Book of Abstracts: 6th Annual Meeting of the European Elasmobranch Association 2002

9.35 –10.45
Welsh Skate and Ray Project

H. Jones, N.K. Dulvy, P.J. Coates and C. Eno

Annual landings of ray species (Rajidae) in England and Wales have fallen from around 18,000 to 3,000 tonnes over the last 40 years. The cause of the decline is believed to be largely due to over-fishing, particularly from the use of trawl gears.

The Bristol Channel area is of particular importance and used to account for around 25-30% of UK landings. Common skate (*Dipturus batis)* was once a frequent catch but is now commercially extinct. Although data is incomplete larger ray species *Raja brachyura* (blonde) and *R. clavata* (thornback) have apparently declined in both abundance and average size, to be partly replaced by the smaller species *R. montagui* (spotted) and *Leucoraja naevus* (Cuckoo).

Fishery Managers face the challenge of identifying practical conservation measures that need to be acceptable to the majority if they are to be effective. Options include:

- Size restrictions i.e. minimum and/or maximum size (and options by species or sex and whether applied to part or whole fish).
- Restricted licencing of vessel effort or catch (quotas).
- Technical measures e.g. mesh sizes, vessel size, gear type.
- Gear restrictions (e.g. by location and/or time).
- No take or limited take zones (e.g. no taking of female rays).

As well as being of commercial value, rays are also of wider recreational and conservation interest and a unique group of interested parties in Wales have come together to address a "common cause". Comprising fishery managers, scientists, commercial fishermen, anglers and conservation interests, "The Welsh Rays Group" has been formed with the following objectives:

- To raise awareness of associated issues.
- To improve understanding.
- To identify projects that will achieve the above.
- To identify practical and appropriate options for future management.

The joint presentation by Group members explains the background to the problem, identifies some of the difficulties in finding a solution, and which might be best tackled by a joint approach by interested parties.

11.00
Passively monitoring the long-term movements of blacktip sharks in a nursery area.

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A series of 25 acoustic hydrophones were used to passively monitor the movements of blacktip sharks, *Carcharhinus limbatus*, within a coastal nursery area on the central Gulf coast of Florida. In 2001, 41 sharks were fitted with long-life (18 month) acoustic transmitters and monitored for periods of 1 – 145 days. The movements and behavior patterns of individuals and the entire monitored population were compared to environmental factors and habitat conditions. During the course of the summer Tropical Storm Gabrielle made landfall along the central Gulf Coast of Florida about 50 km south of the nursery area. In the hours prior to the storm making landfall all 13 sharks being monitored left the nursery area. Sharks were gone from the nursery for periods of 5-13 days when salinity levels were below the physiological tolerance of blacktip sharks due to the large rainfall associated with the storm. Upon the return of salinity to normal levels all 13 sharks returned to the nursery and resumed movement patterns similar to those exhibited prior to the storm event. Environmental factors that could have influenced shark movements are examined and reported on.

11.25
Remarkable presence of Basking shark (*Cetorhinus maximus*) in the Adriatic Sea

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Basking shark has seldom been the subject of specific studies in the Adriatic sea, but last year the North-Central Adriatic sea saw a large increase in the number of sightings of this shark at the surface, rising from few sightings in 2000 to more than 60 sightings in March 2001. This gave us the opportunity, with the collaboration of professional fishermen and the Coast Guard, to obtain much information and many images of basking shark. In this work we give some information on basking shark occurrence in space and time within the Adriatic Sea. Basking shark distribution has been analysed taking into account surface currents, temperature and plankton abundance. Many biological samples were taken from specimens caught for other ongoing research. Records revealed the presence of many sizes specimens going from very young individuals to adults (max L_T of 840 cm).

11.50

Acoustic and satellite archival telemetry reveal patterns of movement and site fidelity of the whale shark on the Belize Barrier Reef.

