Sea Around Us

A global assessment of marine protected areas: a new *Sea Around Us* initiative

by Louisa Wood

One of the main goals of the S*ea Around Us* project is to devise policies that mitigate and reverse the negative impacts of fisheries on marine ecosystems globally. One such policy is the establishment of representative networks of large marine protected areas (MPAs; see *e.g.* Pauly and Maclean 2003). While MPAs represent just one of a suite of policies considered necessary to halt the current decline in fish catches and biomass, and biodiversity as a whole, it is one that resonates through the recent literature and the international conservation community. Most recently, Recommendation 5.22 of the Fifth World Parks Congress (Vth WPC) held in Durban in September 2003 was made to "Greatly increase the marine and coastal area managed in marine protected areas by 2012. These networks should be extensive and include strictly protected areas that amount to at least 20-30% of each habitat" (IUCN 2003).

However, it is currently estimated that less than 0.5% of the world's marine habitats are protected (Spalding and Chape, in press). This estimate is based on the World Database on Protected Areas, WDPA, (maintained by UNEP-WCMC[1]), the only source of global MPA data. However, this database is incomplete and so current estimates are of limited reliability. In the absence of an accurate global MPA baseline, neither international nor the *Sea Around Us* project's recommendations can be implemented. Cognizant of this, the 31st decision taken during the CBD COP7[2] in February 2004 "Invites UNEP-WCMC, in collaboration with relevant organizations and authorities, to provide and maintain up-to-date information on marine and coastal protected areas ..."

A new collaboration, recently developed between the *Sea Around Us* project, WWF, UNEP-WCMC, and IUCN-WCPA[3], explicitly takes up this invitation. This relationship is predominantly manifested as my PhD project, which began in September 2003.

My PhD project has two main aims: firstly, to develop a more robust global MPA baseline than currently exists for either terrestrial or marine protected areas; and secondly, to develop alternative scenarios of global MPA networks using spatial modelling techniques. Achieving the first goal involves:

1. Improving current estimates of marine area and marine habitat coverage of MPAs;
2. Assessing management and governance infrastructure supporting MPAs; and
3. Performing other descriptive analyses of MPAs using the *Sea Around Us* project databases.

The project is embedded within a larger proposal by UNEP-WCMC to develop a sustainable system for the collation of accurate data, including detailed MPA ecosystem information. I am presently implementing the first phase of this, which is to make a series of 'broad-

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brush' global updates. The success of this initiative is clearly contingent on the availability of, and access to, information. The global scale necessitates collaboration. Further collaborations (additional to that between SAUP, WWF, UNEP-WCMC and IUCN-WCPA) are being developed and / or investigated with relevant international (e.g. the Ramsar Convention Secretariat, the UNESCO-MAB[4] Secretariat, the UNESCO-WHC[5] Secretariat, and the CBD Secretariat), regional and national organizations as appropriate (of which there are too many to list). Further collaborations are sought (please contact me for details).

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In September 2003, I was fortunate enough to attend the Fifth World Parks Congress, in Durban, South Africa, where I was able to introduce and promote the project, which was also recently introduced at CBD COP7 by Marjo Vierros of the Secretariat of the CBD. Since acquiring the latest version of WDPA in late December, I have been developing an MPA database, based on the contents of the WDPA and additional sources. This work in progress will be available for review and verification in the near future. For further details on the database, the project as a whole, or your potential collaboration with the project, please contact me (l.wood@fisheries.ubc.ca).

Fisherman at Bazaruto Archipelago MPA in Mozambique. Subsistence fishing by local communities is permitted. Photo by Colette Wabnitz.

Acknowledgements

Thanks to Daniel Pauly and the *Sea Around Us* project team for providing a great working environment. Thanks also to WWF Canada and International, particularly Josh Laughren and Simon Cripps, for financial and logistical support during this first year of my PhD, to UNEP-WCMC for technical support regarding WDPA, and to IUCN-WCPA for additional support. Final thanks to Marjo Vierros and the Secretariat for the CBD for their ongoing support for the project.

End notes

[1] The United Nations Environment Programme - World Conservation Monitoring Centre

[2] Seventh Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD)

[3] World Conservation Union – World Commission on Protected Areas

[4] United Nations Educational, Scientific and Cultural Organisation – Man and the Biosphere.

