SHARK NEWS

SHARK NEWS 6 NEWSLETTER OF THE IUCN SHARK SPECIALIST GROUP March 1996

Localised stock depletion: does it occur for sharks?

Terry Walker, Victorian Fisheries Research Institute

Introduction

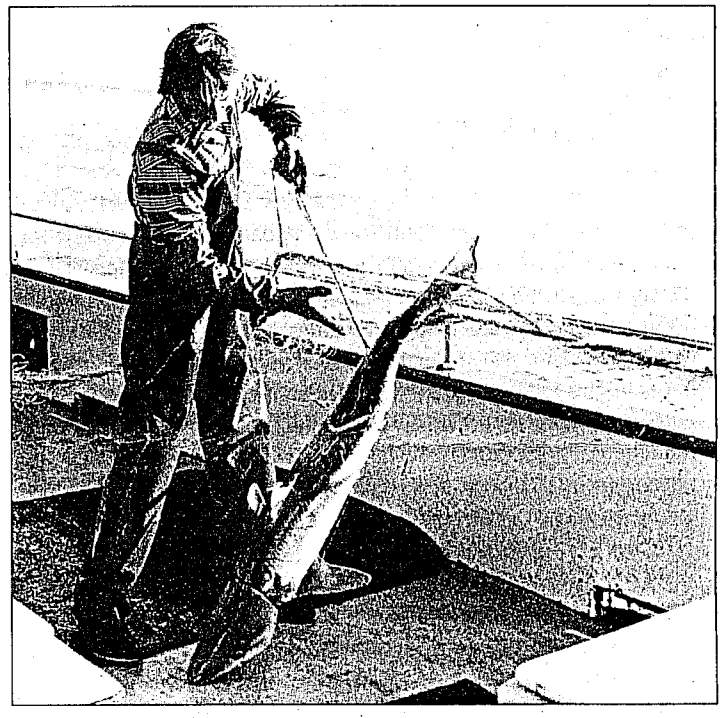
For the purpose of this article 'localised stock depletion' refers to a situation where a species occupies a range of separate regions and where the density of animals in one or more of these regions is reduced more than in the other regions by fishing or habitat modification. Localised stock depletion is expected for sessile and relatively slow moving animals such a scallops, abalone and lobsters which are harvested more intensively in some regions than in others, but is less expected for free-swimming animals such as sharks which can readily move into previously occupied areas. In the following I will briefly outline how localised stock depletion has become apparent in shark culling programs designed to protect bathers at beaches from shark attack and how it might occur in artisanal, recreational and industrial (i.e. modern large-scale commercial) fisheries.

Evidence for localised stock depletion

The concept of localised stock depletion for sharks first arose when Holden (1977) drew attention to the catch per unit effort (CPUE) trends for beach netting programs at two Natal locations – Durban during 1952–1972 and Brighton Beach during 1961–1972. He describes the trends as both having an initial steep decline followed by a steady catch rate, a pattern expected during the early phase of harvesting of any previously unfished stock. Because the initial catch rates at Brighton in 1961 were as high as the initial catches at Durban nine years earlier, and because the netted beaches are only about 10 km apart, Holden concluded that the populations were isolated and that the sharks were territorial.

Several other authors found the trend of initial CPUE decline followed by stability for each of a number of, but not all, shark species. Dudley and Cliff (1993a, b) present additional data for the Natal beach meshing program, which by 1990 involved setting a total of 42 km of netting at 43 beaches on the 560 km Natal coast, and Simpfendorfer (1993) presents data for the Queensland beach protection program. While most species captured by gillnets in these programs followed this trend, Simpfendorfer found no trend for tiger shark *Galeocerdo cuvier* and found constant or rising CPUE trends for several shark species captured by drumlines. He suggests that rates of inshore–offshore movements, seasonal and along-shore migration patterns and amounts of time certain species spend inshore affect the trends. Dudley and Cliff (1993a, b) also suggest that the trends for some species depend on migration patterns and the 'degree of residency'. In addition, they postulate that changes in predator–prey interactions between shark species and between sharks and other vertebrate species might contribute to the observed CPUE trends.

Although not well documented, localised stock depletion is also likely to be exhibited in many of the world's unregulated artisanal and recreational fisheries where sharks are either targeted or taken as part of multispecies fisheries. Many of these fisheries have large numbers of small fishing boats collectively applying high levels of fishing effort in coastal waters. However, because these boats are restricted to a range of only a few miles from shore and because most of the species harvested are distributed widely inshore and offshore, the ranges of these fisheries are small compared with the distribution ranges of the shark species. Provided nursery grounds or major aggregations of breeding sharks do not fall within the ranges of these fisheries and there are not well-developed offshore industrial fisheries harvesting the same species, inshore localised stock depletion of sharks with associated falling CPUE trends can give the appearance of a fishery in decline while the overall stock is only marginally depleted.



A school shark, *Galeorhinus galeus*, caught by demersal gillnet off southern Australia in the world's longest-running industrial fishery targeting sharks. Photo: Terry Walker.

Examples of wider stock depletion

Industrial fisheries either targeting sharks or taking sharks as bycatch operating over wide areas on the high seas and continental shelves of the world have had a greater impact on stocks than inshore localised fishing. For example, falling bycatches from the tuna longlining fleets are indicative of a broad-scale stock reduction of pelagic sharks (Taniuchi 1990) and the unregulated targeting of the soupfin shark *Galeorhinus galeus* on the continental shelf off

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Tagging programmes

California led to a complete fishery collapse during the 1940s. Fishers in the industrial shark fishery off southern Australia targeting school shark *G. galeus* and gummy shark *Mustelus antarcticus* believe that the presence of sharks captured in bottom-set gillnets repels free-swimming sharks from an area. Many express the view that habitat disturbance and/or noise from trawl fishing also have the effect of repelling sharks from an area. Hence to maintain their catch rates the fishers tend to shift position after hauling the gear and for several weeks will avoid grounds known to have been previously fished. The effect of catching part of a population in an area and repelling other sharks by the use of fishing gear can be viewed as temporary localised stock reduction whereas permanently repelling sharks from an area by habitat modification can be viewed as more permanent localised stock depletion.

Stock depletion in the Port Phillip Bay nursery

An example of more permanent localised stock depletion of juvenile school sharks in the Australian fishery is that described by Olsen (1959) for Port Phillip Bay in Victoria. In response to intensive fishing of juveniles, the catch from the Bay increased threefold from 1942 to 1944 and then fell rapidly until the early 1950s when they became protected by the introduction of a legal minimum length. Olsen (1954) identified the Geelong Arm in Port Phillip Bay as a nursery area, where on several occasions during 1947–1951 he captured for tagging more than 200 sharks per day on a handline. Since then inshore fishers have caught only small numbers of school sharks from anywhere in the Bay and monthly sampling over December–March during 1993–1996 by the Victorian Fisheries Research Institute with 400 baited hooks attached to longlines and 150 m of gillnetting (2–4 inch mesh-sizes) produced catches of only 0–10 juvenile sharks per day. This localised stock depletion of juvenile sharks in the Bay is much more severe and occurred much earlier than the overall reduction of stock biomass which current assessments indicate have been reduced to below 25% of the biomass levels occurring before the fishery began in the 1920s.

The lack of any stock recovery in Port Phillip Bay since the 1950s and the high movement rates by adult sharks are difficult to reconcile. On one hand, the wide dispersion of tagged school sharks, the long migrations associated with parturition, and the complex distribution patterns of various age-classes throughout southern Australia described by Olsen (1954) are all consistent with the hypothesis of a single panmictic population with sections of the stock at different life history stages occupying different localities within the range of the distribution. On the other hand, the lack of recovery of juvenile sharks in Port Phillip Bay is more consistent with the hypothesis of discrete subpopulations with limited interchange. The discrete breeding subpopulations using different nursery areas would have to mix at other life history stages to be consistent with Olsen's description. Another hypothesis, which accounts for the lack of diffusion of school sharks into the Bay and its diminished use as a major pupping ground since the 1940s, is that the habitat of the Geelong Arm has become less suitable for *G. galeus*.

