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Large Marine Ecosystems and High Seas Areas

Most of the fisheries catches, biodiversity, ecosystem and governance related information available for the EEZs of maritime countries are also made available for the LMEs described at www.edc.uri.edu/lme, thus complementing this database for researchers working on LMEs. Similarly, we provide a large subset of

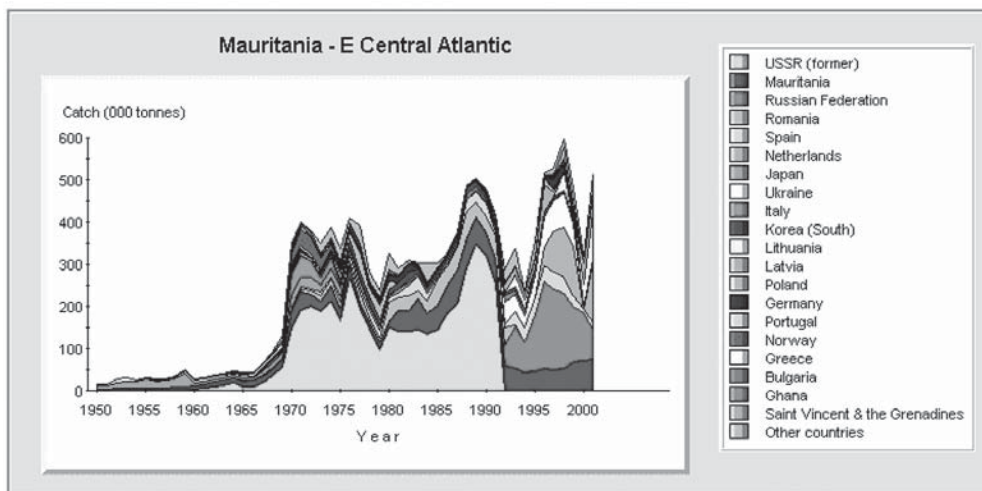


Fig. 5. Graph of commercial catches taken by countries fishing in Mauritanian EEZ waters since 1950.

Primary Production: USA (contiguous states)

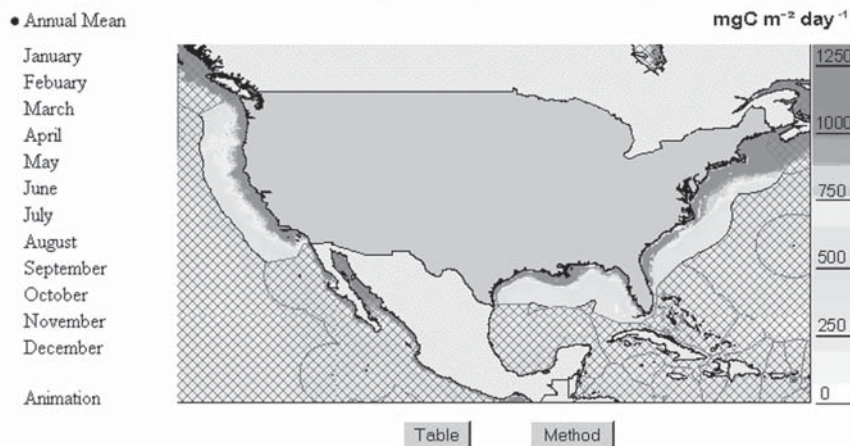


Fig. 6 Primary production for the EEZ of the US contiguous states made possible through collaboration with the European Union's Joint Research Center in Ispra, Italy.

mollusks, and to all species of marine mammals (see Box 4). Other groups, notably reptiles (Wabnitz 2004) and echinoderms (Palomares *et al.* 2004) will be added soon. Each map comes with full facilities such as zooming, panning and the ability to overlay other data layers. In addition, there is a useful link called 'parameters used', which opens a

window describing the parameters such as depth, latitude *etc.*, used to restrict

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our data in the non-EEZ waters of FAO Statistical Areas, thus contributing to a better understanding of these areas - presently the focus of discussions concerning the protections of high seas' biodiversity. These data can also be used to inform the ongoing process for claims to extended jurisdiction for continental shelf areas beyond 200 nautical miles, under provision of the UN Convention of the Law of the Sea.

