

# SHARK NEWS

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## Elasmobranch education in public aquaria

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*"Public Education is even more important than captive propagation in the conservation of a species, for in the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught."* B. Dioum.

Public aquaria, since their inception in the mid-1800s, have always had an element of learning. The primary aims of these first aquaria were both recreational and educational, providing visitors with basic information in areas such as natural history and species identification. Aquaria today have shifted their focus from recreation with education, to education, research and conservation, sprinkled with entertainment.



New England Aquarium "Shark Cart".

One of the most important roles for modern aquaria is to inspire respect for life through the understanding of nature. Another is to inform the public of the conservation issues that face the waters of the world and their inhabitants. De-bunking the many myths that surround sharks and their relatives is a critical part of this role. These include the myths that sharks deliberately seek out and attack humans; that medicines made from their livers will cure or prevent cancer and that they can re-grow their fins, once removed.

The challenge is to hold the visitors' attention long enough to influence and to change their attitudes. Most visitors don't stop to read graphic panels as they rush from exhibit to exhibit and show to show. Visitors are interested in the weird and wonderful facts such as: "is it poisonous? Will it eat me?" This is especially true in today's world of instant entertainment. The aquarium's message must empower the visitors by showing them how they can contribute to species preservation and the conservation of the lakes, rivers, estuaries and oceans. It must teach them the tools they need in order to feel that what they are doing makes a difference.

### What are the necessary messages?

Before 1976, many aquaria were content to influence the public into believing that sharks were vicious, "man-eating" predators. Peter Benchley's book "Jaws" and the resultant movies accentuated this belief. Next to one movie house in Hong Kong, a restaurant hung the sign "Get your revenge here! Shark fin soup."

In aquaria the graphics only displayed basic biology information mixed with photographs or lists of the contents of a shark's stomach. Even the background music playing in the exhibits subliminally bespoke of the danger lurking beneath. Often it was the theme music from "Jaws". In the 25+ years since "Jaws" first came out, millions of sharks have been killed out of fear in the name of sporting competitions, and just because they were considered "bad".

Shark numbers dramatically declined through the 1980s due to overfishing, lack of management and a rise in demand for shark fin soup. Clearly, the message to the public needed to be changed and aquaria found themselves becoming the spin doctors for the sharks! The new message was that sharks were victims, misunderstood and maligned. Statistics comparing the minute chance of being killed by a shark to deaths by bee stings, lightning and automobiles were

advertised. Most crucially, visitors learned that less than ten percent of the sharks in the world were implicated in attacks on humans. Sharks were not vicious, man-eating creatures! The important role of sharks within the food chain, as one of the top predators in the sea, was stressed.

In recent years, the need for an additional message has emerged.

This message highlights the importance for each of us to contribute toward conservation, not only as aquaria and like-minded institutions, but also as individuals. At the time of printing, over

### Aquarium issue also includes ...

Research and education in public aquaria: a South African perspective  
Collection permit regulations  
Captive breeding and sexual conflict in aquaria

South American freshwater stingrays in captivity  
Release to the wild of sharks from public and private aquaria  
Partial recovery of sharks in Chagos waters  
Red List Workshops, recent news, publications and meetings



Whale shark fins drying in Indonesia.

70% of the world's fisheries were at an unsustainable level. Wasteful killing of ocean wildlife, through bycatch, amounted to over 1.2 million tons of turtles, birds, marine mammals and non-targeted fish, including sharks, each year in the USA alone. One of the messages aquaria must advocate is that sustainable fishery plans must include sharks. With the emerging wealth in Mainland China, the demand for traditional Chinese medicine and shark fin soup has increased dramatically. Cultural sensitivity is greatly needed in this area, as shark fin soup has been a highly prized traditional Chinese dish served to honour important guests for over 2000 years. The practice of "shark finning" has devastated shark populations worldwide. It is estimated that about one million tons of sharks and rays are killed every year. It is likely that this figure is an underestimate, as very few countries are keeping track of their shark fisheries or sharks as a bycatch of their finfish fisheries.

Advocacy has become another important part of the aquarium's mandate. Conservation messages can no longer be geared only towards visitors but must also contain an element of advocacy with local, regional and national governments. To accomplish this effectively, there must be public support. The ultimate goal for the aquarium educator is to instil an appreciation for life and to influence their visitors to contribute to the conservation of the environment and the preservation of biodiversity. Education has become a primary conservation tool.

## Accomplishing the goal – influencing the visitors

With over 120 million visitors each year, the opportunities to influence are many. The means of influence are as diverse as the audience. Zoo and aquarium exhibits are dynamic, unpredictable classrooms, filled with creatures that thrill, excite, intrigue and amuse.

Messages are conveyed using exhibit graphic panels, pamphlets, and the exhibits themselves. More active learning takes place when the visitors are able to "discover" the information and to listen to keepers, educators, and scientists in both formal education courses offered by the institutions and informal "chats" that are now so popular at the exhibits themselves and through "behind-the-scenes" tours. Visitor immersion via feeding opportunities, "sleep-overs", "swim-with" programmes and volunteering are effective means to

reach the visitors and create those emotional bonds that will influence their future actions. Exit interviews after "swim-with" programmes have so far shown a success rate of 100% in changing visitors' attitudes towards sharks and stingrays for the better!

In order to reach a larger audience, aquaria have recognized the necessity to "teach the teachers", in addition to the usual school programmes, graphics and interactive interpretation, in order to exponentially expand the number of students that aquarium educators can reach each day. Often, due to the limitations of budgets, space and trained educators, the number of students attending the courses are only a fraction of the potential. There are opportunities to develop teachers' courses that familiarise the teachers with the aquarium and explain how to best utilise the resource for their own students, and to work with the city's education department to develop a certificate course or a continuous professional education course for teachers. Aquaria are also taking their messages to far-flung communities using mobile classrooms and speakers at remote schools.

Personal computers and the World Wide Web have changed the face of education dramatically. Aquaria now have web sites with multiple links to pages of information, live video cameras or video clips and photographs, besides links to other aquaria, conservation groups and university home pages.

The messages aquaria have been promoting evolved alongside our continuing care for the animals and our approach to conservation. The messages we tell in the future will be built on those we tell today. How the messages are conveyed is limited only by one's imagination!



Swimming with rays, Monterey Bay Aquarium.

Elasmobranchs in aquaria are the ambassadors for their wild conspecifics and their habitats, helping to forge emotional ties that will influence the visitor to participate in conservation. Our strongest tool for conservation lies in education and our ability to move the visitors to care. The next challenge is to inspire the visitor to be part of the solution by assisting conservation first within their own homes, in their communities and then by reaching out, assisting in conservation throughout the world.

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## Guest Editorial

Sharks and rays represent an important attraction for many public aquaria where they provide an interesting and invaluable educational tool. Elasmobranchs are also maintained in aquaria for the purposes of scientific investigation and private exhibition. Much of what we know about these animals has been learned through observing them in aquaria.

The 1st International Elasmobranch Husbandry Symposium was convened during October 2001; its principal goal the exchange of information about the captive care of this important group of animals. The meeting was an overwhelming success, attracting 178 people from 16 countries. Of particular note was the wide mix of contributors ranging from those having a strong foundation in academia to those with an experiential "hands-on" background. This response, from a broad cross-section of the "elasmobranch community" was very encouraging. In a world shaken by the recent events of 11 September 2001 it was heartening to see so many people come together for a common worthy cause – the conservation of elasmobranchs through their improved captive care, wider public education, and increased research efforts. As a result of this meeting a hard-bound manual detailing the many and varied aspects of elasmobranch husbandry will be published in the near future.

In keeping with this theme, this issue of *Shark News* is dedicated to aspects of the captive biology and care of elasmobranchs. It also examines aspects of the role that aquaria can play in regard to research, education, and ultimately conservation.

We would like to thank the Columbus Zoo and Aquarium and the Oceanário de Lisboa whose generous contributions made this issue of *Shark News* possible.

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Dr Rachel Cavanagh, Shark Specialist Group Programme Officer, is temporarily working in Australia. She will return to the UK in April, when her address will become: c/o TRAFFIC International, 219a Huntingdon Road, Cambridge CB3 0DL, UK. Telephone: +44 (0)1223-277427 Fax: +44 (0)1223-277237. Meanwhile, you can continue to write to the Shark Specialist Group c/o Naturebureau International, 36 Kingfisher Court, Hambridge Road, Newbury, RG14 5SJ, UK and contact Rachel on rachel@naturebureau.co.uk

### Erratum (*Shark News* 14)

The authors of the article "Neotropical Freshwater Stingrays: diversity and conservation status" (*Shark News* 14) would like to correct an error. In 'Ecology and Conservation' (page 2) it was mentioned that: "So far, five species have been cited in the IUCN (2000) Red List as threatened species". The correct sentence should read: "So far, five species have been listed in the IUCN (2000) Red List".

In fact, new freshwater stingray assessments and reassessments were carried out during the IUCN/SSC Shark Specialist Group South America Region Red List Workshop held in Manaus, Brazil, June 2003 (see page 14). These are now under discussion and others are in preparation. The aim is to assess all Potamotrygonidae species using the Red List categories and criteria by 2004.



## Editorial

Apologies to all our readers and sponsors for the delay with this issue. This is due to intense activities of the Shark Specialist Group (SSG) this year on the series of regional Red List workshops that have taken place in Australia, Brazil, South Africa and San Marino. This has been a huge undertaking. Future workshops are planned to assess the batoids, and regional workshops for North and Central America, Southeast Asia and West Africa may be organised, subject to funding. Our Australia and Oceania Red List workshop report (Cavanagh *et al.* 2003) is available as a pdf file on the SSG website. The other workshop reports are in preparation. See pages 14 and 17 for more information.

A full list of chondrichthyan fish Red List Assessments published by IUCN in 2003 can be downloaded from the online Red List database at [www.redlist.org](http://www.redlist.org)<sup>1</sup>.

*The Global Status of Chondrichthyan Fishes* (Fowler *et al.* in press) will be published this year and will provide the most comprehensive resource documenting the worldwide threat to sharks, rays and chimaeras. Members of the SSG are also close to finalising a *Technical Manual for the Conservation and Management of Elasmobranchs* with support from the Asia Pacific Economic Cooperation (APEC).

SSG members have spent much time and energy providing input to the FAO International Plan of Action – Sharks, and to CITES (Convention on International Trade in Endangered Species). A joint SSG/TRAFFIC document was key to discussions regarding the role of FAO and CITES in shark conservation and management. You can read about this and all our other activities on <http://www.flmnh.ufl.edu/fish/organizations/ssg/ssg.htm>. Our website is now updated on a far more regular basis, so please visit it often to keep up with our work as it happens and to find out where you may be able to contribute. Please also continue to send me any news, updates, announcements, etc. that you consider relevant for posting there.

Lastly, it is with sadness and regret that I must inform you that our SSG representative from Sri Lanka, Dewapriya Amarasooriya, died in September after being ill for some time. He was our only representative working on sharks in Sri Lanka and although I never met him, he was always very active and helpful contributing to our work via email. He will be greatly missed.

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<sup>1</sup> When consulting the online Red List database ([www.redlist.org](http://www.redlist.org)), you will only see all global and regional results if you set the following search parameters:

- type 'elasmobranchii' or 'holocephali' into the text search box;
- check all three taxonomic boxes ('species', 'subspecies', and 'stocks and subpopulations');
- under 'Red List Categories', select 'All Evaluated (including Least Concern)'.

# Research and education in public aquaria: a South African perspective

Malcolm J. Smale

Port Elizabeth Museum at Bayworld, Republic of South Africa

Public aquaria are remarkable facilities creating windows to the sea, allowing the public to see marine animals at close range. Those who would not normally be able to experience sharks are able to see and accept them as part of our natural heritage. People have always been excited by this and even in today's world of media blitz, they remain fascinating attractions. Public aquarium facilities should present unparalleled opportunities for research and education – but do aquaria seize this opportunity? Here, focusing mainly on South Africa, we examine the role public aquaria play in research and education.