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Whale sharks, *Rhincodon typus*, recently revealed patterns of visitation at specific sites on the Mesoamerican reef, particularly in Belize. To characterize whale shark foraging behaviour and patterns of movement and site fidelity, whale sharks were variably tagged with coded acoustic tags, pop-off satellite tags and marker tags. Acoustic data were recorded from 2000-2002 using an array of acoustic receivers moored at 13 sites along the Belize Barrier Reef and Atolls. Whale sharks have shown a high degree of intra-seasonal and inter-seasonal site fidelity at Gladden Spit, a reef promontory in Belize where the sharks feed on the spawn of reproducing snappers every spring. Sharks range along the reef with occasional visits to the three atolls between and outside peak snapper spawning periods. Satellite tags have revealed the whale sharks' ability to undertake very deep dives, potentially to forage at depth, particularly between fish spawning moons. In the spring of 2002, predictable visitations of whale sharks decreased at Gladden Spit. Overall tagging results and possible reasons for the changes in site fidelity patterns are discussed in the context of whale shark tourism and conservation.

12.15
Deployment of satellite tags on great white sharks off South Africa.

R.Bonfils

12.30
Informal presentation
The sandbar shark, *Carcharhinus plumbeus* (Nardo, 1827), in Turkish water.

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A video presentation will be given on the presence of sandbar sharks in a particular Bay in Turkish waters. The video will show the presence of mature male and female specimens, the Bay could be considered as a reproductive area of the species.

13.30-14.30
Poster session

Morphology of the ampullae of Lorenzini in selected Mediterranean skates

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The elasmobranch ampullary system plays a fundamental role for foraging and navigation. In skates, the ampullae of Lorenzini are mainly localized in the cranial region. The aim of this work was to compare the histomorphological and ultrastructural characteristics (using Light Microscopy-LM, and Scanning Electron Microscopy-SEM) of these electroreceptors in four species of skates caught in Mediterranean, in order to investigate a possible relationship between their anatomy and life style. Furthermore, the presence of presumptive neurotransmitters was investigated at LM by immunohistochemical techniques. During the ICRAM elasmobranch research program, specimens of *Raja asterias* (N=3), *Raja clavata* (N=4), *Raja miraletus* (N=2), and *Raja radula* (N=1) were collected in the Gulf of Genoa (Ligurian Sea), and in the Southern-Central Mediterranean Sea by professional bottom trawlers. After deep anaesthesia by MS 222 and dissection, samples of ampullae of Lorenzini were fixed in paraformaldehyde and differently prepared for LM and SEM observation, and for immunohistochemical investigation. In all four species the ampullae are divided in sensory alveoli and the alveolar epithelium is bistratified. On the contrary, numbers of sensory alveoli varies according to the species, being more numerous in *R. miraletus* and *R. clavata*. Such feature leads to an increase of the surface of the sensory epithelium harbouring the receptor cells and may be related to the need of an enhanced sensibility. In this view, we observe a deeper preferential distribution for these two species. Relationships with taxonomic or other ecological features may also occur and need to be investigated.

13.30-14.30
Poster session

Raja brachyura, a rare species in the Mediterranean Sea: Notes on its biology.

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The blonde ray *Raja brachyura* is a shallow water species living mainly on sandy and sand-rock bottoms. Although common in the Eastern sector of North Atlantic, it is considered rare in the Mediterranean Sea where scarce information is available on this skate. The aim of this study is to improve our knowledge on the biology and feeding habits of this Rajidae in the Mediterranean Sea. A total of 314 specimens of *Raja brachyura* were captured in June 2002 in the surroundings of Asinara island (NW Sardinia, Italy) with trammel nets. Of these, 221 individuals (102 females and 119 males) were examined for size, sex, state of maturity and stomach contents. Size range of captured animals was between 18.5 and 95.5 cm Total Length (TL), where longest individuals found were all males. Size relationships for both sexes were similar: that of total length against weight was exponential whilst total length and disc width was linearly related with a correlation coefficient of 0.98. Relative clasper length was used to calculate length at first maturity in males, while in females very few mature individuals were found. Males and females appear to mature at 45 and 47.5 cm. disc width respectively. Taking into account the single summer sampling, stomach contents analysis reveal an almost exclusive feeding on *G. cicerellus*, a small teleost typical of sandy-gravel bottoms of the continental shelf. *Raja brachyura* is one of the most large sized skate in Mediterranean, where it seems characterised by a patchy distribution. Both features are considered to increase the vulnerability of a skate to the impact of fishing pressure. Although essential for a proper management of populations, basic biological information for blonde ray specimens from Mediterranean is lacking.

13.30-14.30
Poster session

Birth and growth of *Dasyatis violacea* (Bonaparte, 1832) in captivity.