Information by species

This part of the site makes available distribution maps, derived using generic rule-based habitat suitability modeling

approaches (see Box 2) and useful links to the most commercially important fishes (see e.g. Fig. 7), crustaceans and

Box 3. Access arrangements by Jackie Alder

Access arrangements fall into the following five categories:

- 1) Formal multilateral or bilateral arrangements (usually government to government).
- 2) Joint ventures (government to private companies or associations).
- 3) Illegal access.
- 4) Documented history of fishing in the area prior to the introduction of EEZs under the United Nations Convention on the Law of the Sea (UNCLOS).
- 5) Observations documented in reports, news services etc.

Catches for any year since 1950 and for all major species and groups are available in form of dynamic maps

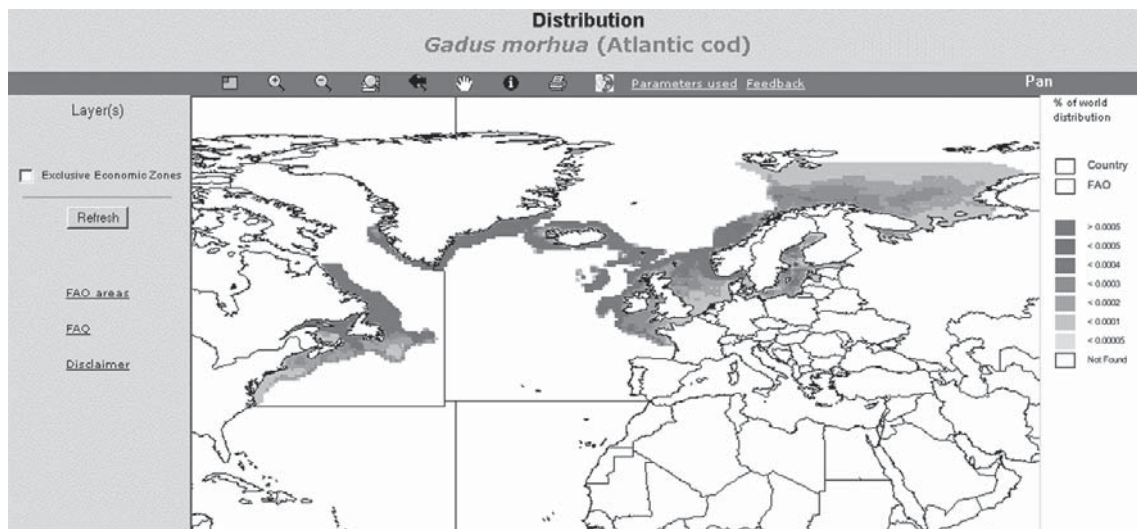


Fig. 7. This example of dynamic mapping shows the global distribution of Atlantic cod.

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the distribution of the species in question, as well as references for the supporting literature. Many of these distributions are tentative (especially for groups of species) and we look forward to feedback on how to improve them.

Global Marine Catch Maps

Catches for any year since 1950 and for all major species and groups are available in form of dynamic maps, based on the spatial allocation algorithm described in Watson *et al.* (2004)

and documented online, through a pop-up window with 'Frequently Asked Questions' and described here in Box 1.

North Atlantic Trends and Dakar Symposium

The *Sea Around Us* website also documents regional products of the project, notably the secular declines in the abundance of high trophic level fishes in the North Atlantic (based on the work of Christensen *et al.* 2003). Furthermore, the website documents an international symposium held in Dakar,

Senegal in June 2002, which was co-sponsored by the project. This symposium served as outlet for much of our work on the status of the marine ecosystems along the coast of Northwest Africa.