## Research

A major benefit of these facilities is the large size of their tanks and water reticulation systems, allowing large specimens to be maintained and creating opportunities for research often not possible in small university research laboratories. Husbandry research, a core function of maintaining healthy exhibits, is undertaken at most public aquaria. This relates to a variety of applied needs; for example, the transport of potential exhibit animals between their natural habitat and the aquarium and investigations into their dietary requirements (e.g. Murru 1990; Smith 1992 and reviewed by Smale *et al.* in press). Research less directly related to husbandry faces some constraints intrinsic to the nature of public aquaria. Ethical treatment and care of the animals is a requirement at all facilities.

Sharks, rays and other animals on public display cannot be in poor condition, or bear spaghetti tags or external markers for experimentation purposes. In general, visitors dislike seeing animals in anything other than unblemished condition. Fortunately, individual marking is possible in less intrusive ways. Some sharks have natural and unique markings or body patterns facilitating identification by researchers. A technological solution for those more difficult to distinguish is to use PIT (passive internal transponder) tags. These inert tags are injected and the unique coded number obtained from a reader passed over the animal. A present disadvantage is that the tags need to be read at close



The ragged tooth shark, *Carcharias taurus*, is a popular shark for aquarium displays. It is hardy, large, and popular with the public.

range and out of water. This means the animal usually needs to be caught and removed from the tank for 'reading', which can be a problem for large sharks that may be damaged in so doing. (Note: waterproof PIT tag transponders, with 'readers' attached via long cables, are now available. They can be incorporated into feeding poles so readings can be taken during daily husbandry routines.)



The endemic Southern African gully shark, *Triakis megalopterus*, adapts well to aquaria.

Gathering data on growth rates and verification of growth checks using tetracycline markers is possible in aquaria with minimal disruption to the sharks. Work at Bayworld, Port Elizabeth, confirmed that growth zones were laid down annually in the endemic triakid shark *Triakis megalopterus*, identified individually by PIT tags (Goosen 1997). A non-intrusive growth study of ragged tooth sharks, *Carcharias taurus*, was undertaken at Seaworld, Durban, by using photographic techniques to estimate specimen size (Govender *et al.* 1991).

Opportunistic information may be gathered from fortuitous records of long-lived animals. For example, the large green sawfish, *Pristis zijsron*, kept for more than 33 years at Seaworld, Durban, after being captured as a juvenile. The species is listed as Endangered on the IUCN Red List of Threatened Species. This specimen suggests that these animals are long-lived and share, with many other chondrichthyans, a "k-selected" life history strategy. Public aquaria may provide information on the maximum attainable age for a given species of elasmobranch. This kind of information may not be research, as such, but it certainly provides useful information when growth rates and maximum ages of different taxa are being investigated.

Public aquaria are not well suited to experimental replication where more than one tank is required, as they often only have one large exhibit available. However, they may offer the opportunity to undertake observational studies of behavioural interactions between specimens and other tank inhabitants. For example, the first description of mating behaviour in *C. taurus* was recorded by Gordon (1993) in an Australian aquarium. Similarly, a host of behavioural and reproductive information has been published from observations made on other aquarium-held elasmobranchs in Japan (Uchida *et al.* 1990). Clearly, public aquaria can provide new information on relatively large and wide-ranging sharks. The obvious caveat to be borne in mind when interpreting the results is that observed behaviour is in artificial and constrained conditions, compared with the open sea.

Although animals with tags and attached experimental apparatus may not be acceptable to the public, many aquaria have holding tanks out of the public view for housing non-display specimens or as quarantine facilities. An early behaviour study, examining shark response to bather-protection nets, was conducted in a holding tank at the Oceanographic Research Institute (ORI) – a facility linked to Seaworld, Durban (Wallace 1972). This study provided new insight into the interaction of sharks and nets that were designed to reduce shark attacks in popular bathing areas. In a more recent study, swim speed experiments were undertaken at Bayworld using ultrasonic tags attached to *T. megalopterus* (Voegeli *et al.* 2001). This study was conducted in a holding tank that was not on public display.

The availability of relatively inexpensive and portable ultrasonic



scanners has opened up a new field of possibilities for undertaking research on reproduction and feeding in public aquaria. Such scanners are similar to those used for a variety of human medical procedures. For example, a study of gestation and embryonic growth rate in *T. megalopterus* is underway at Bayworld, Port Elizabeth. An earlier study of field-caught animals suggests that the gestation may be unusually long (i.e. 19–21 months (Smale and Goosen 1999)). Using an ultrasonic scanner, the growth rates of living embryos are being monitored on a monthly basis. The pregnant female is trained to feed in shallow water, where she may be easily caught, measured, and the embryos scanned. This is a rapid procedure that lasts only a few minutes. Although only recently initiated, it appears that this harmless technique provides an ideal opportunity to verify growth using procedures not possible in most field situations, where sharks probably move over distances of tens, even hundreds of kilometres. Indeed, several aquaria worldwide are now making valuable contributions to the generation of new knowledge about animals that are difficult to study in the wild.

## Education

Public aquaria generally have significant educational initiatives; a substantial number of children pass through the gates as visitors and within formal classes. Approximately 140,000 scholars visit the Two Oceans aquarium in Cape Town as part of the education programme. The number at Bayworld, Port Elizabeth, is approximately 60,000, while Seaworld, Durban has more than 54,000 students per year.

Educational opportunities at aquaria are unparalleled. Students are able to have lessons on a variety of marine taxa, including sharks, as living specimens. Rural and inner-city children are often exposed to their first experience of marine life when they visit an aquarium. The impact of a large shark swimming past a young person is infinitely greater than merely using books or even videos. Perhaps more than the opportunity of learning facts, is the engendering of enthusiasm and interest. Young people are able to see that although large and often well armed with teeth, sharks are not systematically exterminating other denizens within the exhibit – they are generally living in harmony with the other inhabitants. Seeing how various species make way for each other, and then swim on their way, is a lesson in marine biology as well as philosophy. Screams of delight from young visitors coming face-to-face with a large shark are a clear indication that aquaria have a vital role to play in education. Young people can appreciate the diversity of form and function of the animals on display, particularly when armed with appropriate information and fact sheets.

Husbandry information gathered as part of normal aquarium functioning can augment information provided as part of the educational package. For example, the huge, old, and impressive sawfish held in Durban is a great example to use when educating the public about the dangers of habitat destruction, and the fact that many sharks and rays are long-lived. These kinds of messages are important to pass on to the next generation of decision-makers, business people, and students.

Some institutions are particularly well placed to link research and education. For example, the Port Elizabeth Museum at Bayworld has a large static display with sharks and rays. SCUBA divers, with appropriate qualifications, may enter the main tank of a linked aquarium to experience sharks first-hand, following an educational lecture. Aquarists and scientists undertaking shark research at such institutions are well-placed to assist with the displays and facilitate the broader education of the public. Such contributions can only support the conservation of sharks and rays. Both research and education have important contributions to make toward the long-term conservation of sharks and rays and thus aquaria have a fundamental role in this important goal.



An ultrasound scan of embryos in a pregnant *Triakis megalopterus* held at Bayworld.

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# The need for uniformity of permit regulations for shark displays

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Public display of elasmobranchs in aquaria and zoos is widely recognised to play a vital role in educating people about sharks and rays. It provides the opportunity to immerse a large number of visitors in engaging settings in order to educate them about the ecological importance and vulnerability of sharks and the critical need for their effective conservation and global population management. The acquisition of sharks for public display in the USA is, however, made difficult by the complex and inconsistent statutory regulations and non-statutory classifications of the status of these animals.

## Government regulation perplexity

Showcasing these wonderful animals in an aquarium setting requires tremendous logistics, resources and dedicated individuals. Varying government regulations often impede the logistical planning of shark acquisitions due to a lack of global uniformity in the regulations and permit requirements. In the USA, for example, federal regulations are different from those applied at state level, with even greater variance between states (see below). Professionals from various aquaria and zoos have exhausted a tremendous amount of time trying to learn and navigate these. Representatives from the American Zoo and Aquarium Association (AZA) along with AZA-accredited aquarium/zoo officials also spend many hours working with government agencies to educate them about the important role of aquaria and zoos. Issues covered in this way include ethical considerations, commitment to conservation and species preservation, and awareness of how collecting efforts have a negligible impact on wild populations compared with the impact of commercial fisheries.

## Reference lists – potential confusion

Different types of reference lists are used in formulating regulations to control the collection and/or possession of certain species. Such lists may categorise either species or populations as endangered or threatened. For example, the IUCN Red List of Threatened Species classifies those species (and, in some cases, regional populations) that have been evaluated as Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern or Data Deficient. The American Fisheries Society (AFS) recognises the concept of Distinct Population Segments (DPS), as defined by the US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). DPS are defined as populations that are markedly separated from other population of the same taxon as a consequence of physical, physiological, ecological or behavioural factors and that are significant to the species to which it belongs. Categories of risk used are Endangered, Threatened, Vulnerable, Conservation-Dependent and Not at Risk. The US Endangered Species Act (ESA) provides a list of species that are at risk throughout all or a significant portion of their range and promotes the conservation of ecosystems on which they depend. The only elasmobranch currently on this list is the smalltooth sawfish. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) lists species on three Appendices according to threatened status and the degree of international trade regulation they require. Trade in Appendix I species is permitted only in exceptional circumstances. Trade in Appendix II species must be controlled and Appendix III contains species that are protected in at least one state, which has asked other CITES Parties for assistance in controlling the trade.



## Types of permits

The first questions asked when one sets out to acquire and display elasmobranchs are: "What permits, paperwork and permission must be obtained?" In the USA, the answer often results in confusion, acquisition delays and copious amounts of paperwork. Permit considerations must incorporate international and federal regulation compliance, including customs clearance if required, and state regulations.

## US federal government regulations

Three categories of federal regulations pertain to sharks; Prohibited, Regulated and Unregulated (see <http://www.nmfs.noaa.gov/sfa/hms>). The US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) Highly Migratory Species Management Division, Office of Sustainable Fisheries, maintains a list of Highly Migratory Species (HMS) that are Prohibited and Regulated. Unregulated sharks (those not on the HMS list) do not require an Exempt Fishing Permit (EFP). Commercial fishermen require permits to fish for listed species. Recreational fishermen cannot keep any Prohibited species and must stay within quotas set by the plan for Regulated species. An EFP is required to collect sharks listed as Prohibited for: 1) scientific research; 2) acquisition of data for species that would otherwise be prohibited for harvesting; 3) the enhancement of safety at sea; 4) public education or display; 5) investigating means of reducing bycatch, economic discards or regulatory discards; 6) or for the purpose of limited testing of fishing gear and methods. Regulated species are covered under the management programme that provides commercial and recreational fisheries quotas. The EFP process can also facilitate the collection of information to determine whether regulatory changes are needed in the future.

NMFS is no longer issuing new commercial shark fishing permits; the only way to obtain one is by transferring a permit, within the upgrading restrictions, from someone who is leaving the fishery. It is critical for aquaria and zoos to know this, particularly if they are hiring a private collector, as they must ensure that all parties involved comply with regulations. Entities for public display or research may collect the regulated species under the commercial quotas set; an EFP is required, however, if the commercial yearly quota is reached prior to acquisition.