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Request for information on sawfishes, family Pristidae

The Shark Specialist Group is becoming increasingly concerned about widespread reports (both from anecdotal accounts and, less commonly, reviews of historic fisheries data) of an apparently serious decline over the past few decades of formerly healthy populations of all species of sawfish. Similar patterns are appearing in most of the warm-temperate to tropical regions of the world, and we would greatly welcome any comments from readers on this subject.

This unusual family of rays is difficult to confuse with other species (with the possible exception of the very rare sawsharks). Additionally, because of their bizarre appearance, sawfish are generally readily noticed and well recorded (or at least remembered) where they are present or have occurred in the past (albeit not always accurately to species). Their saws are commonly preserved in fishing villages, local museums or as tourist curios, and may appear in the marine curio trade, thus often enabling species to be identified. These characteristics make it relatively easy to determine regional patterns of fisheries yields, even if only on an anecdotal basis.

The pattern of decline reported so far can be broadly summarised as follows: relatively large (or at least reliable) catches prior to the 1960s, followed by a period during the 1960s and 1970s when a steep decline in catches was widely reported, followed by very infrequent records into the 1980s and 1990s. Tyson (pers. comm.) suggests that one of the major reasons for the decline was the big increase in gillnet fishing worldwide around 1960, when cheap and very effective nylon fibre gillnets became widely available. Adams (pers. comm.) indicates that the smalltooth sawfish *Pristis pectinata* may have gone into decline a little earlier than this in the south-eastern United States, where intensive commercial and recreational fishing appear to have had an earlier impact.

Readers are requested to pass on to the editors, Sarah Fowler or Merry Camhi, any information they may have on trends in sawfish catches, whether based on fisheries records, accounts in literature, or indeed anecdotal information (but please indicate your sources clearly and, if at all possible, the species involved).

Editorial

I apologise for the lateness of this issue of *Shark News*, originally targeted for distribution in February. No need to bore you with a list of reasons for the delay – suffice it to say that the excuses are generally feeble ones, but I must also point out in our defence that editing this newsletter is an entirely voluntary effort; both editors and contributors are unpaid. We hope to produce the next issue, *Shark News 7*, in June, back on schedule. The intention is that it will go out well before the next official meeting of the Shark Specialist Group in August. See the next column for more information about this meeting.

This issue, No. 6, concentrates on a theme which was originally aired in August–early September 1995 on the American Elasmobranch Society's internet discussion list, elasmo-l. The discussion was first stimulated by reports of a 'sudden' decline in spiny dogfish *Squalus acanthias* catches off the Mt Desert Island Biological Laboratory, near Bar Harbor, ME (north-west Atlantic) – was this a localised effect or more widespread phenomenon? Bob Hueter suggested that this could be another example of localised 'hole-punching' of a shark stock, defined as localised depletion which is followed by poor recovery within that locality, even though the core of the population may be in relatively good shape. His hypothesis to explain this was that individual sharks are more site-fixed in their migratory habitats than they are generally given credit for. Once individuals programmed to live in a certain segment of the range are removed, it takes a relatively long time for others to stray into the under-utilised habitat. This effect had been seen in the 1980s Florida sports fishery. The general trend in the north-west Atlantic has been for localised depletion to be followed by broad-scale depletion.

This subject was taken up by several correspondents who had noticed localised stock depletion in other species, including commercially fished school or soupfin shark *Galeorhinus galeus* and bull shark *Carcharhinus leucas* taken in KwaZulu-Natal shark nets. In contrast, the tiger shark *Galeocerdo cuvier* did not show any localised depletion when taken in beach protection programmes in Queensland and Hawaii. While this effect can be explained by the very small home range of bull sharks, it was noted by Sheldon Dudley that a migratory species, the ragged tooth shark *Carcharias taurus*, has shown localised depletion in areas where it only occurs for part of the year. A very similar pattern is seen for some basking shark *Cetorhinus maximus* fisheries (see p. 4). It appears likely that small groups of some species of shark return separately to particular locations each year, in a manner similar to salmon or turtles homing to highly specific breeding, nursery, or feeding grounds.

It will be necessary to study local and long-distance shark movements and the degree of mixing of localised stocks in more detail to test these hypotheses. The implications of these observations for the conservation and management of sharks through protected areas or protected species designation require careful consideration.

The next (June) issue will be on the general theme of shark and ray tagging programmes. Please contact the editors NOW if you have any suggestions or contributions for relevant news items, articles, potential contributors or other recommendations. I am particularly interested in featuring a range of examples of tagging programmes, considering the quality of data they have produced, how this has advanced scientific knowledge, and how sports angling tagging programmes may have changed attitudes towards elasmobranch conservation. On the down side, some readers may feel that tagging induced mortality is unacceptably high in some tagging programmes – this subject must also be considered. Please note, however, that for reasons of space and finance we cannot print everything that we are sent and material is subject to editing for flow, sense and to address our readership appropriately.

Sarah Fowler

Notice of the next Shark Specialist Group meeting:

August 1996, Brisbane, Australia

Merry Camhi

The next official meeting of the Shark Specialist Group will take place at the Second World Fisheries Congress in Brisbane, Queensland, Australia. The SSG meeting is tentatively scheduled for the morning of 3 August 1996, immediately following the main Congress meeting and workshop. Details of time and place will be provided to SSG members when available.

At this important meeting, SSG members will finalise the draft of the Global Shark Action Plan, discuss the Red List species assessments, and identify the information needs for the report to the CITES Animals Committee on the global status of sharks. In addition, we will discuss re-appointments to the SSG for the next triennium. All SSG members are encouraged to attend. Following the official business meeting of the SSG, we also intend to hold a working-group session on the various CITES-related projects in preparation for the Tenth CITES Conference of Parties to be held in Zimbabwe in June 1997. The working-group will be open to all Congress attendees.

The theme of the Second World Fisheries Congress, which will run from 28 July to 2 August, is "Developing and Sustaining Fisheries Resources: The State of Science and Management." It will focus on international policy, research, and science that will shape sustainable development of the world's fisheries resources into the future. The registration fee for the Congress is costly at A$650, but this includes admissions to the sessions and trade show, lunches, teas, one dinner, congress abstracts, and the proceedings.

Registration information for the Congress may be obtained by phone (617-3369-0477), fax (617-3369-1512), or on the Congress home page at http://wwwml.csiro.au/bradford/WFC_page.html.

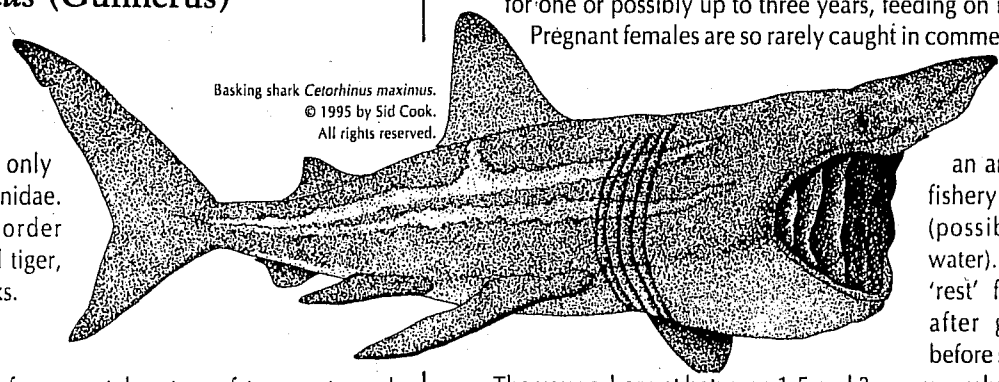
In addition, a special one-day shark workshop entitled "Sharks and Man: Shark Management and Conservation" will take place at the Congress on 2 August from 08:30 to 21:00. It will consist of three sequential sessions: shark control (public safety), shark fisheries management, and shark conservation. A separate A$60 registration fee is required at the time of registration for the Congress. Participants in the Sharks and Man workshop are required to register for the Congress as well.