The Future

Numerous additions to the website are planned for the near future. Thus, the catch series will be complemented by information about illegal, unreported and unregulated catches. Also, we will add a number of taxa to the

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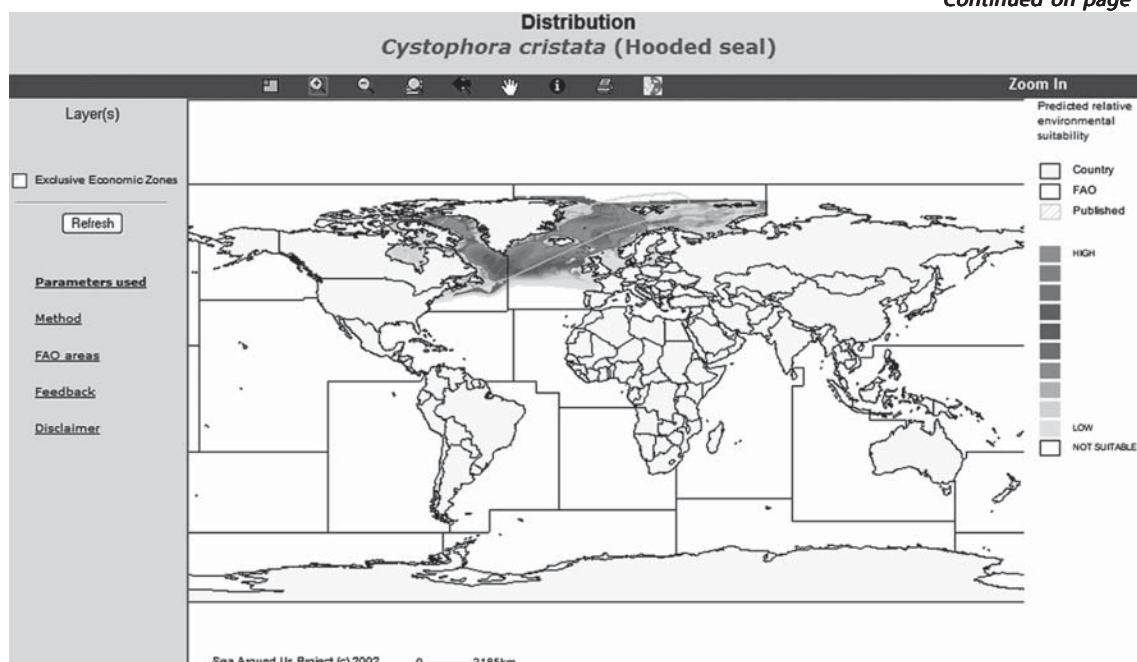


Fig. 8. The predicted global distribution of the hooded seal (see Box 4).

Box 4. We may know more than we think we know...

by Kristin Kaschner

In comparison to fish, most marine mammal species are rare in terms of numbers. Often located at the top of the food chain, marine mammals are affected and frequently threatened by fisheries and other human activities, through bycatch, competition for food resources or pollution. In order to effectively reduce such negative impacts, it is necessary to know where species occur or where there may be areas of conflict. Given the low densities of these species in combination with the vastness of the marine environment and the fact that marine mammals spend the majority of their lives under water and roam widely through the oceans, it is very difficult to determine whether a species does not occur in a particular area or whether we have not spent enough time looking there or simply missed it when we did look there. All of these factors contribute to the difficulties we encounter when trying to map distributions of any whale, dolphin or pinniped species. Consequently, existing maps are very vague, often consisting only of outlines, sketched manually by experts, representing what is believed to be the maximum boundaries of a given species' occurrence. As part of the *Sea Around Us* project we have developed a rule-based approach to map the distributions of marine mammals in a more objective way. Using our model we relate what is known about a species' general habitat preference to the locally prevailing environmental conditions in an area, thus effectively showing where the environment may be suitable for a given whale or pinniped species. In other words, the model visualizes the geographic regions that experts describe essentially when they talk about a "coastal, tropical species" (such as e.g. the Atlantic humpbacked dolphin) or a species that "prefers offshore, polar waters" (such as e.g. the hooded seal, see Fig. 8). Although the actual occurrence of a species may depend on a number of additional factors, we have tested the model extensively and have shown that we can already explain known patterns of species occurrence quite well using this approach. In the context of sustainable fisheries management, our model allows investigations of biodiversity and the relative importance of specific areas to groups of marine mammal species. Moreover, we can map large-scale geographic regions that represent potential zones of conflict with fisheries by linking what is known about abundances and dietary preferences to our mapped distributions and comparing this with disaggregated fisheries catches. All of these applications may help to develop efficient design of marine protected areas.