## US state government level

Some states currently follow the federal guidelines, but many exceed federal requirements or have more stringent programmes. State jurisdiction extends from the coastline to three miles offshore (federal jurisdiction encompasses 3–200 miles). This defining line creates some logistical challenges for facilities that wish to collect and possess sharks for display. For example, some states will not allow anyone to land a shark on their shore regardless of whether it was collected in federal waters or not. Additionally, some states will not allow shark collection in state waters without an EFP. In other states, however, no permits are required. Continually changing policies and the sometimes inconsistent application of these policies can make it very difficult for an aquarium or zoo to acquire the specimens required for public education. More time spent on the important role of educating the public about the plight of sharks and rays is a better investment than navigating the complicated waters of the governmental permitting process. Public aquaria and zoos have a strong desire to achieve global continuity and uniformity with shark management practices and permitting process in order to achieve their education and conservation goals.

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# American Elasmobranch Society's Captive Elasmobranch Census: an elasmobranch information resource

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Virginia Marine Science Museum, USA

A census of captive elasmobranchs has been conducted since 1989 as a means of improving communication between research facilities, public aquaria, and science centres. The Census, known as the Captive Elasmobranch Census (CEC), is currently sponsored by the American Elasmobranch Society (AES) and has been an international undertaking since 1995. It records information about elasmobranchs held in US facilities every year and, with the help of regional coordinators around the globe, records the same information for elasmobranchs throughout international facilities every other year. Participation grows each year (Figure 1). From a small group of US facilities (less than ten in 1989), today's CEC has grown to include more than 125 US and international facilities. Over the years it has recorded thousands of specimens, representing more than 100 elasmobranch species.

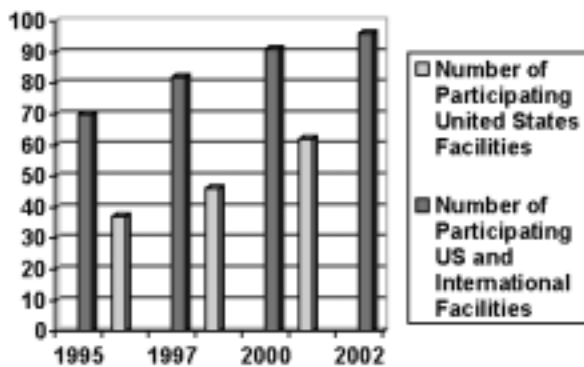


Figure 1. Number of Facilities Participating in AES CEC since 1995.

The CEC provides a unique resource for institutions developing elasmobranch research activities, collection plans, educational programmes, or conservation initiatives. Additionally, it is a contact reference for professionals interested in discussing or investigating captive elasmobranch husbandry and management issues. The Census is composed of two sections. One section includes participating institution contact information and the second details the species and numbers of elasmobranchs held in each facility. Periodically, special surveys related to elasmobranch husbandry and management are included. Success of the CEC depends on the voluntary participation of its members. The information obtained is the property of the CEC and is distributed only to participating members of the programme. Data requests from non-participating organisations or individuals are closely reviewed by the Chairperson and distributed to the participants accordingly.

If you are interested in participating in the CEC or in assisting with the compilation of the Census as a regional coordinator, please contact the Chairperson, Beth Firchau. The CEC is especially interested in participants from Scandinavia, Russia, the former Russian Republics, Eastern Europe, the Middle East, and Asia.

Beth Firchau

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## Captive breeding and sexual conflict in aquaria

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### Introduction

Reproductive behaviours in chondrichthyans are complex and, until recently, few qualitative studies on this subject had been published (Pratt and Carrier 2001), although several reviews of reproductive behaviour have been presented in the last decade (Bres 1993; Demski 1990a,b; Pratt and Carrier 2001). Most reproductive behaviours reported in the literature have been observed in captive elasmobranchs, due to the difficulties of monitoring wild conspecifics closely.

### Captive breeding

Ninety-nine species of chondrichthyans are known to have reproduced in captivity: in aquaria, semi-natural confinements, and in laboratories. These species include one holocephalan and 98 elasmobranchs; oviparous and viviparous species comprise 41% and 59%, respectively. Species from all reproductive modes are represented. Limited space in this newsletter means that it is not possible to reproduce the table of chondrichthyan species that have completed the reproductive cycle or exhibited mating behaviour in captivity; this is presented in the full paper in the *Elasmobranch Husbandry Manual* (see above).

### Sexual conflict

Reproductively related interactions have been referred to as sexual aggression, but the term sexual conflict seems more appropriate in describing the variety of sexual interactions displayed by animals (Birkhead and Parker 1997). Indeed, as noted by Davies (1992) and Reynolds (1996), all mating systems may be the result of both intrasexual and intersexual conflicts. It is beyond the scope of this article to review the range of intersexual, consensual and interspecific interactions that have been documented in elasmobranchs. Pratt and Carrier (2001) provided a recent comprehensive review.

Mating systems in elasmobranchs have resulted in adaptations in both sexes, such as sexual dimorphism in skin thickness (Pratt 1979; Kajiura *et al.* 2000) and sexually dimorphic dentition (McCourt and Kerstitch 1980; Kajiura and Tricas 1996). While many of the intra- and intersexual behaviours function well for wild conspecifics, captive animals are confined to the limited space provided by the aquarium system, and the full spectrum of behaviours are almost always modified or attenuated. In addition, it is possible that some behaviours may be directly related to the confines of captivity. Consequently, captive sharks, skates, or rays may be subject to persistent chasing and biting by members of the same or different sex. In addition, wounds inflicted during pre-copulatory or copulatory behaviours in captive elasmobranchs may act as entry sites for pathogens such as bacteria and fungi, which may have more dire effects than in the wild.

### Biochemical cues

In other animal taxa, specific reproductive behaviours are often induced via biochemical compounds. Pheromones have been identified in several invertebrate and vertebrate groups, including teleosts (Sorensen *et al.* 1995, 2000). To date, however, no

pheromones have been identified in elasmobranchs. Behavioural observations during reproduction (i.e., Springer 1967; Johnson and Nelson 1978; Gordon 1993) suggest that a chemical compound(s) released by the female may induce part of the male behaviour repertoire. Ongoing but unpublished investigations on reproductively active clearnose skates *Raja eglanteria* strongly suggest that males respond to substances released by reproductively active females (Rasmussen pers. comm.). It is also possible that primer pheromones may be involved based upon behavioural observations.

## Future directions

While significant advances have been made in the understanding of reproductive behaviours and the successful reproduction of captive elasmobranchs, some suggestions can be made to focus our efforts in the future. Many species of elasmobranchs have suffered severe declines locally as well as globally. For example, the seven species of sawfishes (or pristids) all are listed on the IUCN Red List of Threatened Species as Endangered or Critically Endangered (Simpfendorfer 2000, 2002). However, to date no accounts of reproductive behaviour or successful reproduction in captivity have been published. It is possible that success may be gained through a focused effort of one institution or through collaboration with other institutions. Success with these as well as other species that have suffered severe declines in the wild (e.g. sand tigers, *Carcharias taurus*, and sandbar sharks, *Carcharhinus plumbeus*), may reduce the numbers taken from the wild for public aquaria and research institutions.

It is of vital importance for aquaria to document and describe reproduction and reproductive behaviours of elasmobranchs, particularly for species where no information has been published.

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## South American freshwater stingrays in captivity

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South American stingrays belong to the family *Potamotrygonidae*. They come in all sizes, from the orange spotted ocellate river stingray *Potamotrygon motoro* that reaches a disk width of over four feet (1.22 m) and can weigh over 40 lb (nearly 20 kg), to the dwarf Magdalena river stingray *P. magdalanae*, with a disk width of one foot (30 cm) and weight of less than eight pounds (about 3 kg).

The majority of freshwater stingrays are found in the Amazon River basin, some of them wide-ranging while others have a restricted geographical distribution. There are differing opinions about the number of

stingray species; twenty species have been described, while several others are not yet fully classified (Charvet-Almeida *et al.* 2002).

### Biology

The biology of freshwater rays is very similar to their saltwater relatives, other than their adaptation to a solely freshwater environment. They are benthic (bottom-dwelling) animals, spending much of their day foraging in the substrate for small crustaceans, worms and fish, using their powerful jaws and special flattened teeth to crush shells and tear food. Stingrays often bury themselves in the sand to ambush their prey or hide from danger. Because of this behaviour, many people have been known to step on them and get stung by the long barb near the tip of the tail from which they take their name. This barb is used mainly for defence and is very sharp with serrated edges covered in mucus. The barb itself is non-toxic, but the mucus penetrating the skin will cause a painful swelling and may lead to a bacterial infection (indeed, the few recorded deaths due to stings were the result of such infections). They should, therefore, be handled carefully.

### Reproduction

Combining a male and female stingray in an enclosure does not guarantee breeding, although stingrays are not monogamous in the wild. When breeding, a male will bite the female and hold her down. Copulation is very violent and the females are often scarred with bite marks that take up to two months to heal. Copulation occurs by the male inserting one of his claspers into the female and releasing sperm. Neither male nor female provide parental care for the young. Studies have shown that females will hold the sperm until ovulation, which can be over three weeks later (Araujo 1998). The gestation period is about three months. Freshwater stingrays are ovoviviparous (live bearing), and can produce as many as twenty-four pups (depending upon species). However, an average female produces two to ten pups. When born, the young still have a small yolk sac on the underside of their body. Normal feeding will not begin until this has been absorbed (usually within two to four weeks). The relatively long gestation period means that most females will only breed twice a year. Since they produce a relatively small number of young per birth, healthy populations depend on high survival rates.



### Conservation status

The IUCN Red List of Threatened Species currently classifies several species of freshwater ray as "Data Deficient". This indicates that there is not enough information to estimate their population size and status and that more research is required, but does not mean that they are not threatened with extinction (see page 3). Indeed, some species or populations are thought to be threatened as a result of various environmental, human and biological factors, including:

- Loss of habitat, e.g. due to damming of rivers and deforestation from logging operations and for cattle farming.
- Eradication of rays because of the risk they pose of painful stings.
- The recent impact, in some areas, of the ornamental fish trade on wild populations.
- Slow reproductive rates, which limit recruitment and make ray populations vulnerable to fisheries and other threats.

For more information, see Charvet-Almeida *et al.* (2002). Updated Red List assessments for several species will be available in late 2004.

### Aquarium trade

Many rays are caught and sent to Asia where they receive higher prices than in the USA. The rate of survival for traded rays is very low. When trapped, rays are put in holding pools until packing and dispatch to distributors or buyers. Often, these rays have not eaten in weeks and are thin, injured, and ultimately succumb to starvation or bacterial infections. However, socio-economic demands preclude a cessation of the capture and exportation of wild stingrays, for locals help distributors catch rays, using the money for food, schooling and other essentials. Working with natives and project leaders to help them manage populations is a possible way to alleviate the problem. Teaching breeding techniques and proper care for both young and adults could help increase the chances of their long-term survival.

### Role of public aquaria

The goals of most public aquaria are to educate, conserve and entertain. Since these stingray species are often a focal point in Amazon displays, it is possible to use these collections to educate the public and enlist their help in saving this important group and their natural habitat. Public aquaria have displayed stingrays for over twenty years. Those exhibited include *P. motoro*, the black and white spotted bigtooth river stingray *P. henlei* and the vermiculate, otorongo or jaguar river stingray *P. castexi*. Some public aquariums have even had success in breeding *P. motoro*, *P. henlei*, and *P. castexi*.

Public aquariums could play an important role in the future conservation of this important group of rays by:

- Educating people about the effects of over-fishing and habitat loss on the conservation status of wild populations.
- Breeding and distribution of freshwater stingrays to reduce pressure on wild populations from the pet trade.
- Educating collectors about conservation threats and husbandry techniques (e.g. feeding, care of young and adults, breeding practices).
- Encouraging local people, distributors and researchers to work together.