Neil Gribble is organising the shark control session of the Sharks and Man workshop. SSG member Terry Walker is organising the fisheries management session, which will present an overview on world landings, fishery management in general and in Australia, and models of shark fisheries. The evening conservation session is being organised by SSG Vice Chair John Stevens. The conservation session is restricted to invited talks, including updates on the IUCN/SSG Global Shark Action Plan and Red List assessments, the TRAFFIC/CMC trade study, the CITES shark resolution, and protective species status, among other topics.

All SSG members are strongly urged to attend, if possible, this official meeting of the Shark Specialist Group and the workshop. The meeting will be of particular importance because of its critical timing: some of the most important global conservation and management initiatives for sharks in this century will be discussed, including the Global Action Plan, TRAFFIC's analysis of the shark trade, CITES, and the IUCN Red List of Elasmobranchs. Because we recognise that high registration and travel costs may prohibit attendance by some SSG members, limited SSG funds may be available to help underwrite these costs for some SSG members, based on need. Please contact Sarah Fowler or Merry Camhi for further information on this meeting of the Shark Specialist Group.

Status of the basking shark
Cetorhinus maximus (Gunnerus)

Compiled by Sarah Fowler



Basking shark *Cetorhinus maximus*.

Taxonomy
The basking shark is the only species of the family Cetorhinidae. It is classified in the order Lamniformes, with the sand tiger, thresher and mackerel sharks.

Distribution
Basking sharks occur in surface coastal waters of temperate and boreal oceans in the North and South Atlantic, North Pacific, South Pacific, and in southern Australian and New Zealand waters. They have not been recorded from tropical areas, and are very rarely seen in surface waters of the open ocean. In some areas records are made only during the spring and summer months, suggesting a seasonal migration, either from deep to shallow water or from lower to higher latitudes in warmer weather. Exchange between northern and southern populations could occur in deep cold waters below the thermocline, but fisheries data suggest local stocks are highly isolated.

Description
The basking shark is named from its habit of 'basking' on the surface in good weather conditions, when both the dorsal and upper lobe of the tail fin, and sometimes the snout, may break the surface. It has extremely long gill slits, very small teeth and modified gill rakers for feeding on plankton and small fish. It is also huge (the second largest fish after the whale shark), with maximum recorded lengths of 10 m and unconfirmed records of over 13 m. The smallest free-swimming young recorded have been 1.7–1.8 m. Coloration is variable, dark to light grey and mottled on the back and lighter on the underside. Distinctive patterns and scars have been used to re-identify individual sharks. The liver is very large and may amount to 17%–25% of the body weight, accounting for much of its commercial importance.

Ecology and reproduction
The basking shark is a filter feeder, and sightings are often associated with surface aggregations of zooplankton. Stomach contents also contain deep water zooplankton. Large aggregations (of 50 to 100 sharks) are sometimes reported, particularly along ocean fronts, or off shoals, headlands and islands in areas of strong tidal flow. These may be feeding or possibly breeding aggregations (pairing takes place in early summer in the UK), and tend to occur in favoured areas. Surface breaching of sharks is occasionally recorded here.

The presence of the large liver and high levels of squalene may indicate a deep water habit for at least part of the life history. Winter records are very uncommon in coastal areas at high latitudes. Some specimens caught in the north-east Atlantic in winter had shed their gill rakers, possibly indicating inactivity in deep water when low zooplankton populations in winter make feeding activity inefficient.

Commercial summer surface catches in Scotland were dominated by non-pregnant females (with a ratio of about 18:1). Incidental catches in deeper water around Newfoundland were of just over two males per female. There is only one record in literature of a pregnant female, which gave birth to five large (1.5 to 2.0 m) live young and one still-born on board a fishing vessel. There appears to be segregation during the life cycle and between sexes.

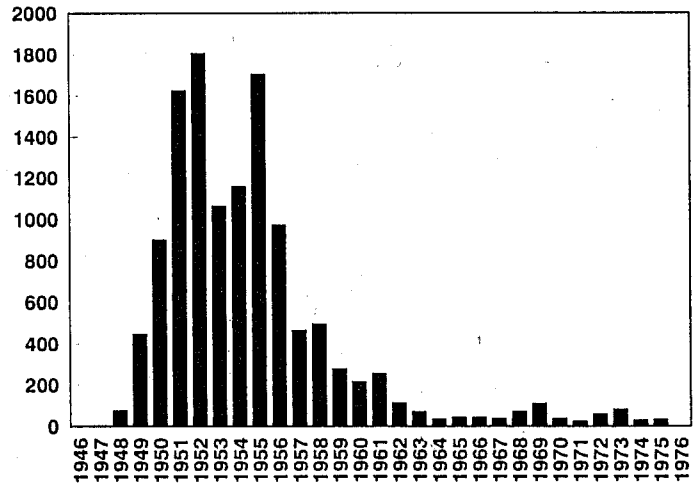
The reproductive biology of basking sharks is considered to be similar to that of other lamnoid sharks. A single functional ovary contains a very large number of small eggs. Ovoviviparity occurs, with fertile eggs hatching within the uterus and the embryos gestating for one or possibly up to three years, feeding on infertile eggs.

Pregnant females are so rarely caught in commercial fisheries that they presumably segregate to an area where no fishery takes place (possibly in deep water). Females may 'rest' for one year after giving birth before mating again.

The young, born at between 1.5 and 2 m, are rarely encountered until they reach more than 3 m in length. Growth rates and age at sexual maturation are unknown. Males become mature at 5–7 m, possibly 12–16 years, and females at 8.1–9.8 m, possibly 20 years old.

Threats
Directed fisheries mainly utilise liver oil, fins and meat for food or fishmeal. Small-scale active fisheries still occur in the north-east Atlantic and north-west Pacific. Most localised fisheries, even where very small scale, have provided initial high yields followed by serious and long-lasting depletion of local stocks. This is considered to be one of the species of sharks most vulnerable to overfishing.

Two of the best-documented fisheries occurred off the west coast of Ireland. The Sunfish Bank fishery took large numbers of basking sharks from small boats from 1770 to the 1830s, when sharks became very scarce. Basking sharks were next recorded in abundance off this coast in the 1940s, and a shore-based net fishery started at nearby Achill Island in 1947. This fishery boomed for several years, then declined steeply despite increasing shark oil prices and investment in vessels with harpoon guns to enable exploitation of sharks further away from the base (see Figure). This decline has been long-term; very few basking sharks occur in the area today, 40 years later.



Number of basking sharks caught per year in the Achill Island fishery, Ireland.

The problems caused by entanglement in net gear have resulted in some deliberate kills of basking sharks, for example in Barkley Sound off Vancouver Island, where the kill of some hundreds of basking sharks in the 1950s appeared to remove most of the population, which has shown no significant recovery since then. Incidental catches of basking sharks in other fisheries can also be significant. For example, 77–120 basking sharks are taken annually in a bottom set gill net fishery in the Celtic Sea. Certainly, sightings of basking sharks around the Isle of Man in the Irish Sea are declining, despite no known large-scale targeted fishery in the region.