[5] United Nations Educational, Scientific and Cultural Organisation – World Heritage Convention.

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Our mailing address is: UBC Fisheries Centre, Lower Mall Research Station, 2259 Lower Mall, Vancouver, British Columbia, Canada, V6T 1Z4. Our fax number is (604) 822-8934, and our email address is SeaNotes@fisheries.ubc.ca. All queries (including reprint requests), subscription requests, and address changes should be addressed to Robyn Forrest, *Sea Around Us* Newsletter Editor.

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.

SPECIAL FEATURE
SEACUKES: a database

by M.L. Deng Palomares, Vasiliki Karpouzi and Daniel Pauly

CITES has been considering how it might assist with managing the international trade in sea cucumbers. Partly as a result, sea cucumbers became the first group for which the *Sea Around Us* project created a biodiversity database. This database includes taxonomic and distributional information on more than 1700 nominal species (of which more than 1400 are valid: Smiley 1994; Kerr and Kim 2001) of sea cucumbers (Holothuroidea, Echinodermata) distributed in more than 200 genera and 25 families.

Biology of sea cucumbers

Sea cucumbers belong to the marine invertebrate group of Echinoderms (Class: Holothuroidea) and inhabit benthic environments from shallow intertidal zones to the depths of ocean ridges and trenches (Kerr and Kim 2001). Species diversity for this group increases significantly towards the equatorial belt (Kerr et al.1993), though they occur from the Barents Sea to the Amundsen Sea off the coast of Antarctica.

Sea cucumbers are slow-moving animals usually found lying on the substrate, sometimes in sand or mud burrows. The shallow water forms are also found in hard bottoms under crevices, beneath rock or stones or among algae, notably near large macroalgal holdfasts (Rupert and Barnes 1991). A few pelagic species occur in the deep and/or offshore seas (Miller and Pawson 1990). Their modified mouths, consisting of a circle of tentacles, filter suspended particles in the water or sweep the bottom for deposited particles.

The use of sea cucumbers

Sea cucumbers, consumed dried, raw, boiled or pickled, have long been exploited in Southeast Asia and the South Pacific. Early 19th century explorers observed Malay fishers harvesting sea cucumbers in the Timor Islands (Peron 1807-1816) and traders in the Northern Territory of Australia processing 'trepang' (Dumont d'Urville 1841-1854). Available estimates of bêche-de-mer (the dried form of trepang; see Robertson et al. 1987) exported from Fiji to China in 1828-1852 amounted to 1000-1500 t per year (Dalzell 1998; Ward 1972). Adams (1988) suggested that these stocks were depleted when records showed that a fleet of 100 canoes harvested only 32 t in 1852.

Conand and Byrne (1993) suggest that sea cucumber fisheries are based on only about 12 species from two families and 5 genera. However, this is probably an underestimate due to the species not being differentiated out by fishers, exporters and importers. There is growing concern about the exploitation of sea cucumbers as the bulk of populations are slow growing, slow moving animals, subject to 'boom and bust' fisheries. As a consequence, management of international trade in sea cucumbers will be discussed at a CITES technical workshop in Malaysia in March 2004.

Coverage of sea cucumber biodiversity in the *Sea Around Us* project database

Data on sea cucumbers have been gathered over a period of 4 months in an Access database . The data included here were extracted from over 100 published sources and the names were checked against the Integrated Taxonomic Information System (http://www.itis.usda.gov/) and the species database of UNEP/WCMC (www.unep-wcmc.org/species/index.htm). Table 1 presents a comparison of the coverage of our database with that in Kerr (2000). Based on these figures, we can assume that our sea cucumber database covers the bulk of species so far described worldwide.

An important aspect of this exercise was assigning the occurrence of species to countries and FAO fisheries statistical zones. We were able to assign 720 species from 145 genera and 24 families to 150 countries using the over 2100 occurrence records extracted from more than 30 published sources (mostly local checklists and reports of species

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occurrences at a particular locality). These countries occur in 19 of the 21 fisheries/maritime zones categorized by the FAO. Table 2 presents a preliminary analysis of this dataset and shows that sea cucumbers are concentrated in FAO areas 71 (Western Central Pacific) and 27 (Northern Eastern Atlantic). Table 2 also implies that about 51% of sea cucumber species occur in tropical and sub-tropical zones, e.g., FAO areas 31, 34, 37, 51, 57, 71 and 77. This leaves about 29% in northern waters, 6% in southern waters, and just over 3% in Arctic and Antarctic seas. These results, therefore, corroborate earlier statements that the bulk of sea cucumber biodiversity occurs circumglobally along the tropical belt (see Conand and Byrne 1993).