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# Release to the wild of sharks from public and private aquaria

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## Background

Sharks are an integral and important component of marine ecosystems and are now a major conservation concern. Globally, shark populations are in trouble, with a recent study in the Northwest Atlantic estimating that populations of all recorded shark species had declined in the past eight to 15 years, some by up to 86% (Baum *et al.* 2003). Shark fisheries have expanded in size and number around the world since the mid-1980s, primarily in response to the rapidly increasing demand for shark fins, meat and cartilage. Despite the boom-and-bust nature of virtually all shark fisheries over the past century, most shark fisheries today still lack monitoring or management. For example, only a handful of the 125 countries that are now involved in shark fishing and international trade have even the most minimal management in place, and there is still no management for sharks fished on the high seas. As a result, many shark populations are now depleted and some are considered threatened (Camhi *et al.*, 1998). At the 2002 CITES Conference of the Parties, both the whale shark and basking shark were accepted for listing under Appendix II ([www.cites.org](http://www.cites.org)).

Sharks are widely held in zoos and aquaria and, increasingly, education and awareness of the conservation issues facing these large marine predators is being shared with millions of visitors. In general, their life history means that these fishes are unlikely candidates for captive breeding and reintroduction programmes. However, an important benefit of captive breeding programmes is the collection of information about reproductive strategies, growth rates, maturity and other life history parameters. This information may be used by policy makers, with appropriate caution, to help formulate elasmobranch conservation management strategies (Smith and Crow, 2000).

The release of captive sharks has occurred historically and continues today. In general, little thought has been given to the scientific robustness of such activities and in some cases reintroduction has been used as a means of disposal of unwanted specimens, against the recommendations of the IUCN Reintroduction Specialist Group guidelines. One area of increasing concern is the release of sharks from the private sector, specifically from misguided acquisitions of species that grow extremely large yet are available in the pet trade, such as nurse sharks. Some animal activist groups are actively campaigning to rescue sharks from pet shops, restaurants and nightclubs and return them to 'the wild'.

## Approach

This subject has been under discussion within the aquarium community and this article aims to outline some of the considerations with regards to the release of sharks. The information in this article was obtained through basic questionnaires, email discussion fora and panel discussions at aquarium conferences.

## Discussion

There must be a reason to release any species into the wild, for example if the species has become locally extinct or supplementation of a small population is required to correct skewed sex ratios. The IUCN Guidelines for Reintroduction clearly state that the availability of surplus stock is not a reason to release animals into the wild.

Many of the common species kept in aquaria have been released into the wild, including Caribbean reef, lemon, nurse, sandbars, sand tigers, silky and sevengill sharks and dogfish. The



Photo: Sea Life Centres, UK.

reasons behind the release may be that the animal has outgrown a facility, or is surplus to requirements. On a number of occasions, sharks have been released after very short periods in captivity (days to weeks). There are no documented reports of shark releases that are part of a coordinated conservation programme that is looking to improve the status of the species in the wild.

The best documented information on a released shark is from a sevengill known as 'Big Emma' at Monterey Bay Aquarium (Powell, 2001). After four years, Big Emma had developed an abrasion on her snout and was showing potentially aggressive behaviour to divers in the tank and a decision was made to release her. The shark was tagged with an external identifying tag and released into the Monterey Bay. On October 16, 1994, in Humboldt Bay, two years and four months after her release in Monterey, a sportfisherman captured Emma. She had returned to the very same bay she came from six years before, a distance of about 400 miles.

Smith and Crow (2000) outline the many problematic issues that emphasise the need to exercise extreme prudence when formulating elasmobranch reintroduction programmes. There are valid concerns that reintroduction could potentially expose discrete 'wild' elasmobranch communities to exotic parasites or 'exotic' genetic material. In addition, re-introduced elasmobranchs, that have previously received antibiotic treatment, may be carriers of resistant strains of pathogens. Finally, the consumption of recaptured elasmobranchs may represent a health risk if they were given a chemico-therapeutic agent during their time in captivity.

Aquaria recognise the importance of veterinary screening of sharks prior to release, and many institutions have comprehensive routine health monitoring procedures in place independent of any release programmes. There is some evidence that elasmobranchs, and especially sharks, are less prone to many of the pathogenic parasites that affect bony fishes with similar ranges. However, concerns of exposure to new species of pathogen or those that have a different virulence than native populations is still a concern.

Tagging released animals has taken place in some cases. In the USA this has been with National Marine Fisheries Service (NMFS) shark tags, or with PIT (passive internal transponder) tags. A





concern is the generally low rate of returns for tags of this kind (<1%) meaning that data on the survival or otherwise of released sharks is extremely limited. Satellite tracking is potentially able to provide better information, such as environmental parameters, though only for relatively short time periods after release. A limitation is that these tags are only able to give one position at the surface and the calculation of the true position of the shark is difficult and uncertain, making post-release monitoring difficult. Satellite tags are also extremely expensive.

The legislation controlling releases of native elasmobranch species to areas within their natural range is limited. In North America, there is no written rule or policy regulating their release, though prior permission is required in some states. However, if the animal had ever been treated with any non-

FDA (Food and Drug Administration) approved drug that could affect a human that caught and ate the animal, then the release is forbidden. In the UK, there is no legislation controlling release of native species, though as with many countries, the release of non-native species is banned.

Shark releases are of single individuals rather than large numbers and the total number of animals released is relatively small (though not well documented). The potential negative impact on wild populations is therefore potentially limited, though the benefit of the release, even from an individual welfare point of view, is likewise limited. Pre-release preparations have included the holding of species in lagoon areas prior to release and feeding of live prey for two weeks prior to release.

One of the benefits of the release of sharks has been the publicity received that has often been used to raise awareness on shark conservation issues. A concern is that the fate of some of the sharks rescued from poor facilities, such as the nurse shark exhibited in a Burger King in Toronto, and another in a nightclub in Detroit, is that they would otherwise be euthanased. The abundance of these species as unwanted pets has overwhelmed public aquaria that no longer have capacity for these fishes.

When considering the large coastal sharks in the pet trade, the issue lies with the inappropriate nature of the acquisition. The individual may not be aware of the final size of the animal, as is common for many other fish species purchased through the pet trade. Education and responsibility in the pet trade is required, as exemplified by associations such as OATA (Ornamental Aquarium Trade Association). The institutional and regional collection planning process being undertaken by aquaria and their related associations (American Association of Zoos and Aquaria, AZA; European Association of Zoos and Aquaria, EAZA; European Union of Aquarium Curators, EUAC) encourage the appropriate collective management of species in facilities and reduce the issues of over-population of species and the holding of species in inappropriate facilities.

## Conclusion

The release of sharks as currently practiced has no obvious conservation benefit and raises some significant concerns. It is

clear that a more definitive policy needs to be developed and this is being undertaken by the respective North American and European Taxon Advisory Groups (AZA, EAZA/EUAC) with the IUCN Reintroduction Specialist Group Fish Section Chair. Criteria will provide a way of evaluating current practices and may eliminate some of the current industry collection practices.

To minimise the negative effects of shark releases, the immediate introduction of the following conditions is recommended for any captive shark that is being considered for release:

- They have been quarantined and housed only with sympatric species from the area where they will be released, to reduce the risk of spreading novel pathogens and disease.
- No water has been shared with non-sympatric display animals (as above).
- Fresh food (containing parasites) has been limited to sympatric species. Drug treatments throughout the animals' life have been limited to FDA approved aquaculture chemicals.
- Entire captive custody history is known so all above can be confirmed (including the holding situation at collectors, wholesalers, other facilities where animals formerly resided, etc.).
- Releases are not "imprinted" on humans e.g. through hand-feeding, and therefore would be no threat to swimmers etc.
- Full health screening is carried out prior to release and the full medical history is known.
- The animal can be returned to the point of collection in the wild.

While these rules make releases from many exhibits unlikely, and they would impact the collection of animals for experimental husbandry trials by some facilities, they are no obstacle to releases of animals in a number of situations. Open systems containing endemic (to the display location) animals in particular, would not be affected by these guidelines. Except where they meet all of the above criteria, releases are not part of a responsible collection plan and animals should be retained for life including transfer to other facilities. The release of sharks is not currently part of any conservation management plan, but their use in public education programmes in aquaria is a vital component of their conservation.

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# Partial recovery of reef sharks in Chagos waters

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The Chagos Archipelago (or British Indian Ocean Territory) is a group of coral reefs, including five true atolls and a number of submerged atolls and platform structures. The Great Chagos Bank, a submerged atoll, is the largest atoll structure in the world, with a surface area of 13,000 km<sup>2</sup>. The total area of shallow reefs is 3,770 km<sup>2</sup> or 1.3% of the global total (Spalding *et al.* 2001). There are some 50 reef-associated islands or coral keys. With one exception, these have been uninhabited since 1971. There is a large US military installation on the largest island and southernmost atoll of Diego Garcia (Sheppard and Seaward 1999).



Blacktip reef shark, *Carcharhinus melanopterus*, Chagos Archipelago.

In 1998 we documented a large decline in the numbers of reef sharks observed in the waters of the Chagos Archipelago (Anderson *et al.* 1998). Using logbook records kept by four divers, estimated shark abundance statistics were derived. From 1975–1979, with a combined total of 207 dives, an average of 4.2  $\pm$  0.3 sharks per dive were noted. This figure fell to 0.6  $\pm$  1 sharks per dive in 1996 (over 113 dives), an 86% decrease. These declines were seen as evidence of fishing pressure, notably from an illegal Sri Lankan fishery, but possibly exacerbated by a licensed Mauritian reef fishery. During a recent visit to the same reefs in early 2001, a small, but notable increase in shark numbers was observed.

## Methods

The author was able to visit all five atolls and three locations on the Great Chagos Bank during a 14-day visit to the Chagos Archipelago in February and March 2001. During this period 29 dives were undertaken. The primary purpose of these dives was to carry out reef fish assessments, including standardised underwater visual census (UVC) surveys and more general species inventory. The limited duration and spatial extent of the census area in these surveys (Spalding 1999) provides insufficient sampling for a shark census, however the author maintained a detailed log of every dive, both on this trip, and in 1996. Almost all dives were of a similar duration (c. 60 minutes) and were located on outer reef slopes away from atoll channels. All observations of sharks were noted in these logbooks, with identification to species. These data from 1996 and 2001 are compared here, alongside

some of the data gathered by other divers as presented in Anderson *et al.* (1998). Although other divers were present during the 2001 visit, their logbook records have not been utilised here as they were generally diving together with the author and hence do not represent independent samples.

There would appear to be variance in the ability of divers to notice sharks, which is largely influenced by the other ongoing activities of the diver. This was apparent in 1996 when one diver (Charles Anderson, RCA) was undertaking photographic work and may have missed some shark observations. By focusing on the observations made by one person only, the present author, such observer differences are reduced. This is strengthened by the fact that the diving activities, and average dive length, undertaken by the author were the same in both 1996 and 2001. It should also be noted that the dives in both years were undertaken during the same months (February–March).

## Findings

Table 1 shows the changes in overall shark abundance from logbook records from the 1970s, from two observers in 1996, and from the author in 2001. Although the sample size in 2001 is considerably smaller than the previous surveys, the increase observed lies well beyond the error margins. The combined data for 1996 (RCA and MDS) showed a shark-sighting rate of 0.6  $\pm$  0.1 sharks per dive. In 2001 this figure had increased to 1.7  $\pm$  0.3. This increase remains even if the observer records of the present author (0.7  $\pm$  0.2 in 1996) are used separately from those of RCA. Although all figures are presented as sharks per dive, these can be broadly equated with sharks per hour. Average dive length in 1996 was 64 minutes in 1996, and 62 minutes in 2001.

Five shark species were observed on the dives, as in previous years. Table 2 uses the observations of the present author and summarises the changes in abundance of each species between 1996 and 2001. It can be seen from this table that increases were observed in all species, but further that such observations are more reliable for the more abundant species, where larger sample sizes are more likely to be statistically significant.