Most taxonomic databases found online do not include sufficient geographic information to allow for the global linkages to EEZ and LMEs that we consider essential

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biodiversity section. This requires more work than widely assumed, as most taxonomic databases found online do not include sufficient geographic information to allow for the global linkages to EEZs and LMEs that we consider essential. To complement our taxonomic information, we will be adding historical species distributions, determined from the log books of early explorers (see Box 5). To the ecosystem section we will be adding an extensive database of estuaries of the world (Alder 2003). Rashid Sumaila and other members of the Fisheries Centre's Fisheries Economics Research Unit will be contributing ex-vessel prices for

fish and invertebrates, thus allowing mapping of catch values and graphing their trends. Fisheries Centre graduate student Pablo Trujillo will soon complete his global mapping of coastal aquaculture, while collaboration with Dr Ratana Chuenpagdee, of St. Francis Xavier University in Antigonish, Nova Scotia, will allow mapping of a number of small-scale fisheries. We also plan to add recently-created maps of fishing effort, based on the fuel consumption of fishing fleets, and other indices. A planned collaboration with the World Resource Institute will allow mapping of trawled and dredged catches, while another

collaboration with the World Wildlife Fund will allow mapping the marine protected areas of the world (Wood 2004). We will also make available images quantifying the changes in ecosystem structure brought about by fishing, based both on indicators (mean trophic levels, FiB index, indices measuring the diversity of species in the catch, etc.) and through direct reconstruction of the biomass that must have been present, given observed catches and other constraints.

In other words: lots of work! We hope this will be found useful.

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Box 5. Unfolding history

by M.L. Deng Palomares

Occurrence records indicate the presence of a species in a specific locality during a specific period of time. Occurrence records presented in species distribution maps may be used to determine areas of high biodiversity or endemism. Comparisons of these maps through time may also help in identifying trends in the fish biodiversity of the world's oceans and hence to the appropriate management actions needed for their conservation. However, such distribution maps are available mainly for commercially exploited fish species - the lack of baseline biodiversity data is the main hindrance to creating distributions for a broader set of species. Though not easily accessible, such data can be 'reacquired' from records of specimens brought back by, e.g., the many French scientific expeditions from the late 1700s to the early 1900s. Records of specimens brought back by these expeditions are available in digital format. However, the related geographic information, though extractable from the original expedition logs, is most often captured incompletely or even erroneously. Differences in the reference meridian used (e.g., of Paris as opposed to that of Greenwich), changes in the scientific name of the species and/or in the place names of the area in which the sample was caught need to be standardized before any useful analysis of the data can be done. To meet this challenge, the *Sea Around Us* project and the Ichthyology Laboratory of France's Muséum National d'Histoire Naturelle are collaborating to 'reacquire' records of specimens obtained by these early expeditions. Sources used to complete this work include expedition journals, memoirs and logbooks from the 18th, 19th and 20th Centuries, more recent publications summarizing or analyzing these earlier reports and catalogues of museum fish collections (hand and type-written logs), both computerized and in hard copy. This effort will soon be made available through the *Sea Around Us* project's Expeditions web page. As it turns out, electronic media can give a second breath or 'second souffle' to data and samples which many thought lay mummified in old museums. Vive la biodiversité!

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Acknowledgments

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