This exercise was initially a challenge to create a 'geo-graphically enhanced' global taxonomic database for one group of species

Lessons learned

This exercise was initially a challenge to create a 'geographically enhanced' global taxonomic database for a group of species. Given that most libraries are now searchable through the Internet and that many locality-specific Internet resources are freely available, gathering the information required for such a database was straightforward. Thus, we were successful in creating a searchable biodiversity database with the minimum information on scientific and English local names and in assigning these species to countries and FAO areas. As stated above, we can claim that we have covered all described species of sea cucumbers and that we have included the bulk of scientific literature dealing with the occurrence of these species in different countries and FAO areas.

We are currently working on including additional information on the habitat (type of bottom, depth), biology (growth parameters and natural mortality) and catch statistics (by country and also including import and export values). The database will also be regularly updated. Thus, we would appreciate inputs from colleagues who might have literature which we still haven't processed (note that we are also keeping hard copies of all the references we have so far used and would appreciate receiving print or pdf copies of additional references).

Acknowledgements

We would like to thank Dr Amanda Vincent for encouraging us to undertake this project.

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***Table 1**. Number of sea cucumber species by Order obtained from the* Sea Around Us *project's database compared to estimates reported by Kerr (2000).*

Subclass	Order	Species		Genera		Familes	
		This study	Kerr (2000)	This study	Kerr (2000)	This study	Kerr (2000)
Apodacea	Apolida	270	269	33	32	3	3
Apodacea	Molapdiida	84	95	17	11	4	4
Aspidochirotacea	Aspidochirotida	404	340	27	35	3	3
Aspidochirotacea	Elasipodida	104	141	25	24	5	5
Dendrochirotacea	Dactylochirotida	38	35	8	7	3	3
Dendrochirotacea	Dendrochirotida	570	550	79	90	7	7
	Totals	**1470**	**1430**	**189**	**199**	**25**	**25**

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Table 2. *Distribution of over 2100 records of sea cucumber species assigned to countries included in the* Sea Around Us *database by FAO fisheries statistical areas.*

	FAO Area	Species
18	Arctic Sea	2
21	Atlantic, Northwest	50
27	Atlantic, Northeast	431
31	Atlantic, Western Central	74
34	Atlantic, Eastern Central	156
37	Mediterranean and Black Sea	207
41	Atlantic, Southwest	43
47	Atlantic, Southeast	9
48	Atlantic, Antarctic	29
51	Indian Ocean, Western	109
57	Indian Ocean, Eastern	80
58	Indian Ocean, Antarctic	30
61	Pacific, Northwest	79
67	Pacific, Northeast	59
71	Pacific, Western Central	333
77	Pacific, Eastern Central	130
81	Pacific, Southwest	31
87	Pacific, Southeast	36
88	Pacific, Antarctic	11
-	Unassigned	243

Quantitative Ecosystem Indicators for Fisheries Management

The symposium aims to review existing indicators that have been developed as well as to develop new indicators

The programme for the International Symposium, "Quantitative Ecosystem Indicators for Fisheries Management" (March 31 - April 4, 2004, Paris, France) has now been finalized (www.ecosystemindicators.org/program.htm). This important symposium aims to review existing indicators that have been developed to support ecosystem approaches to managing fisheries (e.g. mean trophic level of landings), as well as to develop new indicators reflecting the exploitation and state of marine ecosystems. It is also aimed at evaluating the utility of indicators relative to specific objectives.

Several members of the *Sea Around Us* team will attend. Villy Christensen is one of the two co-convenors of the symposium (with Philippe Cury of the Centre de Recherche Halieutique Méditerranéenne et Tropicale, France). Villy will present a joint paper with Carl Walters, entitled "Ecosystem structure erosion under myopic management", which shows, through the use of ecosystem models that have been calibrated with long-term historical datasets, that widespread application of single-species MSY policies would in general cause severe deterioration in ecosystem structure, in particular loss of most top predator species.