The relatively small sample size prevents a meaningful breakdown by reef units. While the majority of dives were located in identical localities both years, in 2001 additional brief visits were made to Blenheim and Egmont atolls, not visited in 1996. Although only two dives were made on each, shark abundances at both sites were higher than average (3.5 sharks/dive in both places). Exclusion of these figures from the overall statistics for 2001, however, does not have any major impact on the overall findings. Three dives were also undertaken on the outer slopes of Diego Garcia, where no sharks were observed. In 1996 only three short dives were made here, with only one shark sighting.

## Discussion

The decline of sharks observed in 1996 was largely related to fishing pressure, as exemplified by the two illegal Sri Lankan fishing vessels which were impounded in 1996 with holds full of sharks. Subsequent to this year, the UK government has kept a fisheries patrol vessel on permanent station in Chagos waters. This vessel is charged with managing offshore tuna fishing, but also patrolling the islands and reefs. A small number of Sri Lankan fishing vessels have been captured and impounded since 1996, and most recently in 2000. It seems likely, however, that the presence of the fisheries protection



vessel, combined with the high profile these captures have received in Sri Lanka (in the national media), may have greatly reduced the size of this illegal fishery.

The ongoing licensed Mauritian fishery in Chagos is a relatively small-scale mothership-dory operation, and in recent years relatively few vessels have been taking up licenses. This fishery primarily targets demersal species, including snappers and groupers. Historically there has been no major focus on sharks, however in 1998 there was a large shark catch, (amounting to several thousand kilograms), associated with the use of electric reels and steel trace. This led to a ban on the use of steel trace from 1999 (Mees *et al.* 1999, 2000).

One other shark fishery is a sport fishery operating out of the US military base on the southernmost island of Diego Garcia. Although detailed breakdown of catch is not available at the present time, the total catch from this fishery (including sharks) has been estimated as 112 tonnes in 1999, with about 50% coming from the lagoon, and the remainder from reef flat, reef slope and surrounding oceans (Mees *et al.* 1999). Sharks are caught both from boat and shore fishing, however it is unclear how important they are within this fishery. Insufficient dives were made to assess any loss of shark numbers from the waters around Diego Garcia, however it is of some interest that no sharks were seen by any of the divers on the outer reef slopes (three dives in total). US Navy divers working in the lagoon channel, and much further south on the outer slope (some distance from the point of access by fishers) reported regular shark sightings however (pers comm.). Similarly the author also observed a number of sharks in the lagoon.

Overall, there would appear to be grounds for cautious optimism. It would appear that reef shark stocks in the Chagos Archipelago are increasing, possibly as a response to active management. Further observations will be needed to confirm this, however the present work also shows the viability of a relatively simple sampling method. The use of diver log-books enables broad census information to be gathered as an adjunct to other work.

On a related note, the impact of the 1998 coral bleaching and mortality event, which killed up to 90% of the corals in this region (Sheppard 1999), does not appear to have impacted the shark populations. This fact is further supported by the observations that most other fish communities have thus far remained largely unimpacted by this event (Sheppard *et al.* 2002).

The pelagic shark stocks in Chagos waters may not be faring so well – as in all waters of the region there is a high level of shark bycatch from tuna long-lining and purse seine fishing. One estimate for the bycatch from long-line fishing in the 1998/99 season suggested over 3,000 blue sharks and almost 2,000 thresher sharks were taken from Chagos waters as bycatch (Friends of Chagos, in litt. 2000).

Given the perilous state of the global shark stocks, any recovery, however small, is worthy of comment. It may be hoped that the continued vigilant management of Chagos waters, with rapid management intervention as new threats develop, may allow for a more complete recovery in coming years. Continued monitoring will be required to support such management intervention, and may also provide information of considerable scientific interest regarding the rate and pattern of recovery. Under these conditions the Chagos reefs could become one of the major safe havens for reef sharks in the Indian Ocean.

## Acknowledgements

Many thanks to Charles Sheppard and to the Friends of the Chagos (now Chagos Conservation Trust) for their support in the 1996 expedition. Thanks also to Charles Anderson for all the work he put into the 1998 paper. Thanks to the BIOT Office in the UK Foreign and Commonwealth Office for their support for the 2001 trip, and to the fellow scientists on that trip, particularly Charles Sheppard, Clare Bradshaw and Simon Wilson.



**Table 1.** Summary of survey data and shark abundances in the Chagos over three decades. Data from 1975, 1979 and 1996 are taken from Anderson *et al.* (1998).

	1975+1979	1996	1996	2001
Observer	CRCS & RC	RCA	MDS	MDS
No. dives	207	45	68	29
No. sharks	874	17	49	50
No. sharks/dive	4.2	0.4	0.7	1.7
Standard Error	0.3	0.2	0.2	0.3

**Table 2.** Changes in shark abundance by species between 1996 and 2001. Observations are from the present author only.

Species		1996	2001
<i>Nebrius ferrugineus</i>	Total obs.	10	7
Tawny nurse shark	Sharks/dive	0.15	0.24
<i>Carcharhinus amblyrhinchos</i>	Total obs.	33	34
Grey reef shark	Sharks/dive	0.49	1.17
<i>C. albimarginatus</i>	Total obs.	2	5
Silvertip shark	Sharks/dive	0.03	0.17
<i>C. melanopterus</i>	Total obs.	4	3
Blacktip reef shark	Sharks/dive	0.06	0.10
<i>Triaenodon obesus</i>	Total obs.	0	1
Whitetip reef shark	Sharks/dive	0	0.03
	Total sharks	49	50
	Sharks/dive	0.72	1.72
	Total dives	68	29

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# Shark Specialist Group (SSG) Red List Workshops in 2003

Rachel Cavanagh and Sarah Fowler

By mid-2003, the SSG had assessed the threatened status of 263 species of chondrichthyan fishes for publication in the 2003 IUCN Red List of Threatened Species ([www.redlist.org](http://www.redlist.org)). Fifty-seven species are threatened (Critically Endangered, Endangered or Vulnerable) and 64 Near Threatened globally. An additional 26 stocks are threatened or Near Threatened regionally. Sixty-four species are currently classified as Data Deficient, meaning that inadequate information is available to make an assessment of their extinction risk. Only 77 species are classified as Least Concern. Red List assessments for >200 additional species have been prepared but not yet approved by the SSG.

The results of these assessments have highlighted two categories of chondrichthyans under particular threat of extinction when most (if not all) of their range is affected by fisheries for other more fecund species. These are coastal endemics (although some are assessed as Least Concern when their range is protected from fishing activity e.g. within a Marine Protected Area) and deepwater species. Indeed, some of these species may be threatened with extinction before they have even been described. Without exception, sawfishes (Pristidae), have been assessed as Critically Endangered at each workshop, although uplistings were not finalised in time for inclusion in the 2003 list.

The aim is to complete Red List assessments for as many as possible of the >1,000 chondrichthyan species, by consultation and consensus within the SSG, for publication in IUCN's Red List analysis in 2004. Comprehensive status assessment of the entire taxonomic group for the IUCN Red List is one of the SSG's most important tasks because it will establish a baseline against which to monitor future changes in the global and regional status of chondrichthyan fishes and scientific knowledge of this group. This information will be a powerful tool with which to promote improved management of and research funding for these biologically vulnerable species.

The SSG is undertaking these Red List Assessments through a series of regional and thematic workshops, the results of which are reviewed and agreed by the whole SSG (IUCN's Red List Authority for the taxa). These workshops provide training in the Red List assessment process, facilitate discussions and assessments of the regional status of species by local and international experts, identify species of conservation concern, and help develop broader priorities for future research and management. Five workshops were held in 2003.

## Australia and Oceania. Brisbane, 7–9 March

The chondrichthyan fauna of this area is particularly diverse, with ~350 (approximately one third) of all known species occurring in this region together with a high degree of endemism. A total of 175 species were assessed during the workshop and most of these will appear on the 2003 Red List. Critically Endangered species include deepwater sharks: Harrison's dogfish, *Centrophorus harrissoni*, a regional endemic, and the southern dogfish, *C. uyato* (Critically Endangered in Australia, but currently Data Deficient globally due to taxonomic uncertainty). Other Critically Endangered species include the Bizant river shark, *Glyphis* sp. A and the northern river shark, *Glyphis* sp. C. The rare Pondicherry shark, *Carcharhinus hemiodon* has not been recorded for over 20 years despite surveys in much of its range, and is now considered Critically Endangered. The grey nurse shark, *Carcharias taurus*, whilst a globally Vulnerable species, is Critically Endangered on the east coast of Australia where severe declines in abundance have been documented. The workshop report containing detailed assessments is available as a pdf from the SSG website (see page 3).



## South America. Manaus, 23–25 June

This region is an important centre of chondrichthyan biodiversity, with >300 species, including many endemics. The results of this workshop are not yet available; considerable consultation remains to be undertaken on the ~90 Red List assessments agreed by consensus among workshop participants before an analysis can be provided. These assessments will be included in the 2004 Red List. Preliminary indications are that a number of species are cause for serious concern, these include the endemic daggernose shark, *Isogomphodon oxyrhynchus* for which population declines of >90% have been documented in the past decade. Another endemic, the striped smoothhound, *Mustelus fasciatus* is also considered Critically Endangered, with the Brazilian population thought to be on the verge of extinction. The Brazilian guitarfish, *Rhinobatos horkelii* and several other species of batoid in this region are also under threat.

## Subequatorial Africa. Durban, 4–7 September

African waters support ~25% of the world's chondrichthyan species. The high endemicity of the fauna, coupled with virtually no fisheries regulation, accelerating fisheries and other marine activities by humans, and localized marine habitat degradation, calls for considerable urgency in addressing the sustainable exploitation and conservation of chondrichthyans of this region. Results from this workshop (~120 species) are pending, and will be included in the 2004 Red List. Huge gaps in the knowledge of trends in chondrichthyan populations were revealed with many Data Deficient species. This region is one of the least known areas in terms of biodiversity and conservation status of sharks and rays, and much work is needed to address this.

## Mediterranean. San Marino, 29 September–1 October

Preliminary results from this workshop indicate that almost half of the species assessed in the Mediterranean are threatened and 30% Data Deficient. Highly threatened species include the common skate, *Dipturus batis*. This once common species, extremely vulnerable to trawl fisheries, has virtually disappeared from the region. *Carcharias taurus* and the smalltooth sandtiger, *Odontaspis ferox* are also extremely rare. Other species of concern include the three regional species of angel sharks, *Squatina aculeate*, *S. oculata* and *S. squatina*; the sawfishes *Pristis pectinata* and *P. pristis*, guitarfish *Rhinobatos cemiculus* and *R. rhinobatos*; the blue stingray, *Dasyatis chrysonota* and several other batoids.

## Deepsea species. Dunedin, 29–30 November

Nearly 35% of chondrichthyan species are confined to the deepsea environment and are generally more vulnerable to exploitation than coastal and epipelagic oceanic species, due to even slower growth and reproductive rates, lower biomass and the limited productivity and geographic constraints of deepsea environments. This short workshop took place in New Zealand at the end of the *Conservation and Management of Deepsea Chondrichthyan Fishes: Pre-Conference Meeting* in conjunction with DeepSea 2003. See page 18.

## Future Workshops

Planning is underway for workshops in 2004, including one on the batoids of the world (focusing on species not covered by the regional workshops) and one for Central and North America. Funds and time permitting, we also hope to work in West Africa. The major regions for which workshop funding has not yet been identified and for which planning is, therefore, not yet underway are the Northern Indian Ocean, East Asia and Northwest Pacific.