IUCN threatened species assessment

With increasing emphasis being placed on shark fisheries, it seems very likely that an overall, world-wide population reduction of at least 20% will occur within the next 50–60 years, even if only the result of a somewhat desultory and opportunistic rise in landings. The species is therefore assessed as **Vulnerable** (A2d) throughout its range.

Some local or regional populations where targeted fisheries are in progress, are likely to occur, or have resulted in a past population decline of more than 80% with no recovery apparent after 40 years (e.g. west coast of Ireland) are considered to be **Endangered** (A1d, 2d, D), or even **Critically Endangered** (A1d, 2d, and possibly C1 in the Barkley Sound area).

Editor's note. The above is a greatly abbreviated version of the draft account supplied by the author for the *Shark Action Plan.* The original, including many references, is available from the Editor.

ICES Study Group on Elasmobranch Fishes

Ramon Bonfil

The International Council for the Exploration of the Sea (ICES) established a Study Group on Elasmobranch Fishes during its 1994 Statutory Meeting and Annual Science Conference. This group met at the ICES headquarters in Copenhagen, Denmark, on 15–18 August 1995, under the Chairmanship of Dr Helder da Silva. The meeting represented an important first step towards a more organised and integrated approach to the study of elasmobranchs and their fisheries in the North Atlantic.

The Study Group's terms of reference were as follows:

a) To review the status of elasmobranch stocks within the Northeast and Northwest Atlantic and, where possible, identify trends in biomass and recruitment.

b) To identify the extent of the commercial and sport fisheries in which elasmobranchs are targeted or caught as bycatch and estimate the amount (biomass/numbers per size class) of elasmobranchs taken as catch and lost as discards.

c) To describe/review the ecological role of elasmobranch species, their reproductive dynamics and predation of elasmobranchs by species or group of species.

d) To coordinate techniques of age determination and age verification of elasmobranchs.

e) To coordinate methods of modelling and assessment of elasmobranch stocks.

f) To identify the development of compensatory mechanisms as a response to exploitation.

g) To outline an action plan for attaining the goals set above.

h) To report to the Demersal Fish Committee in September 1995.

The major achievements of the meeting were to produce a single report containing much of the available information on elasmobranch fishes and their fisheries in European and eastern North American waters, and to initiate some much needed joint work on key issues relevant to the sustainable exploitation of elasmobranchs.

Because the terms of reference for the meeting covered such a broad selection of topics, it is not surprising that it was not possible to provide full answers to all questions posed at this first meeting. Nevertheless, a preliminary account of all the topics to be addressed was provided.

Work at the meeting included discussions on the state of the knowledge of some processes of population dynamics relevant to fisheries assessment and management. A major task was to prepare synopses of the extent of commercial and sport fisheries (including varying amounts of catch statistics) for Belgium, Canada, Denmark, France, Germany, Iceland, Ireland, Netherlands, Norway, Portugal, Spain, UK, and USA. Because this was an ICES meeting, these synopses as well as many of the other issues included in the report were centred on waters covered by the ICES and NAFO statistical areas. In many cases it was felt that there is not enough information available at present to draw conclusions about the status of shark stocks in the ICES/NAFO regions.

The Study Group report to the Demersal Fish Committee included a number of recommendations, summarised as follows:

- the identification to species level of skates and sharks, including deep-water sharks, during all survey cruises;
- an improved level of species classification for records of skates (including those landed as wings) and sharks in commercial catches;
- a reminder for member countries to check the conversion factors used to raise species to live weight;
- examination of patterns of discards of elasmobranchs from other fisheries, quantification of discards and survival studies;
- elasmobranchs to be included in the remit of the ICES Study Group on Stock Identification;
- convening Workshops on predation (to examine availability of data and elasmobranch stomach content samples) and aging (methodologies, validation and verification);
- use of a case population for which there is a good data set to test validity of methodological assessments in elasmobranch populations;
- management advice for elasmobranch exploitation, including consideration of precautionary measures (e.g. direct catch or effort controls, or technical conservation measures) where there is strong evidence of decreasing abundance in an elasmobranch fishery; and
- maintaining contact between ICES and the International Commission for the Conservation of Atlantic Tuna (ICCAT), which sent observers to the Study Group meeting.

The terms of reference for the Elasmobranch Study Group agreed by ICES at its 1995 Annual Science Conference are to work by correspondence in 1996 to:

a) advise on the preparation of identification sheets for deep-water sharks, skates and rays, including skate wings, and identify the most important species;

b) compile the data available on the geographical distribution of species and identify species for which data are sufficient for analytical assessment;

c) plan a meeting in 1997 to conduct analytical assessments and evaluate the effects of exploitation and/or environmental changes on the stocks considered.

In addition, there is the possibility of organising an age and growth determination/verification workshop in the near future.

The final report of the meeting, ICES 1995, is available from the ICES Secretariat, Palægade 2–4, DK-1261 Copenhagen K, Denmark (http://www.ices.inst.dk/).

Participants, 1995 Study Group on Elasmobranch Fishes

R. Bonfil-Sanders	Canada	H.M. da Silva (Chairman)	Portugal
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S. Mykklevoll	Norway	Y. Uozumi (Observer)	ICCAT[1]
H. Nakano (Observer)	ICCAT[1]	P. Walker	Netherlands
M.G. Pawson	United Kingdom		

[1] International Commission for the Conservation of Atlantic Tuna

ICES. 1995. *Report on the Study Group on Elasmobranch Fishes. ICES CM 1995/G:3.* ICES Demersal Fish Committee, Copenhagen, Denmark. 88pp.

The author greatly appreciates the partial funding provided by the IUCN Shark Specialist Group and the Fisheries Centre, UBC, and accommodation in Copenhagen provided very kindly by Mr Garry Hopwood.

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Evolution of sharks: hints for successful management strategies

Erich K. Ritter, Green Marine, Miami, USA

Introduction

In the past 60 years, the demand for shark products has peaked and waned, only to rise again. Very few shark fisheries existed in North America and other countries until the 1930s, when the huge market demand for liver oil caused rapid exploitation of shark stocks. The arrival of synthesised products saved many shark stocks from collapse. Shark populations were safe from exploitation until a new public demand for shark fins and shark meat hit the market. For the past 25 years, shark stocks have been declining rapidly. They are heavily overfished and many populations show alarming signs of collapse (Bonfil 1994).

Although this overfishing must end to allow shark populations to survive, regulations on fishing alone will not produce the necessary or expected results. There is another major threat that must be addressed – the destruction of coastal habitats. Loss of coastal habitat, particularly the loss of nursery grounds, poses a significant threat to shark stocks and marine biodiversity. A glimpse at life cycles and evolutionary histories clearly indicates that stresses on coastal habitats must be minimised to achieve adequate conservation of shark stocks.

Improved controls on directed shark fisheries (like this Taiwanese gillnet fishery for shark fins) are essential, but must be combined with protection of coastal habitats and nursery grounds if stocks are to be protected. Photo: J. Stevens.

Evolution of sharks – importance of coastal nursery grounds

Sharks are one of the most successful marine vertebrates in evolutionary history. During more than 400 million years of evolution, sharks encountered, with very few exceptions, one major predator – larger sharks. This being one of the major selective forces, sharks developed some remarkable features in their reproductive biology to avoid predators and compensate for losses. Life history characteristics such as numerous pups, fast growth rates, continuous female life cycles, or intra-uterine cannibalism or oophagy aided offspring survival (Branstetter 1990). Arguably, one of the most important strategies is the behavioural adaptation of giving birth in coastal nursery grounds. Whatever the mechanism, all such strategies originated in coastal areas.