Daniel Pauly will present two papers: "Mapping indicators of the state of the world's marine ecosystems" and, with Deng Palomares, "A biodiversity-based data quality indicator for fisheries catch statistics and its socio-economic correlates". *Sea Around Us* project graduate student, Vasiliki Karpouzi, with Reg Watson and Daniel Pauly, will present the results of her research on "Seabird population dynamics as indicators of ecosystem change".

The Paris Symposium represents the final meeting for the Intergovernmental Oceanographic Commission/ Scientific Committee on Oceanographic Research (IOC/ SCOR) Working Group 119, the first of which was "Quantitative Ecosystem Indicators for Fisheries Management" held in Reykjavik, Iceland in 2001 (see www.ecosystemindicators.org/wg/reykjavik/wg119report1001.pdf).

The objective of the Working Group is to develop theory to evaluate changes in marine ecosystems (both states and processes) from environmental, ecological and fisheries perspectives.

The marine reptile database

by Colette Wabnitz

One of the aims of the *Sea Around Us* project is to be able to provide species information for any specific country's EEZ and to produce maps of individual species' distribution (www.seaaroundus.org/default.htm). So far marine, freshwater and threatened fishes have been listed as well as cephalopods. Marine mammals, seabirds and marine reptiles are soon to be added to the existing database. The marine reptile database, which relies in part on data in the EMBL Reptile Database (www.embl-heidelberg.de/~uetz/LivingReptiles.html), encompasses data for 1 species of marine crocodile, 1 species of marine iguana, 7 species of marine turtles (with 11 sub-species) and 175 species of sea snakes.

The distribution of *Crocodylus porosus* stretches throughout the Eastern Indo-Pacific region, whilst *Amblyrhynchus cristatus*, the Galapagos marine iguana, as its name points out, is only found on the Galapagos Islands. Although one can encounter sea snakes in South America, Madagascar and the Middle East most species are to be found in the Eastern Indo Pacific region, with the highest diversity found in Australia. Marine turtles on the other hand enjoy a circumglobal and subtropical or tropical distribution (with the exception of the flatback turtle, *Natator depressus*, only found in Australia).

For all species collectively, the greatest number of species is, by far, to be found in Australia (140), followed by Papua New Guinea (52), Indonesia (48), Thailand (28), Sri Lanka (28), India (27) and Malaysia (20).

Sea turtles have been listed as endangered under the 2000 IUCN Red List, with the exception of leatherback, Kemp's ridley as well as hawksbill turtles listed as critically endangered and flatback turtles listed as data deficient. Both the sea iguana and the sea snake species *Laticauda crockeri* have been listed as vulnerable under Red List criteria.

... it was fun tracking all this stuff down and writing it up!

Darwin's Fishes: the writing of a lost book

by Daniel Pauly

Charles Darwin (1809 - 1882), as we all know, wrote numerous books on particular groups of organisms: barnacles, orchids, earthworms - but never on fishes. Hence, I have assembled a new book, titled *Darwin's Fishes: an Encyclopedia of Ichthyology, Ecology and Evolution* out of scattered quotes 'lost' in the many works of Darwin.

Darwin's Fishes documents everything ever written by Darwin on fishes and closely related groups. Entries were extracted from Darwin's books, his short publications, his notebooks and that part of his complete correspondence now published. An appendix by Jacqueline McGlade presents Darwin's list of "Fishes in Spirits of Wine", so far unpublished, while two other appendices present Darwin's fishes in the Natural History Museum (London) and Zoology (Cambridge University) museums. The text extracted from Darwin's works was matched against his sources and then complemented by entries that provide a modern context for ideas discussed by Darwin.

Overall, quotes comprising about 45, 000 words were extracted, contributing over one third of this book. Given the extent of Darwin's writing (well over six million words), this indicates a limited interest in fishes. However, the sample of 0.7% of Darwin's entire written output analyzed here allowed me to draw a number of inferences that are missed in many conventional biographies. Examples are the high accuracy of Darwin's citations of his sources, his mining for and systematic re-publication of information relevant to Natural Selection and the high success rate of his many hypotheses.

You have to like fishes or be interested in Darwin (preferably both) to find this exciting. But it was fun tracking all this stuff down and writing it up!

Darwin's Fishes *(2004, 359 pp.) is published by Cambridge University Press.*