For further information and updates as pending results become available, please see [www.flmnh.ufl.edu/fish/organizations/ssg/](http://www.flmnh.ufl.edu/fish/organizations/ssg/) ssg and the Red List website at [www.redlist.org](http://www.redlist.org)

# Recent News

Compiled by Rachel Cavanagh and Gavin Keirse

## CITES Lists Basking Sharks and Whale Sharks in Appendix II

At the 12th CITES Conference of the Parties (CoP) in Santiago de Chile, November 2002, the basking shark, *Cetorhinus maximus*, and whale shark, *Rhincodon typus*, were listed on Appendix II. This followed almost a decade of discussion of shark conservation and management issues and unsuccessful listing proposals, and the Appendix III listings of the basking shark by the UK and the white shark, *Carcharodon carcharias* by Australia.

Appendix III listings can be made by states that regulate the exploitation of the listed species but need the cooperation of other Parties to CITES to control international trade in those species (e.g. by ensuring that appropriate permits accompany traded products). Trade in species on Appendix II is subject to strict regulation and monitoring to ensure that it is not detrimental to the status of the listed species.

The CoP agreed that controls on the lucrative and increasing trade in basking shark and whale shark products were essential to ensure the survival of these vulnerable species as well as to protect sustainable fisheries and eco-tourism operations that might be threatened by unregulated exploitation elsewhere. Important factors in the decision to list these species on Appendix II included acknowledgement of the value of such listings as complementary to traditional fisheries management measures and the disappointing progress with implementation of the FAO's International Plan of Action for the Conservation and Management of Sharks (see opposite).

Since the CoP, Reservations have been taken out on these listings by Iceland, Indonesia, Japan, Norway and the Republic of Korea, some of which are important shark fishing and trading states. This means that these CITES Parties are formally treated as a non-Party with respect to trade in the species concerned and therefore not bound by the provisions of the Convention with respect to trade in these species. It is far too early to judge progress with implementation of these listings, but future assessments of the results of the listings will be complicated by the existence of these Reservations.

The CoP also adopted a Resolution on the Conservation of Sharks (Res. 12.6), proposed jointly by Australia and Ecuador and incorporating recommendations from the 18th Animals Committee meeting. This Resolution will ensure the continued involvement of CITES in shark conservation and management issues and ensure that it will, through its Animals Committee, continue to maintain a 'watching brief' on international progress towards sustainable shark fisheries management, at least until CoP13 in 2004.

For further information, please refer to the SSG website and to the CITES website at <http://www/cites.org>

*Rachel Cavanagh*  
SSG Programme Officer

## Tangaroa Research Cruise

An international group of scientists recorded and photographed more than 500 species of fish and 1,300 species of marine invertebrates on a recent expedition. Mark Norman of Museum Victoria said the survey around Lord Howe and Norfolk Islands was the most complex research expedition ever conducted in Australasia. "Many species new to science were recognised including new sharks and rays, redfish, rattails, and a range of invertebrates," Mr Norman said on the voyage's web site (<http://www.oceans.gov.au/norfanz>). Scientists spent four weeks aboard the National Institute of Water and Atmospheric Research (NIWA) research vessel 'Tangaroa' collecting and photographing species at depths up to 2 km.



## FAO Statement to CITES CoP12

A statement was delivered on behalf of FAO to the 12th Conference of Parties to CITES, under agenda item 41, during which the CITES Animals Committee expressed concern over the slow progress in implementation of the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks).

"It is widely acknowledged and agreed that progress in implementing the IPOA-Sharks has been slow. As mentioned in the FAO intervention on the Animals Committee report, in June 2002 the FAO Secretariat contacted all FAO members encouraging them to increase their efforts to implement this IPOA. The FAO members themselves are aware of the difficulties and discussed these at the 24th Session of the Committee on Fisheries (COFI) in 2001. At that meeting, countries discussed common problems and some countries called on FAO to provide technical guidance and to assist in building capacity. This need was anticipated in Paragraph 30 of the IPOA which called on FAO to 'support development and implementation of Shark-plans through specific, in-country technical assistance projects with Regular Programme funds and by use of extra-budgetary funds made available to the Organization for this purpose.' Unfortunately, to date only one country, Japan, has responded to the requests for extra-budgetary funds to assist in implementation of the IPOA on sharks. These funds are currently being used in appropriate ways for this purpose. If additional funds were available, FAO would be able to do more to facilitate the implementation of the IPOA, especially in developing countries.

Further, in response to instructions from COFI, FAO has undertaken an in-depth analysis of the problems being experienced in implementation of the IPOA. Twenty-two case studies have been undertaken, providing valuable information on the constraints being faced by countries.

It is to be noted that the IPOA-Sharks is directed specifically at all States whose vessels conduct directed fisheries or regularly take sharks in non-directed fisheries, as stated in the proposal by Australia and Ecuador. The vast majority of those States are represented at this meeting, Mr Chairman, and must look to themselves to address the slow progress being made in implementation of the IPOA. FAO therefore fully supports the encouragement given in the fourth paragraph on p4 of the proposal for the national CITES management authorities to work with their fisheries departments in addressing this problem.

The role of CITES in assisting in the implementation of the IPOA is a matter to be decided by the parties to CITES, taking due account of the respective mandates of FAO, CITES, the regional fishery organizations and the member States. In making this decision, the national CITES authorities should ensure that they have consulted closely with the relevant fisheries agencies in their countries and that agreement has been reached on the best way to ensure the conservation and management of sharks and their long-term sustainable use. The problems being faced by shark-fishing nations in achieving the goal of the IPOA are not trivial and it is essential that suitable approaches are developed to achieve that very important goal without causing unnecessary social and economic hardships, and avoiding costly duplication of effort."

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## Red List Regional Guidelines

The IUCN SSC Red List Programme office is delighted to announce that the Regional Guidelines publication is now available to download from the Red List pages of the IUCN SSC web site. <http://www.iucn.org/themes/ssc/redlists/regionalguidelines.htm>.

## The earliest records of whale sharks?

John Nevill and David Rowat

Marine Conservation Society, Seychelles

During a recent data search in the Seychelles National Archives, John Nevill, the Project Officer for the Marine Conservation Society Seychelles, unearthed two very intriguing references.

The first was in an account of the Marion Dufresne Expedition, on 24 Sept 1768 aboard the ship "La Curieuse" off what is now known as Port Victoria, Mahe, Seychelles (Lionnet 1984): "*Nous avons vu ce matin le long du bord un monstre qui avait a peu pres la forme d'un grand requin. Sa couleur etait noiratre, mouchete de blanc, qui nous a parvu avoir 16 a 18 pieds de long sur 10 a 12 pied de grosseur. Ses mouvements etaint lents, il etaient entoure de beaucoup de petits poissons.*" Translation: "We have seen this morning alongside the vessel a shark-like monster. It was blackish in colour, speckled with white; we estimated it was 16–18 feet long and 10–12 feet wide. It moved slowly and was surrounded by many small fish."

Is this the first published record of a whale shark, *Rhincodon typus*, some 60 years before Dr Andrew Smith first described it?

The second reference is a remarkable confirmation of the power of hindsight; whale sharks were shown to be ovoviviparous in 1995 with the discovery of live young in a pregnant female harpooned in the Taiwan fishery, prior to this they had been thought to be egg layers. This had, however, already been observed in 1805 according to this quote from the journal of Captain Beaver: "*In January, 1805, an enormous monster was taken in Mahe Bay, while cruising round our ship, in company with many of her kind, and surrounded by a numerous progeny. She was caught with a small hook, which had been baited for rock fish and it was surprising that her attempts to escape should not have disengaged her. On the first perception of danger, and while she was being drawn alongside, the fry entered the mouth of the dam to seek safety. With some difficulty and much dexterity she was secured and slung; but such was the weight of the prey, that it required the fore and main yard tackles to hoist her on board. After giving sundry violent flaps, she was overpowered; and I saw with astonishment, on a large gash being made in the belly, no less than thirty-eight young sharks tumble out of the orifice alive! They were each nearly two feet in length, and their mouths admitted a man's hand with ease.*" (Smyth 1829).

If readers have any other early records of whale sharks, we would be very pleased to receive details.

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## Partnership to promote conservation efforts for threatened marine species

IUCN Species Survival Commission and the Florida-based Perry Institute for Marine Science have joined forces to help protect the world's oceans through research and the development and promotion of conservation efforts for threatened marine species. The alliance will support critical scientific efforts to identify the growing number of threatened marine species worldwide. Full story: [http://www.iucn.org/themes/ssc/news/SSC\\_perry.htm](http://www.iucn.org/themes/ssc/news/SSC_perry.htm)



## Humphead Wrasse Awareness Campaign

The IUCN Grouper/Wrasse Specialist Group is running an awareness campaign on the Humphead wrasse, *Cheilinus undulatus*, one of the largest of all reef fishes. This species is distributed throughout much of the Indo-Pacific and is being threatened by overfishing, in some places quite severely. It is currently listed as 'Vulnerable' on the Red List. Numbers have declined in many places, we predict fishing will increase and there is now a burgeoning trade in wild-caught juveniles (for 'grow-out' and aquarium use). This species is long-lived, slow to mature and nowhere common. We are very concerned that if not managed or better protected it will quickly become rare. We want to expand our distribution list for campaign materials and would be most grateful for contact details for schools, colleges, NGOs, relevant government offices, dive shops, public aquaria or other meeting places that might be relevant in the Pacific or Indian Oceans.

Please send details to: Yvonne Sadovy, Chair, Grouper and Wrasse Specialist Group, University of Hong Kong, [yvsadovy@hkucc.hku.hk](mailto:yvsadovy@hkucc.hku.hk) <http://www.hku.hk/ecology/GroupersWrasses/iucnsg/index.html> <http://www.humpheadwrasse.info>

## Shark Finning News

This year has seen more states introducing regulations to control shark finning (defined as the retention of shark fins and discard of carcasses at sea). This practice is clearly wasteful and in contravention of the principles of the FAO International Plan of Action for the Conservation and Management of Sharks. The Shark Specialist Group has developed several papers in order to inform the associated debates. See <http://www.flmnh.ufl.edu/fish/Organizations/SSG/finning.htm>.

In the **European Union**, Council Regulation (EC) No 1185/2003 on the removal of fins of sharks on board vessels was adopted in June and came into force in September 2003. This followed an unusually long and heated debate in European Parliamentary Committees and internal fisheries working groups on issues such as the correct fin:carcass ratio for European fleet practices, and possible enforcement problems if fins and carcasses are landed at different ports. Individual European states may introduce stronger national legislation to compensate for the shortcomings of the European Regulation and must report on its implementation. The Regulation will be reviewed in 2005.

In the Pacific, the extensive EEZs and remote islands of several small island states have become the focus of shark fishing and finning activity by Asian vessels. As a result, **Palau** has banned finning and legally protected all sharks within 50 nautical miles of the main islands in order to protect its dive tourism industry. An international campaign against shark finning in **French Polynesia** led to the Environment Minister's announcement in September that shark finning would also be banned around these islands.

In 2001, **Costa Rica** was one of the first states requiring sharks to be landed with fins attached. Unfortunately, there have since been numerous reports of illegal landing of fins by foreign vessels. There is currently considerable debate over whether a new regulation permitting shark fins to be landed detached from carcasses is the correct way to address the problem of ineffective enforcement of the original law.

Finally, the United Nations General Assembly (UNGA) debated shark finning for the first time this year, recognising the vulnerability of sharks to fisheries and the importance of conservation and management actions (including the development of National Shark Plans). The Fisheries Resolution urges States to ban directed shark fisheries conducted solely for the purpose of harvesting shark fins and to take measures for other fisheries to minimize waste and discards from shark catches and encourage full use of dead sharks. FAO is invited to prepare a study on the impact on shark populations of shark catches from directed and non-directed fisheries and to report to the UN Secretary-General.