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A female pelagic stingray was caught in the Adriatic Sea in July 2000. The ray was put in a circular 50,000l tank (diameter 5m, depth 1m) where she gave birth to 5 young (3 females and 2 males). The young were immediately separated from the mother and from other stingrays and maintained in a smaller circular tank of 3,000l. During the first few days, the young stingrays were fed with small fish (live) and subsequently with pieces of crab and squid. Over the next two years, there were other births (the last one in June 2002) and data were recorded.

13.30-14.30
Poster session

Feeding and reproductive biology of the common Torpedo (*Torpedo torpedo*, Linnaeus,1758), and of the marbled electric ray (*Torpedo marmorata*, Risso, 1810) from central Tyrrhenian waters.

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In the present work we studied the feeding habits and reproductive biology of two electric rays species *Torpedo torpedo* and *Torpedo marmorata*. In 2000–2001 we monthly collected 535 specimens of *Torpedo torpedo* and 375 of *Torpedo marmorata*, caught by professional otter trawlers in Central Tyrrhenian waters. The diet of *Torpedo* spp. was totally piscivorous and was principally based on Soleidae for *T. torpedo* while *T. marmorata* fed on different teleost families such as Sparidae, Clupeidae and Gobiidae. *T. torpedo* and *T. marmorata* showed an unbalanced sex-ratio only in upper size classes and size at first maturity in both sexes of *T. torpedo* differs from the other studied Mediterranean populations. The ovarian and uterine fecundity is similar and the reproductive cycle is annual in males and females with a breeding summer season. *Torpedo marmorata* females show a significant difference between ovarian and uterine fecundity. In males of the species we found an annual sexual cycle while in females it appears to be longer than one year. Our results represent an insight into the feeding and reproductive biology of the two studied species in Central Tyrrhenian waters, with the aim to complete the present knowledge on the genus *Torpedo* spp. in the Mediterranean sea.

13.30-14.30
Poster session

Elasmobranchs sperm as the object for cryobiology and conservation biology.

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Nowadays for fishes all over the world just the cryobanks for bony fish species sperm are available. They allow the extending of the possibilities of conservation biology due to a long-term storage of spermatozoa fertilising ability. Modern state of the knowledge in the field of cryobiology allows only partially to predict the possibility of successful cryopreservation of such a new and absolutely unstudied in this respect object as elasmobranch sperm. Complicated organisation of both elasmobranch sperm and their system of reproduction in a whole determine the spectrum of questions, which make difficult the possibility of application of cryobiological methods. This work is devoted to a detailed analysis of available data on spermatology and biology of fertilisation in sharks in respect of theoretically existing possibility of long-term storage of their sperm in a frozen state. The aim of the work is to discuss the expediency of application of the knowledge in the field of cryobiology to the investigations of shark sperm for following their application in the measures for biodiversity conservation.

13.30-14.30
Poster session

Diel activity patterns of the yellow stingray *Urobatis jamaicensis*, in coastal waters of Southeast Florida, USA.

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The yellow stingray (*Urobatis jamaicensis*) is the most common elasmobranch found along the coastal waters of Southeast Florida. None of the few ecological studies on this species have addressed daily movement patterns. Ultrasonic telemetry was used to track the diel movements of 14 stingrays over a period of 18 months to determine their patterns of activity and space utilization. Continuous manual tracking was conducted for periods of 8 to 30 hours with locations recorded at 15-45 min intervals. Arcview® GIS with Spatial Analyst and the Animal Movement Analysis Extension (AMEA) was used to analyze location data. The 95% and 50% kernel distributions were calculated to determine the 24-h utilization distributions (UD) and core areas of intense use, respectively. All diel UD data were divided into four 6-h periods for statistical analysis of day vs. night rates of activity and area utilized. Monte Carlo simulations and linearity indices were conducted for comparison of randomized tracks with observed data to determine if movements were random, confined or directional. The majority (approximately 80%) of tracked stingrays evidenced intermittent movement patterns throughout the day with peak activity and larger scale movements during the night. Short-term tracking suggests that *U. jamaicensis* possess small home ranges (HR). Intermittent tracking across several days also demonstrates confined movements, reflective of home ranging behavior and suggests that only small portions of the HR are utilized on a daily basis. Further long-term research is necessary to confirm the existence of a permanent HR or temporary/seasonal HR.