A look at the fossil record suggests that ancient sharks lived along shores and shelf areas. For example, fossil records from Bear Gulch Bay clearly suggest that as far back as the Upper Mississippian period, approximately 320 million years ago, coastal areas were heavily utilised by sharks and served as nursery grounds (Lund 1990). By choosing protected coastal areas (bays, estuaries, and lagoons) to give birth, adult sharks reduced the risk of predation on their offspring. Shallow nursery grounds limit access to predators such as larger sharks, offering a haven for juveniles.

Until recently these successful reproductive strategies gave sharks a competitive advantage to remain at the top of most trophic webs. Nevertheless, one of their oldest and most effective strategies, the utilisation of coastal nursery grounds, is accelerating the demise of many species. What has taken millions of years to evolve is now threatened by human activities.

Destruction of coastal habitats

With more than half of the total world population living within approximately 100 km of the ocean, there is inevitably destruction and degradation of coastal habitat, rapidly altering coastal areas. Sharks, however, do not have the mechanisms to adapt quickly to rapid alteration in their environment. As typical K-selected species, sharks rely on fairly stable environmental conditions to survive. With the majority of shark species occupying the coastal zone during some stage of their development, the rapidly declining quality of habitats reverberates in the decline of stocks.

Habitat degradation affects entire ecosystems. Whole food webs are disrupted. In highly protected areas where food limitation may be a factor, even subtle declines in lower trophic levels can result in severe alterations to top predator populations. In addition, a decline in prey populations forces predators to expand their hunting activities. In the case of juvenile lemon sharks *Negaprion brevirostris*, activity space may be correlated with prey species composition (Ritter in prep.). If a decline in preferred prey population leads to an increased activity space, as suggested by a crisis model, juvenile populations will increase their home range into less protected littoral waters, competing with larger sharks. Such a scenario undermines the advantage conferred by utilising protected nursery grounds.

Reproductive strategies and their implications for management

Phylogenetic hypotheses are important tools to understand how elements in nature developed. Fossil records combined with current behaviour provide a window into evolutionary strategies. Natural resource managers must take life history patterns into account when instituting conservation methods and regulations (Ritter and Cardoch in prep.). These patterns provide important hints as to the requirements for sustaining a viable population. Attempts to manage shark fisheries are few and efforts focus primarily on regulating total catch. However, the reproductive strategies outlined above clearly indicate that efforts to regulate catch alone are insufficient and beg consideration of several recommendations.

Harvesting of sharks at the current rate could lead to extinction of several species. Sharks did not evolve with the outside pressure of human predation and do not reproduce quickly enough to compensate for the losses caused by commercial fisheries. Present levels of harvesting must end and management regulations must be re-evaluated. Current regulations on total catch ignore an important aspect of shark biology – sharks take years to reach maturity and

New-born lemon shark *Negaprion brevirostris* with placenta still attached. This species gives birth in nursery areas (here a shallow water lagoon fringed by mangroves) where there are very few marine predators. Photo: S. Gruber.

reproduce. Therefore, management plans need to include restrictions on takes of juvenile and subadult sharks. At a minimum, populations at risk should have a total ban on fishing for juveniles and subadult sharks to help stabilise their populations.

Very few fishery services around the world are sensitive enough to monitor shark stocks and populations. Of those that do, regulations focus on stocks and dynamic fisheries, and not on entire life cycles. In April 1993, the United States National Marine Fisheries Service (NMFS) launched the Shark Fishery Management Plan of the Atlantic Ocean in an attempt to include reproductive needs for monitoring shark populations (NOAA 1993). The first of its kind, this large-scale management plan focuses on shark fisheries in the Atlantic Ocean and Gulf of Mexico. In addition to the expected stock regulations and management of target species, the Shark Fishery Management Plan recommends research into reproductive requirements and identification of mating and nursery grounds. Furthermore, the plan acknowledges the need to include habitat initiatives for effective stock management. Although attempts have been made to include those recommendations in actual management decisions (e.g. Carrier 1995 and 1996, M. Bailey 1995 pers. comm.), NMFS continues to invest the majority of its efforts in defining and enhancing commercial values and goals. Without consideration of species-specific habitat requirements sustainable yields will drop due to insufficient knowledge and protection of the essential neonate and juvenile populations.

Many shark species are highly migratory and move through different national boundaries and different exclusive economic zones. Therefore, international cooperation is needed to ensure that protective measures taken in one country are not undone by migration into another country lacking similar practices. An international effort should be launched to ensure protection for all shark species at all stages of their life cycle.

Conclusions

Shark reproductive strategies provide valuable information for successful stock management. In an age of limited funding opportunities, protective measures must be employed at points ensuring maximum effectiveness. Shark life history patterns tell us where those points are. They begin with protection of coastal habitats, focusing primarily on mating and nursery areas. It is critical to enact regulations that are synchronous with life cycles and that protect all ontogenetic stages. Without them, efforts to protect adult stocks will be insufficient. Negligence will result in a loss greater than just shark depletion and a gamble too high to take – the loss of entire marine ecosystems and biodiversity.

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Social and economic importance of elasmobranchs

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Elasmobranchs are versatile fisheries resources, providing meat and shark fins for human consumption; leather; shark liver oil used to produce lubricants, cosmetics, and vitamin A; live specimens for aquaria; and shark teeth and jaws for sale as tourist curios. More recently, shark cartilage has been exploited as a treatment for cancer and other ailments, and sharks and rays have become an important attraction to scuba divers and recreational fishers.

The social and economic importance of elasmobranchs is increased by the fact that fisheries for sharks, skates, and rays are seldom regulated or limited, and therefore readily available when other species are depleted, restricted, or seasonally unavailable.

According to published data (FAO 1993a), world elasmobranch catches totalled 6,460,500 Mt in the decade 1982–1991, with an upward trend from 617,446 Mt in 1982 to 698,249 Mt in 1991. A recent review of world elasmobranch fisheries (Bonfil 1995) estimates total world elasmobranch catches at 6,474,000 Mt in the decade 1982–1991, reaching 704,000 Mt in 1991. Catches by China are not included in FAO data, but are known to exceed 10,000 Mt annually, giving a minimum estimated world catch of 714,000 Mt in 1991. However, FAO data are likely to significantly underestimate commercial elasmobranch catches and landings, due to the limited reporting capabilities of many nations, the difficulty of extrapolating from processed weights, and the exclusion of recreational landings. Furthermore, an estimated 230,000 to 240,000 Mt of elasmobranchs may be discarded annually in high seas fisheries, but this incidental catch is often not reported (Bonfil 1995).

Elasmobranch fisheries, directed as well as incidental, are often described as being characterised by a great deal of waste due to the low commercial value of the meat and the difficulty or economic unfeasibility of obtaining all potential products from a single animal.

Utilisation of elasmobranchs is often poorly known, however, because national fisheries statistics seldom report products such as skins and leather, jaws, fishmeal and fertiliser, liver oil, cartilage, or even fins. Artisanal fisheries producing salted meat and other products for local consumption are also under-reported.

Drying and salting of shark and ray meat has traditionally been practised in rural areas world-wide, and allows for simultaneous removal of skins, cartilage, and other by-products. However, drying is time-consuming and the dried/salted meat commands low prices, limiting possibilities for export. Shark meat contains high tissue levels of urea, so that production of fresh chilled or frozen meat requires immediate processing to prevent spoilage and therefore requires the installation of costly refrigeration or freezing facilities.

Smaller sharks are more easily marketed for human consumption due to lower concentrations of mercury and urea, ease of processing, and size comparability with other fisheries species, while large sharks are sought for dried fins and leather. Markets for skins are limited by the small number of specialised facilities available for the tanning of shark leather and removal of denticles from the skin. It is also difficult to simultaneously process sharks for fresh meat and skins.