# Publications

## *Why I Care About Sharks*

**Lisa Cook/Joel Simonetti. 2003. Big Fish Press. ISBN 0-9729262-0-8**  
Lisa Cook and Joel Simonetti of "The Shark Finning and Live Reef Fish Education Project" have produced this unique children's book and accompanying teacher's activity guide. The easy-to-follow book combines biological and ecological information about sharks with the problem of overfishing the world's oceans. Using comics, photographs, beautiful illustrations, charts and graphs, together with a fiction story, the authors cleverly and sensitively incorporate questions raised by science, international law, culture and tradition, all encouraging children to consider how seafood reaches their tables. In the story, two friends overcome their fear of sharks and become fascinated with their plight. As they find out more about sharks they begin to question our responsibilities towards the conservation of sharks and the oceans and to the many people who depend on the sea for their livelihoods. For more information, including an activity guide and reviews from kids, see [http://www.mcabi.org/SharkBook/book\\_release.htm](http://www.mcabi.org/SharkBook/book_release.htm)

The authors are seeking avenues for distributing this book (available at [www.barnesandnoble.com](http://www.barnesandnoble.com)) and its companion classroom activity guide. Do you have connections at large aquaria, museums and elsewhere? Does your organization's website have space to advertise or to provide a link to advertise the book? NB All proceeds from sales go back into *The Shark Finning and Live Reef Fish Education Project*. Please contact Joel Simonetti at <[jsimonetti@jisedu.or.id](mailto:jsimonetti@jisedu.or.id)>

## *Elasmobranch Biodiversity, Conservation and Management. Proceedings of the International Seminar and Workshop, Sabah, July 1997*

**Edited by: Fowler, S.L., T.M. Reed and F.A. Dipper. 2002. Occasional Paper of the IUCN Species Survival Commission No.25. 258pp. ISBN: 2-8317-0650-5. GB£14 or US\$21, plus p&p: 20% overseas surface, 30% airmail (Europe), 40% airmail (rest of world).**

The IUCN Shark Specialist Group's research project on the biodiversity, conservation and management of elasmobranchs, in Sabah, East Malaysia, was funded by the UK Darwin Initiative. It was undertaken in collaboration with the Department of Fisheries, Sabah, in liaison with WWF Malaysia, the Universiti Malaysia Sabah and the Sabah Institute for Development Studies. An international workshop held at the end of the project aimed to disseminate the results to other countries in the region and raise awareness of the importance of elasmobranch biodiversity in the context of conservation, commercial fisheries management and for subsistence fishing communities. The workshop proceedings include papers presented during the workshop, conclusions and recommendations for future work.

SSG members are entitled to a 33.33% discount on the selling price, plus p&p; AES members to a 20% discount, plus p&p (see above). Contact [info@books.iucn.org](mailto:info@books.iucn.org) or go to <http://www.iucn.org>

## *Tiburones del Mediterráneo*

**Joan Barrull and Isabel Mate. 2002. Llibreria El Set-ciències. ISBN: 84-95526-07-7.**

[www.ample24.com/setciencies](http://www.ample24.com/setciencies), [setciencies@ample24.com](mailto:setciencies@ample24.com)

This Spanish guide book will provide a useful tool for those working in the Mediterranean, whether researchers, fishermen, divers, or those with a general interest in sharks. It is illustrated with 115 drawings and 125 photographs, and is structured in two sections: the first for general information on the anatomy, feeding, reproduction and fishing of sharks and their commercial importance, the second section is a guide of the 45 species of sharks recorded in the Mediterranean Sea, together with accurate summaries of the diagnostic characters, distribution, biology and use, and biometric data.



## *The Shark Chronicles: a scientist tracks the consummate predator*

**John A. Musick and Beverly McMillan. 2002. Times Books, Henry Holt and Company, New York, USA. ISBN 0-8050-7093-1.**

John (Jack) Musick and his wife Beverly McMillan have written this wonderful book detailing Jack's lifelong career working with sharks and shark biologists. It is written in a popular style, for the intelligent lay person, but certainly appeals to experts in this field, not least because you may find yourself among the pages, together with many of your favourite shark scientists! Chapters focus on different aspects of shark biology, highlighting the work of individual scientists, interspersed with the often high drama and excitement of shark research both in the laboratory and in the wild. A strong conservation theme runs throughout the book, in keeping with Jack Musick's position as Co-Chair of the IUCN Shark Specialist Group. *The Shark Chronicles* is a fascinating and educational adventure, documenting Jack's career and his interactions with others who have dedicated their lives to shark science and conservation. In addition to being inspired to find out more, readers will be reminded of the all too daunting task of conserving sharks in a world where human activities are the most dangerous threat to these ancient fish.

***The Conservation Status of Australian Chondrichthyans: Report of the IUCN Shark Specialist Group Australia and Oceania Regional Red List Workshop***  
**Rachel D. Cavanagh, Peter M. Kyne, Sarah L. Fowler, John A. Musick, and Michael B. Bennett. 2003. The University of Queensland, School of Biomedical Sciences, Brisbane, Australia. x + 170pp. ISBN: PB 0-9751041-0-1. Free of charge from <http://www.flmnh.ufl.edu/fish/organizations/ssg/ssg.htm> Note: A very limited number of hard copies are available for researchers and organisations in the Australasia region. Contact Peter Kyne [p.kyne@uq.edu.au](mailto:p.kyne@uq.edu.au) to find out if you qualify for a copy.**

The IUCN Shark Specialist Group (SSG) held a regional Red List Workshop at the University of Queensland's Moreton Bay Research Station in March 2003 to assess the conservation status of the chondrichthyan fauna in the SSG's Australia and Oceania region (encompassing Australia, New Zealand, New Guinea and many smaller Pacific Island nations). The chondrichthyan fauna is extremely diverse, with ~350 (approximately one third) of all known species occurring in this region. A total of 175 species were assessed during the Workshop and their status agreed by consensus throughout the SSG network. This includes all regional endemic shark species together with several endemic rays and chimaeras, and many wider-ranging species. For each species, in addition to the Red List assessment, information is presented on distribution, habitat and ecology, threats and conservation measures. The Workshop outcomes are discussed in the context of the overall regional and global conservation status of chondrichthyan fishes. Summaries of Red List assessments carried out by the SSG network in 2000 of species occurring within this region are also included in this report.

## *Sharks of the World. An annotated and illustrated catalogue of the shark species known to date.*

**Volume 2. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes)**  
**L.J.V. Compagno. 2001. FAO Species Catalogue for Fisheries Purposes No. 1, Vol.2. FAO, Rome. ISBN 92-5-104543-7.**

This is the second volume of an extensively rewritten, revised and updated version of the original FAO Catalogue of Sharks of the World. (Volumes 1 and 3 are expected in 2004). This volume reviews all 15 families, 25 genera and 57 species of living bullhead, mackerel and carpet sharks (orders Heterodontiformes, Lamniformes

and Orectolobiformes). Accounts for all orders, families and genera are given and all keys to taxa are fully illustrated. Information under each species account includes: valid modern names and original citation of the species (or subspecies); synonyms; the official FAO names for the species in English, French and Spanish; a lateral view and often other useful illustrations; field marks; diagnostic features; distribution, including a GIS map; habitat; biology; size; interest to fisheries and human impact; local names when available; a remarks section when necessary; and literature. The volume is fully indexed and also contains sections on terminology and measurements, including an extensive glossary, a list of species by FAO Statistical Areas, an appendix on shark preservation and an extensive bibliography.

Copies are available from Publications-Sales@fao.org or can be downloaded from [www.fao.org/fi/sidp/products/pub\\_cata.htm](http://www.fao.org/fi/sidp/products/pub_cata.htm)

### **Shark Conference 2002: Sustainable Utilization and Conservation of Sharks**

**WildAid and National Taiwan Ocean University.**

**Summary of Conference Proceedings, Taiwan, May 2002.**  
[www.wildaid.org/programs/SC2002Proceedings.pdf](http://www.wildaid.org/programs/SC2002Proceedings.pdf)

### **Regional Fisheries Organisations and the World Trade Organization: Compatibility or Conflict?**

**Richard G. Tarasofsky, 2003. TRAFFIC International. ISBN: 1 85850 202 0. [www.traffic.org/news/fisheries\\_trade.pdf](http://www.traffic.org/news/fisheries_trade.pdf)**

Compiled in order to increase understanding of the relationship between World Trade Organisation rules and trade measures adopted by Regional Fishery Organisations.

### **Shark Finning: Unrecorded wastage on a global scale WildAid and Co-Habitat**

This report discusses the global issue of shark finning, including case studies from Costa Rica and Indonesia, reports of illegal fishing and a series of recommendations. To obtain a copy contact WildAid, 450 Pacific Avenue, Suite 201, San Francisco CA 94133. [info@wildaid.org](mailto:info@wildaid.org)  
<http://www.wildaid.org>

## **Meetings**

**Compiled by Rachel Cavanagh and Gavin Keirse**

### **19th American Elasmobranch Society Meeting Manaus, Brazil, 26 June–1 July 2003**

Abstracts available from [www.flmnh.ufl.edu/fish/Organizations/aes/abst2003.htm](http://www.flmnh.ufl.edu/fish/Organizations/aes/abst2003.htm) (oral) and [www.flmnh.ufl.edu/fish/Organizations/aes/abst2003p.htm](http://www.flmnh.ufl.edu/fish/Organizations/aes/abst2003p.htm) (poster).

### **Vth IUCN World Parks Congress Durban, South Africa, 8–17 September 2003**

The IUCN World Parks Congress is a 10-yearly event that provides the major global forum for setting the agenda for protected areas. It assists governments to create new protected areas and direct more resources towards biodiversity conservation. Congress Patrons, former South African President and Nobel Peace Prize winner Mr Nelson Mandela and Her Majesty Queen Noor of Jordan, strongly endorsed the Congress theme: "Benefits Beyond Boundaries".

S.S.G. members were actively involved in a side event organised by the IUCN Species Survival Commission and Global Marine Programme. This introduced a new initiative to "Shatter the Myth" about marine extinctions. Participants agreed there is a need to show decision-makers that marine species can go extinct, contrary to widespread belief, and change current marine management policy and practice.



The S.S.G. issued a press release with the message that marine protected areas may provide the only hope for some threatened shark species, but that MPAs are just one vital aspect of a suite of measures needed to protect ocean species. Documents and press releases are posted on <http://www.iucn.org/themes/wcpa/wcpa2003/>

### **7th European Elasmobranch Association Meeting San Marino Republic, 26–28 September 2003**

Themes covered at this two-day meeting included: Public Aquaria; Conservation; Education; Ecology and Genetics. One hundred and twenty researchers and students from all over the world attended, with 32 oral presentations and 21 poster presentations. <http://www.unosqualoperamico.org/eea.html>

### **Managing Our Nation's Fisheries: Past, Present, and Future**

**Washington, D.C., USA, 13–15 November 2003**

This conference, sponsored by the eight Regional Fishery Management Councils and the National Marine Fisheries Service (NOAA Fisheries) aimed to educate the public, policy makers, and media on the marine fishery management process, successful management examples by region, and current management and research initiatives; help bridge the gap between perception and reality regarding fisheries management; and to provide a forum for information exchange and solicit a wide range of perspectives on future management and marine research directions. The conference featured keynote speakers followed by regional perspectives from each Council/Region and workshop/panel discussions on specific issue areas. [www.managingfisheries.org](http://www.managingfisheries.org)

### **Conservation and Management of Deepsea Chondrichthyan Fishes**

**Dunedin, New Zealand, 27–29 November 2003**

This Pre-Conference Meeting, convened jointly by FAO and the IUCN SSC Shark Specialist Group, was held in conjunction with DeepSea 2003 (see below). The workshop contributed to promoting the implementation of the FAO IPOA-Sharks and was funded by the Packard Foundation, UK Defra, and the Japanese Government Trust Fund. Specialists from a dozen countries (including two keynote speakers from Japan) presented poster and papers reviewing the life history, ecology, taxonomy, stock status, utilisation and threats to deepsea chondrichthyans. Much of the third day was devoted to recommending priorities for data collection, research and management for these highly vulnerable fish, many of which are threatened by deepsea fisheries. These conclusions were presented to the DeepSea 2003 Conference the following week and are summarised on pp. 25–28 of the interim conference report (see [www.deepsea.govt.nz](http://www.deepsea.govt.nz)).