13.30-14.30
Poster session

A simple technique for a preliminary vertebral ageing study in *Etmopterus spinax* in Central Mediterranean Sea

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Etmpoterus spinax (Linnaeus, 1758) is a bottom dwelling shark, typical of bathyal stratum of Mediterranean Sea and it is usually caught by professional otter trawlers as part of shark by-catch. By means of these professional deep fisheries, we collected 309 specimens during the 2000, from a depth range 200–1000 metres in the Thyrrhenian and Ligurian Sea. The sample was analysed in laboratory and pectoral vertebrae were used for a vertebral bands ageing study. The technique chosen was based on staining the phosphate in the calcified bands with cobalt nitrate and ammonium sulfide (Hoenig and Brown, 1988), modified and adapted for *Etmopterus spinax* vertebrae. Total lengths ranged from 100 to 435 mm and individuals were grouped in size classes by season. Some length representative vertebrae were chosen from the sample in order to read vertebral bands and to verify their number increment with the length. The analysis of length frequency distributions suggests an agreement between band count and length mode seasonal shift in *Etmopterus spinax*. The aim of this study is to give a simple, inexpensive and rapid method for successfully staining and reading *E. spinax* vertebrae which present a poor calcified bands such as the other bottom dwelling sharks.

13.30-14.30
Poster session

Tag and release' of Raja asterias juveniles in South Ligurian Sea: Preliminary results and future perspectives

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Raja asterias is a skate geographically confined in the Mediterranean Sea inhabiting sandy shallow grounds. In many Italian fisheries it is a common by-catch of otter trawls and "rapido" beam trawls and it is of low commercial value. Like for other elasmobranchs, there are indications of the decline of this resource. In order to improve our knowledge on the biology and ecology of this species (also for managing purposes), a "tag and release" campaign on juveniles of *R. asterias* has been carried out in the South Ligurian Sea. An area previously identified as a nursery for this species has been chosen for our studies. Specimens were caught using a small bottom trawl with 40mm mesh size at the cod end. Between July 2001 and May 2002, 103 hauls were carried out in shallow waters within 6 NM from the coast. Caught specimens were sexed and measured for total length (L_T) and disk width (DW). Only individuals bigger than 13 cm in L_T and in good health condition were tagged. Tags used were of T-bar anchor type (from Floy Tag catalogue mod FF-94). A total of 1034 specimens out of 1142 captured were tagged. In order to evaluate the effect of tags on such young animals a vitality experiment was conducted in August 2001, observing an equal number of tagged and non-tagged specimens in aquaria for a week. To ensure the maximum number of skate returns, a deep information campaign directed to local fishers, fish-market personnel and Sea Surveillance Bodies (Coast-guards etc.), was carried out in all fish landing sites of the studied area. To date only 11 skates have been recaptured, one of which almost a year after tagging.

13.30-14.30
Poster session

On the capture of a giant specimen of Greenland Shark *Somniosus microcephalus* (Bloch & Schneider, 1801) with some considerations about maximum sizes collected for the Genus *Somniosus* compared with the Genus *Carcharodon*.

*Paul Crozier *, Marco Zuffa **, Tiziano Storai ***.*

A large female Greenland Shark, *Somniosus microcephalus*, measuring 730 cm (Total Length) was accidentally caught in the nets of a deep-water French fishing-boat on the 17th of March 2001 at 58.35ºN, 9.65ºW and at a depth of 1100 m. Although a detailed examination of the specimen was not possible, some biometrical data and some biological observations are proposed. From this record, research on scientific literature and on photographic documentation has been conducted, with the main object being to find other records concerning sharks of the Genus *Somniosus* measuring over 600 cm in length. This search has led to the discovery of 4 other cases concerning captures or documented sightings of *Somniosus*: 3 cases concerning *S. microcephalus* and 1 case concerning *Somniosus pacificus* (Bigelow & Schroeder, 1941). Another record of a sighting of a giant *S. pacificus* (Wood, 1982) measuring over 900 cm in length has been considered as an over-estimate. Other cases have not been taken in to consideration because they are not sufficiently reliable or well documented. A specimen measuring about 600 cm (total length) was captured in the 1930s near a whaler station in Charlotte Island, British Columbia (Sheffer and Slipp, 1944). This specimen was tentatively identified as a Greenland shark and was the first occurrence of this species in an area that is also frequented occasionally by large white sharks. On the basis of the collected data, some considerations are discussed on the maximum sizes of the two largest species of the Genus *Somniosus* with those known for the white shark; previously considered as one of the largest predator sharks, but now considered as reaching smaller sizes than *Somniosus*.