As a result, shark fisheries have been historically undervalued and ignored except during boom-and-bust cycles for export products such as liver oil and fins. In the 1930s and 1940s, the use of shark liver oil as a lubricant and source of vitamin A prompted a boom in fisheries for soupfin or liveroil shark *Galeorhinus galeus* and the spiny dogfish *Squalus acanthias*. The development of synthetic substitutes soon caused the shark liver oil market to collapse; although the oil is still used in the manufacture of cosmetic and pharmaceutical products, reported production totalled only 609 Mt from 1982 to 1991.

Commercial production of shark meat began in the 1950s and 1960s. Fresh or frozen shark steaks and fillets are increasingly popular in urban markets, but world-wide human consumption of sharks, skates and rays is poorly reflected in FAO data. Their fisheries production data report only 38,445 Mt of chilled or frozen shark fillets and 105,593 Mt of dried salted meat of mixed sharks, skates and rays in the period 1982–1991 (FAO 1993b). However, a separate FAO document (1991) reports that EEC imports of shark totalled 35,400 Mt in 1988 alone. Shark cartilage obtained as a by-product from commercial and artisanal fisheries is increasingly marketed as a health supplement world-wide, but no information is available on the volume of production or trade.

Shark fin soup is a Chinese delicacy that has been used for more than 2,000 years to honour special guests or important occasions, and world trade in fins has been recorded since the 19th century. According to the FAO, reported world exports of dried shark fins totalled 43,732 Mt during 1982–1991, with a declared value of more than US$600 million. Hong Kong and Singapore are the world's largest traders of shark fins, together accounting for 84% of reported world imports and 41% of reported world exports. In the mid-1980s, a surge in demand for fins in China, coupled with declining shark stocks available to many traditional suppliers (e.g. Nicaragua, Nigeria, Pakistan), led to a rapid increase in fin prices. As a result, marketing of shark fins has expanded to new regions and has increased for fins from species previously considered undesirable and smaller fins and fin pieces (Cook 1990). Opportunities for cash earnings in subsistence and commercial fisheries have risen, contributing in some cases to increased catches or landings of shark bycatch that was previously discarded. However, available data are substantially incomplete, as several countries do not report fin exports.

The paucity of historical information on elasmobranch fisheries and uses, poor reporting of production and trade of products other than meat for human consumption, and lack of species-specific catch, production, and trade statistics have hindered efforts to assess the impacts of fisheries and use on elasmobranch stocks and to predict the management implications of rising demand for products such as meat, fins, and cartilage. In 1994, the TRAFFIC Network, the wildlife trade monitoring program of WWF and the World Conservation Union (IUCN) began to address these information needs by initiating a study of international trade in sharks and shark products. This research is expected to greatly enhance available information on elasmobranch utilisation, markets, and trade, and thereby to assist current management and conservation efforts. Regional reports by TRAFFIC offices in North America, Europe, India, Africa, East Asia, Southeast Asia, and Oceania, accompanied by a global overview report, are currently being developed. They will be available in October 1996 to national and international fisheries agencies and organisations, the CITES Secretariat, the Shark Specialist Group, industry, and other interested individuals and organisations.

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Identification and closure of nurse shark breeding grounds

Jeffrey C. Carrier, Albion College, USA

World-wide efforts to deal with dwindling shark stocks have resulted in numerous initiatives to protect local populations as well as legislation to protect specific species, most notably white sharks. South Africa, California and Australia boast of regulations protecting these animals, and the shark fisheries management plan to regulate fisheries along the east and Gulf coasts of the United States (NMFS 1993) represent successful attempts at addressing depletion of local populations of sharks, generally from overfishing. The inability of local populations to rapidly recover from overfishing can be attributed to reproductive strategies which are incompatible with an intensive fishery. Most studies suggest that sharks grow slowly, mature late in life, and produce comparatively few offspring, biological characteristics which may in fact be an epitaph for commercially valuable species.

All of the legislative endeavours to date have been directed toward reducing loss of animals from local populations. Few efforts have been directed toward increasing rates of replenishment of populations by identifying and managing breeding and nursery grounds. This has been hampered by the inherent difficulty of observing shark mating in the wild and actually identifying breeding grounds and assessing the importance of habitat to mating activities. Our study of nurse shark *Ginglymostoma cirratum* mating in the Florida Keys is unique in many aspects, and it has begun to reveal the critical role of habitat to successful mating in this species. This note will describe recent efforts which have led to closure of the breeding grounds during the mating season.

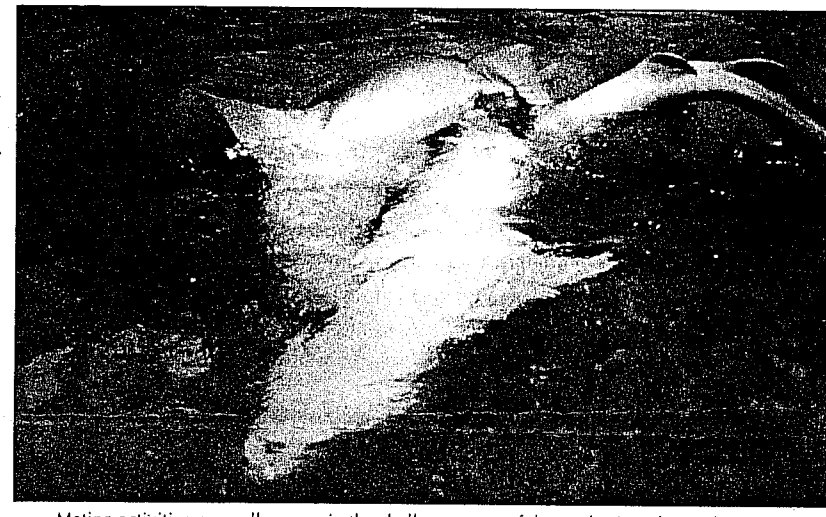
E.W. Gudger (1912) first described mating activities in the islands of the Dry Tortugas National Park in the western Florida Keys. Our observations of these activities began in 1977 and the mating behaviours have been systematically studied by Wes Pratt and I each year for the last five years (see Carrier *et al.* 1994 for a recent review). All of these studies and observations have shown that nurse sharks utilise the same specific area each year and, in fact, our tagging studies suggest that the same animals, at least the males, faithfully return to this site each year. This is not particularly surprising since very little migration has been shown for this species (Carrier 1985, Carrier and Luer 1990).

During the course of our studies, we have been able to approach mating pairs and groups to videotape and photograph their mating behaviours (see Pratt and Carrier 1995). During our studies, when it appeared on occasion that our presence disrupted the mating event, we moved away to observe activities from a distance. While making these observations, we often witnessed boats and swimmers entering the area, unaware of the presence of pairs or groups of sharks, and observed that a mating event could be interrupted and terminated by such intrusions.

With the knowledge that the area has had historical importance as a mating grounds for this species, and with the observation that human presence interrupts the mating activities, we approached the National Park Service with a proposal to close the area to human activities during the months of May through August, the time frame we have identified as the breeding season. We proposed to place buoys adjacent to the site, an area measuring approximately 400 m by 100 m. The site is also adjacent to a mangrove island which is a rookery for several species of terns and frigate birds and which is already protected from human activities by the same system of buoys.

Following an extensive review process by Park Service biologists, including site visitations, the proposal was approved. Permanent underwater moorings ('mantas') are to be placed around the site, and buoys will be attached to the moorings in May and removed in August. In this fashion activities will be limited only during the time when they are potentially disruptive.