The meeting concluded with a Red List Workshop (see page 14).

### **DeepSea 2003**

**Queenstown, New Zealand, 1–4 December 2003**

This international conference provided a forum for experts to discuss the issues relating to the present and future needs for science, conservation, and governance and management of the continental slope and deep seas. Participants from almost 40 countries brought a wide range of information and skills to the conference and gained an up to date appreciation of all components of science, technology, compliance, management and governance issues (integral considerations to today's overall governance and implementation initiatives). The Interim Report (see [www.deepsea.govt.nz](http://www.deepsea.govt.nz)) summarises presentations and discussion points. The full report should be available in April 2004 after consideration by the DeepSea 2003 Steering Committee.

*For forthcoming meetings, see page 20.*

# Oceanário de Lisboa

(Co-sponsor of Shark News No. 15)

Mark F. L. Smith, IDEA Inc., Australia, and  
João Pedro Correia, Oceanário de Lisboa, Portugal

The centre-piece pavilion for the World Exposition in 1998, the Oceanário de Lisboa was designed by the renowned architect Peter Chermayeff and cost 68 million US dollars. Opened on May 22 during the year of the Exposition, the Oceanário remains an important attraction for domestic and international visitors (approx. 900,000 *per annum*) and continues to display a diverse collection of fishes, mammals, birds, and plants from around the Planet. In every effort the team at the Oceanário de Lisboa attempts to meet the objectives laid down in its mission statement: 'to contribute toward global conservation by entertaining, inspiring and educating through bringing people into intimate and emotional contact with the marine environment and its inhabitants. Further, to promote and maintain excellence in animal welfare, innovation in exhibition and encourage environmental preservation through applied research, staff development, and the unification of international marine conservation efforts'.

Elasmobranchs have always been an important part of the collection and command great public interest. Species are exhibited from a wide range of families and geographic origins (Northern Australia, Southern Africa, Southern USA, South Eastern Asia and Southern Europe). Great efforts have been undertaken to ensure a suitable environment for these animals, which can be observed swimming freely in large community exhibits with a wide range of prey species.

## Education

A critical component of the Oceanário's mission is its education programme. Formal and informal classes are given to students and public alike. Many of the educational modules address the importance of elasmobranch conservation. A 'sleep-with-the-sharks' programme enables students to sleep overnight in the aquarium adjacent to the windows of the principal exhibit. Myths about elasmobranchs are replaced by facts as students have dinner, sleep, and breakfast with the nearby sharks and rays.



## Husbandry

Throughout the Oceanário's history, husbandry challenges have demanded the need to adopt interesting solutions. These have included the successful use of cryo-surgery to repair the damaged rostrum of a *Rhinobatus typus* and the application of intensive vitamin supplementation to rectify the softening of supportive cartilage in *Himantura uarnak* and *H. undulata*. The Oceanário has also assisted many aquaria throughout Europe with similar challenges.

## Research

The Oceanário supports a number of different research programmes, two on elasmobranchs. The first, in partnership with the Monterey Bay Aquarium and the Centro de Investigación Científica y Educación Superior de Ensenada, seeks a better understanding of the family *Mobulidae*. Research in Baja California, Mexico, has included studies related to life history (i.e. age and growth, morphometrics, sexual maturity, etc.), fisheries, migration patterns, brain function, and captive biology of the *Mobulidae*. The second programme, directed at learning more about the migration patterns of *Prionace glauca* within the Atlantic Ocean, is being conducted in cooperation with the Portuguese association for the study and conservation of elasmobranchs ('APECE'). The movement of this commercially important species has implications for fisheries and associated regulations. During 2003, four specimens will be tagged and tracked using satellite tags. Results will not only be published in the scientific literature, they will also be made available to visitors of the Oceanário using a graphic interface showing real-time positions of the sharks throughout the study.

Since opening, we have striven to achieve excellence in animal husbandry techniques, support research efforts, and educate the public about the Oceans and its inhabitants. Sharks and rays play a critical environmental role. We endeavour to highlight their importance to our visitors not only through words, but also through our actions.

Mark F.L. Smith,

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and João Pedro Correia,

Oceanário de Lisboa, Doca dos Olivais, 1990-005 Lisboa,

Portugal. E-mail: jpcorreia@oceanario.pt

## Subscribing to Shark News

The SSG does not charge a formal subscription for this newsletter, (administration costs would be too high, particularly when handling foreign currency). We do, however, greatly welcome all institutional and personal contributions towards the cost of printing, mailing, and other SSG work. Currently, each issue costs around US\$ 3,500, including printing, distribution and editing. The mailing list is more than 900 worldwide, ranging from SSG scientists and government agencies to interested members of the general public. We welcome offers to part-sponsor Issue 16 and have no sponsors for future issues at this stage.

### Donation for Shark News

I enclose a donation for : .....

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Return to: Rachel Cavanagh, SSG Programme Officer, c/o TRAFFIC International, 219a Huntingdon Road, Cambridge CB3 0DL, UK.  
Please send donations in US\$ to Sonja Fordham, Ocean Conservancy, 1725 DeSales Street NW, Washington, DC 20036, USA.

Donations may be made as follows:

1. by cheque or Bankers Order in US\$ to Sonja Fordham at the Ocean Conservancy (marked payable to "TOC - Shark Specialist Group, account number #3020"), or

2. by cheque or Bankers Order in £ sterling to Rachel Cavanagh (made payable to the "Shark Specialist Group"), or

3. by credit card. Send details to Rachel Cavanagh.

Invoices for subscriptions (£5.00 per issue) can be sent to organisations or libraries unable to contribute without a formal request for payment. All addresses are given below.

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## The Columbus Zoo and Aquarium

The Columbus Zoo and Aquarium is proud to be a sponsor of the 15th edition of *Shark News* in partnership with the Oceanário de Lisboa. This effort is a direct extension of the spirit of international cooperation created during the 1st International Elasmobranch Husbandry Symposium, Orlando, Florida, October 2001.

The Columbus Zoo and Aquarium is a not for profit conservation institution. Its purpose is to promote awareness and understanding of the interdependence of the natural world, and to present to our community, interactive, participatory and educational exhibits and activities, which represent that relationship. This is achieved by teaching and practicing conservation, both on and off site, contributing to the discovery of biological knowledge, offering enjoyable, educational and family-oriented recreational opportunities and instilling in all who visit a sense of adventure and discovery. The Columbus Zoo and Aquarium's commitment to conservation is expressed through support of staff and independent field researchers worldwide.

We gratefully acknowledge the donations for newsletter production received from Tim Anderson, Jose Manuel N. Azevedo, E.K. Bourne, California Academy of Sciences, Paulo Chaves, Gilles Cuny, Beth Firchau, Suzanne Gendron, Jack Stein Grove, Heather Hall, David Hoffman, Robert L. Jenkins, Matthew Kane, Joel Kimber, Greg Knowles, Maurice Kottelat, Dr and Mrs Ladle, Helen Lamey, Dr Rod Lenanton, Dr David Lowe, R.D. McVean, Scott Mycock, Joseph S. Nelson, Jacinth O'Donnell, P.J. Peck, R.J. Peirce, Jeanette Sanders, Alex Schneider, Shark Reef at Mandalay Bay, Christine Snovell, Mike Sugden, Ron and Valerie Taylor, Bruce A. Thompson, Julia Todd, P. Vine, Eric Wittenberg, Jennifer Zimmerman and George Zorzi. We would also like to thank Natalia Wase and Gavin Keirse for their assistance editing the articles in this issue.

## Oceanário de Lisboa



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In every effort, the team at the Oceanário de Lisboa attempts to meet the objectives laid down in its mission statement: 'It is the mission of the Oceanário de Lisboa to contribute toward global conservation by entertaining, inspiring and educating through bringing people into intimate and emotional contact with the marine environment and its inhabitants. Further, to promote and maintain excellence in animal welfare, innovation in exhibition and encourage environmental preservation through applied research, staff development, and the unification of international marine conservation efforts'.

## Forthcoming meetings

**Asociación Chilena de Ictiología**  
**Valdivia, Chile, 14–16 January 2004.**

Contact Julio Lamilla jlamilla@uach.cl

**Quantitative Ecosystem Indicators for Fisheries**  
**Management International Symposium**

**UNESCO, Paris, 31 March–3 April 2004.** www.ecosystemindicators.org

**4th World Fisheries Congress**

**Vancouver, Canada, 2–6 May 2004.** www.worldfisheries2004.org

Congress theme: Reconciling Fisheries with Conservation: The Challenge of Managing Aquatic Ecosystems.

**20th American Elasmobranch Society Meeting**

**Oklahoma, USA, 26–31 May 2004.**

www.dce.ksu.edu/2004jointmeeting

**10th International Coral Reef Symposium**

Okinawa, Japan, June 28–July 2, 2004. www.plando.co.jp/icrs2004

**VIth International Conference on Wildlife Management**  
**in Amazonia and Latin America**

**Iquitos, Peru, 5–10 September, 2004.** www.vicongreso.com.pe

Contact conference organisers at congreso\_fauna@amauta.rcp.net.pe

**13th meeting of the Conference of Parties to CITES**

**Bangkok, Thailand, 2–14 October 2004.** www.cites.org

**2004 IUCN World Conservation Congress**

**Bangkok, Thailand, 17–25 November 2004.** www.iucn.org

One of the key international platforms for knowledge sharing, policy dialogues and governance issues on environment and sustainable development. Theme: People and Nature – Making a Difference.



## Editorial details

*Shark News* aims to provide a forum for exchange of information on all aspects of chondrichthyan conservation matters for Shark Group members and other readers. It is not necessary to be a member of the Shark Specialist Group in order to receive this newsletter.

We publish articles dealing with shark, skate, ray and chimaeroid fisheries, conservation and population status issues around the world; circulate information on other relevant journals, publications and scientific papers; alert our readers to current threats to chondrichthyans; and provide news of meetings. We do not usually publish original scientific data, but aim to complement scientific journals. Published material represents the authors' opinions only, and not those of IUCN or the Shark Specialist Group. Publication dates are dependent upon sponsorship and receiving sufficient material for publication, usually one or two issues per annum.

**Manuscripts should be sent to Rachel Cavanagh at the address given on p.19.** They should be composed in English, legibly typewritten and double-spaced. Word-processed material on IBM-compatible discs would be most gratefully received, or as email attachments. Tables and figures must include captions and graphics should be camera-ready.

Length of features: (word counts include titles and references): The lead article, with two good size illustrations, should be no more than 1,300–1,400 words. A single column article should be 550–600 words, (450–500 words leaves space for a small illustration). A full page (2 column) article with good-sized illustration should be 800–1000 words. Other main articles, for an inside two page spread with one large or two medium-sized illustrations, should be 1,800–2,000 words, depending on the number of illustrations. Short newsy communications and letters are also welcome.

**Writing style:** This newsletter goes to members of the general public and to managers and policy-makers, as well as to elasmobranch specialists, fisheries scientists and the conservation community. We need a clear and brief style of writing. It is also essential to break up the text with plenty of sub-headings, and to provide one or two photographs or graphics. There is room for small tables, but nothing too long and complex. Author's name, affiliation and address must be provided, with their fax number and email address where available.

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