We believe that this protection is important for two reasons beyond its obvious value to nurse shark mating. The area closure extends recognition of breeding grounds, with the appropriate protective measures, to an aquatic realm in a fashion similar to the protection historically reserved for terrestrial species. Secondly, it creates an important precedent for the protection of habitats recognised as critical for successful breeding of sharks. Though the nurse shark is of limited commercial value, appearing mostly as incidental bycatch, we believe our studies of mating in this species may serve as a model for describing mating in other species and for protecting near shore areas which are identified as critical for their mating. Since we have also observed, collected, and tagged new-born animals and juveniles in this area, we believe the protection will eventually also recognise the value of this area as a nursery and protection can be extended to protect juveniles in the same fashion as the adults will now be protected.



Mating activities generally occur in the shallow waters of the study site. The study suggests that shallow waters may afford some protection for females attempting to escape from pursuing males. Photo: Copyright Jeffrey C. Carrier.

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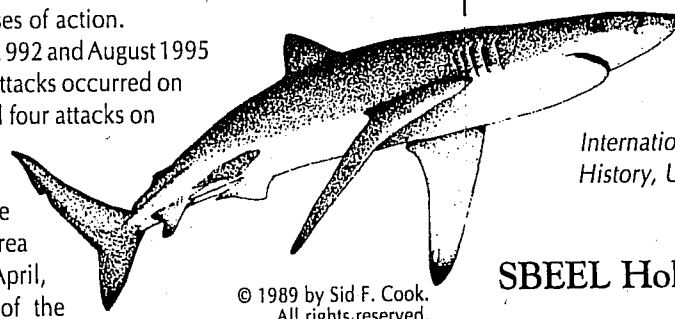
Shark Attack Workshop held in Recife, Brazil

George H. Burgess, Florida Museum of Natural History

Prompted by a marked increase in local shark attacks in recent years, an international shark attack workshop was conducted in Recife, Brazil, on 14–18 November 1995. Chaired by Dr Fabio H.V. Hazin of Federal Rural University of Pernambco (UFRPE), the assembled working group included 16 local participants representing universities, natural resource and beach safety agencies, and state/local government, plus five invited national and foreign scientists, Alberto F. de Amorim (Brazil), Otto B.F. Gadig (Brazil), John D. Stevens (Australia), Geremy Cliff (South Africa), and George H. Burgess (USA). The object of the Workshop was to investigate possible factors influencing the recent rise in attacks in the Recife area and to suggest potential remedial courses of action.

Between September 1992 and August 1995 a total of 16 confirmed attacks occurred on surfers and an additional four attacks on bathers could represent unprovoked attacks. Attacks occurred at five beaches in the Recife area in all months except April, May and June. Sizes of the attacking sharks are estimated to have ranged from 1 to 3 m. The tiger shark *Galeocerdo cuvier* and bull shark *Carcharhinus leucas* are implicated in some of the cases. Shark attacks seem to have been associated with strong south and south-easterly winds, turbid water conditions, and new and full moon periods when higher tides may have facilitated shark movements into nearshore waters.



Armed with the results of a one-year research project conducted by Hazin and co-workers at UFRPE ("Ecology of Sharks in the Coast of Pernambucu State") and having benefited from site visits, the working group came to a series of conclusions. Several factors were noted as possibly contributing to the recent upswing in attacks:

(a) The opening of Suape Port, a deepwater coastal facility located to the south of Recife. Construction was accompanied by massive environmental damage, including changing the courses of two rivers, considerable loss of mangrove habitat, and dynamiting an opening in the barrier reef. Opening of the Port also resulted in a large increase in nearshore maritime traffic.

(b) General degradation of other nearby coastal ecosystems as a result of coastal development.

(c) A concurrent increase in the number of surfers and bathers in the region.

(d) The presence of shrimp trawling, with associated discarded bycatch, very close to the beaches in the affected area.

(e) The submarine topography of the region characterised by a nearshore channel bordered by a barrier reef, resulting in a bottle-neck situation with only one way in or out of the lagoon.

(f) Climatic changes that have influenced wind and precipitation regimes in recent years.

Measures suggested by the working group focused on keeping sharks and people apart from each other at observed 'hot spots'. Installment of protection netting was dismissed as being too environmentally damaging and excessively expensive. The panel recommended:

(a) The banning of surfing inside the high risk area.

(b) Implementation of a public education programme designed to make the public more aware of sharks being a natural part of the ecosystem and ways to minimise possible interaction, including revised safety signs at public beaches.

(c) Better equip and train life guards and emergency personnel.

(d) Continue biological and oceanographic research within the high risk area to gain a better understanding of environmental, bathymetric, and biotic factors contributing to the problem.

(e) Create a scientific shark attack committee to continuously monitor the situation and be in place for potential future attacks.

(f) Create a socio-economic working group to assess the importance of nearshore shrimp fishing to the community.

(g) Establish an official data collection system for all cases of confirmed and suspected shark attacks in the region.

The Workshop was characterised by excellent cooperation between local and foreign scientists, local government, and affected user groups. If all recommended measures are enacted, shark attacks may be expected to decrease by at least 80%. Since the ban on surfing has been implemented the only attacks that have occurred have involved surfers illegally surfing in the high risk area.

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SBEEL Holds Founding Meeting

The Sociedade Brasileira Para O Estudo De Elasmobrânquios (SBEEL) held its inaugural meeting on 20–24 November 1995 during the VII Reunião do Grupo de Trabalho Sobre Pesca e Pesquisa de Tubarões e Raias no Brasil in Rio Grande, Brasil. Hosted by Carolus Maria Vooren and the Fundação Universidade do Rio Grande, the meeting was attended by nearly 100 scientists from Brazil and several foreign countries. Sixty papers were given at the meeting; in addition a large number of posters was presented and several workshops were conducted. Subject matter covered a wide range of subjects from systematics and zoogeography to life history and conservation.

Ninety-six founding members voted in elections of officers on 24 November, resulting in the election of Carolus Maria Vooren as Director, Alberto F. Amorin as Secretary, Fabio Hissa Vieira Hazin as Treasurer, and Otto Bismarck Fazzano Gadig (4 years), Rosangela Lessa (4 years), Sergio Macedo Gomes de Mattos (2 years), Everaldo Lima de Queiroz (2 years), and Ricardo de Souza Rosa (2 years) as Deliberators. Director Vooren appointed members to two committees. The Conservation Committee is composed of Ricardo de Souza Rosa (Chair), Rosangela Lessa, and Everaldo Lima de Queiroz. The Shark Attack Committee consists of Otto Bismarck Fazzano Gadig (Chair), Nayra Sanches Ficher, Fabio Hissa Vieira Hazin, Everaldo Lima de Queiroz, and George H. Burgess. An Editorial Committee will be appointed at a later date.

Members overwhelmingly passed several resolutions concerning conservation issues. Resolutions to be forwarded to IBAMA, the Brazilian governmental agency responsible for natural resources, include a call for prohibition of gillnets greater than 2.5 km in Brazilian waters, the prohibition of finning (no fins can be landed without carcasses), cessation of the issuance of new regional permits for drift gillnets, placement of observers aboard vessels using drift gillnets, and reclassification of existing permits so that they specify the type of net and intended target species.

SBEEL membership dues are USA $20, payable on 31 December each year. Interested elasmobranch biologists can join by sending cheque payable to SBEEL to: Fabio H.V. Hazin, Universidade Federal Rural de Pernambucu, Departmento de Pesca, Laboratório de Investigaçao Pesqueira Marinha, Recife, PE, CEP: 52171-900, BRAZIL.

George H. Burgess (address above)

News

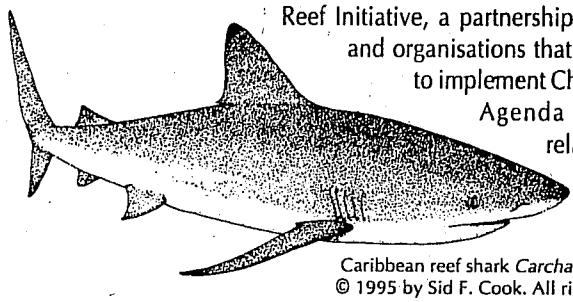
Protection of the white shark in Australia

As reported in *Shark News 5* (p.10), following the circulation of a South Australian Fisheries Department discussion paper on the white shark *Carcharodon carcharias*, the Australian Marine Conservation Society and the Australian Seafood Industry Council have been actively promoting the protection of the species. Indeed, the latter organisation passed a resolution at its national meeting stating: "The Australian Seafood Industry Council is aware of the susceptibility of the great white shark to targeted fishing pressure and will seek an end to existing, and any proposed, targeted fishing by requesting fisheries agencies to protect this species under appropriate fisheries legislation." In January this year the Tasmanian State Parliament announced that the species has been officially listed as protected in Tasmanian waters. No news has yet been obtained of similar moves from other Australian states (the species already receives partial protection in South Australia), and it is not possible to provide the more detailed article we had hoped to feature in this issue.

Two readers of *Shark News* have reported that numbers of white sharks at Dangerous Reef, South Australia, formerly an important white shark filming and study site, have declined to such an extent that many visits there in recent years have been unsuccessful. One likely reason for this decline has been incidental catch in fishing operations. It is now suggested that this source of mortality is being augmented as a result of changing fishing practices in the local tuna fishery. Tuna caught in circular nets offshore are now being towed back alive to Port Lincoln for fattening prior to sale. The live tuna reportedly attract predatory sharks (primarily whites and bronze whalers *Carcharhinus brachyurus*) which are shot and powerheaded to protect the catch. The numbers of sharks killed in this way are unknown, but may be significant for a species which is not thought to be abundant even in its centres of distribution and which will readily approach boats, so is particularly vulnerable to directed kills by fishermen.

International Year of the Reef

1997 is to be promoted as the International Year of the Reef (IYOR), in an effort to raise public awareness and alert the global community to the rapidly deteriorating state of the world's coral reefs. This is an initiative of the international coral reef research and conservation community and has received endorsement from a wide range of organisations. In particular it is supported by the International Coral Reef Initiative, a partnership of nations and organisations that is working to implement Chapter 17 of Agenda 21 as it relates to coral reefs.



Caribbean reef shark *Carcharhinus perezi*.

IYOR will involve a major effort to assess the condition of coral reefs worldwide, to document patterns of degradation and seek their causes, to educate public users and the public on the value of coral reefs and to assist in the development of strategies to advance their recovery and promote their sustainable management. The emphasis is on promoting collaboration and coordination between existing organisations and programmes involved in reef research and management. The concept has taken off well in the United States, through the efforts of the Coral Reef Alliance (CORAL) and the American Association of Zoological Parks and Aquariums. In Australia, the Great Barrier Reef Marine Park Authority will be promoting IYOR and plans are underway in the UK to develop a programme of activities.

For further information contact: Sue Wells, 56 Oxford Road, Cambridge, CB4 3PW, UK. Tel. (+44) (0)1223-350409; email: sue.wells@wcmc.org.uk; or Stephen Colwell, CORAL, 809 Delaware St, Berkeley, CA 94710, USA. Tel. (+1) 510-528-2492; Fax. (+1) 510-528-9317; email: CoralReefA@aol.com

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The November 1994 meeting of the Convention on International Trade in Endangered Species (CITES) proved to be a pivotal event for sharks when a resolution to improve international shark data collection received unanimous approval. Since that time, international efforts to fulfil this resolution have flourished, and many anticipate that the information gathered through this process will lead to significant improvements in shark conservation efforts worldwide. The Center for Marine Conservation (CMC) believes strongly that resulting shark management policies must be based in science and supported by an informed public. Since *Shark News* contributes immensely to both of these objectives, CMC is proud to be a sponsor of its publication.

CMC is a private, non-profit organisation dedicated wholly to maintaining the ocean's ecological integrity for sustainable use and enjoyment. We use science-based advocacy to prevent over-exploitation of living marine resources and degradation of marine habitats. Representing 120,000 members, CMC headquarters is in Washington, DC, with regional offices in Virginia, Florida and California.

CMC has worked for many years to promote comprehensive management for shark species in US waters and abroad. We played a leadership role in advocating the implementation of the US Atlantic shark management plan and we continue to be closely involved in its amendment. On the US Pacific Coast, CMC successfully supported a bill in the California legislature to prohibit directed fishing for white sharks in state waters. CMC has served on the Executive Committee for the IUCN Shark Specialist Group since its inception in 1991.

At the 1994 CITES meeting, CMC lobbied for the shark resolution, and we remain committed to its fulfilment. To this end, CMC is conducting a review of the international legal authorities relevant to management and trade of sharks. We will analyse these provisions against the conservation and management standards set forth in the UN Treaty on Straddling Stocks and Highly Migratory Stocks, and other model conservation agreements. Following the release of TRAFFIC's shark trade study, CMC and TRAFFIC will produce a joint shark trade report including policy recommendations.

In the coming year, as we move towards the decisive shark deliberations at the next CITES meeting, *Shark News* will serve as an important vehicle for fostering communication and cooperation on the various shark initiatives being conducted around the globe. CMC looks forward to participating in this collaborative process.

For more information on CMC or our shark conservation efforts, write to: Sonja Fordham, Center for Marine Conservation, Suite 500, 1725 DeSales St., N.W., Washington, D.C. 20036, USA.

Center for Marine Conservation

Meetings

American Elasmobranch Society 12th Annual Meeting

New Orleans, Louisiana, USA. 13-19 June 1996. Deadline for papers and pre-registration was 1 April. Contact Dr Sandford Moss, Dept. of Biology, University of Massachusetts, Dartmouth, USA. Fax: (+1) 508 999-8196. E-mail smoss@umassd.edu.

Second World Fisheries Congress Developing and Sustaining World Fisheries Resources: the state of science and management

Brisbane, Queensland, Australia. 28 July–2 August 1996. Contact: Congress Secretariat, PO Box 1280, Milton, Brisbane, Qld 4064, Australia. Fax: +61 7 3369 1512. Email: im@cc.qu.oz.au. Congress home page is http://www.ml.csiro.au/~bradford/WFC_page.html.

Sharks and Man: Worldwide Management and Conservation

This one day symposium will be held on 2 August, the last day of the World Fisheries Congress. See page 3 for more information.

IUCN World Conservation Congress

Montreal Conference Centre, Canada. 14–23 October 1996.

Contact IUCN, 28 rue Mauverney, 1196 Gland, Switzerland.

5th Indo-Pacific Fish Conference

ORSTOM Centre, Noumea (New Caledonia). October 1997.

A symposium will be devoted to Chondrichthyan fishes. Contact the URL at http://www.mnhn.fr/sfi/Congres/IPFC5.html, or B. Séret, Antenne ORSTOM, Muséum National d'Histoire Naturelle, Laboratoire d'Ichtyologie, 43 Rue Cuvier, 75231 Paris cedex 05, France. Fax: (33) 1 40 79 37 71. Email: seret@mnhn.fr.

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 will publish articles dealing with shark, skate, ray and chimaerid 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 publish original scientific data, but aim to complement scientific journals.

Publication dates are dependent upon sponsorship and receiving sufficient material for publication, but the target is three to four issues per annum.

Manuscripts should be sent to the editors at the address given on this page. They should be composed in English, legibly typewritten and double-spaced (generally 750–900 words, including references). Word-processed material on IBM-compatible discs would be most gratefully received. Tables and figures must include captions and graphics should be camera-ready.

Author's name, affiliation and address must be provided, with their fax number and email address where available.

Enquiries about the Shark Specialist Group and submissions to *Shark News* should be made to:

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