13.30-14.30
Poster session

Occurrence of a juvenile specimen of sandbar shark *Carcharhinus plumbeus* in the Southern Tyrrhenian sea: morphological and meristic description.

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In November 2001 a male specimen of *C. plumbeus* was collected at the Golfo di Patti, a Gulf located along the Sicilian coast (Southern Tyrrhenian Sea). Since 1980 the Gulf has been a closed area for fishing, where trawling is banned except for scientific purposes. The shark was found during a sampling by bottom trawl gear in order toevaluate the state of demersal resources (MEDITS and GRUND projects). The specimen was 75 cm in total length and weighed 2600 grams; morphological measurements and meristic details are determined and compared with those of other young individuals coming from other Mediterranean districts. We also considered the finding of this juvenile as a contribution to enrich the knowledge of potential nursery areas of C. plumbeus in Mediterranean Sea.

14.30
Endangered smalltooth sawfish (*Pristis pectinata*): science for conservation

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The smalltooth sawfish, *Pristis pectinata*, is listed by the World conservation Union as Critically Endangered in the western Atlantic. Within US waters its historic distribution reached from New York to the Mexican border. Today, however, the US population has declined over 95% and is restricted mostly to remote sections of the southern Florida coast. To address a lack of biological and ecological data on which to base conservation action Mote Marine Laboratory has been conducting research program that includes surveys, a public sightings database, acoustic telemetry and monitoring, satellite telemetry and genetic analysis. The results of this research are reported and its application to conservation is discussed.

14.50
Elasmobranch Conservation

Sarah Fowler
Nature Conservation Bureau

15.05
Finning Finis: Finning bans as a shark conservation strategy

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It is widely acknowledged that the growing demand for shark fins is a driving force behind burgeoning shark fisheries and the decline of shark populations worldwide. The high price paid for fins is fueling the practice of shark finning, which results in the waste of nearly 95 percent of the shark biomass. Fishery managers are slowly becoming aware of the extreme vulnerability of most sharks to overfishing and the need for conservative management of shark fisheries. To date, six fishing nations have officially banned the practice of shark finning, but issues remain concerning the implementation and enforcement of these laws. This paper will review the status of current and proposed finning bans (including in the EU) and evaluate the effectiveness of finning bans as a management tool to ensure the long-term sustainability of shark populations and their fisheries.

15.20
The NE Atlantic spurdog and its fishery: Historical perspective and current status

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Spurdog (*Squalus acanthias*) is a relatively small (<125 cm length in the NE Atlantic) squaliform shark that is one of the most important elasmobranchs fished in European waters. During the early 1900's, spurdog were of little economic value and landings were small. As in other parts of the world, spurdog were viewed as a nuisance, as shoals of spurdog could cause considerable damage to fishing nets. During the 1950's and 1960's, landings of spurdog in the North Sea increased rapidly and total annual landings rose to 58,000 t during the 1960's. The major fishing nations for spurdog were the UK, Norway, Ireland and France, and the main fishing grounds the Norwegian Sea, North Sea, NW Scotland and the Celtic Seas. During the 1980's, long-line fisheries for spurdog became relatively important in the Irish Sea, with boats targeting shoals of large females. This fishery subsequently declined. Spurdog are currently taken in mixed demersal fisheries (e.g. otter trawls) and also in gill nets, where they may be the target species. Since the late 1980's, total landings of spurdog have declined and more recent catches (1997-1999) have been around 15,000 $t.yr^{-1}$. We have used demographic techniques to estimate the maximum population growth rate (r) for spurdog. As in McAllister et al. (2001), demographic techniques were used to convert prior distributions for age-specific fecundity and mortality (based on published information) to prior distributions for r. The priors for r generated in this manner were then used in a Bayesian, Schaefer-model assessment, fitted to research vessel survey data (CPUE). The results of this preliminary assessment, which are coherent with life-history constraints, will be discussed.

16.00
The Centre for Shark research at Mote Marine Laboratory: Mission, Staff, Activities and Accomplishments.

R.E.Hueter

16.20
The status and conservation of elasmobranchs in the Northeast Atlantic

Rachel Cavanagh
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The conservation status of elasmobranchs in the Northeast Atlantic has recently been reviewed by the IUCN Shark Specialist Group. This presentation will provide a brief overview of the current information available for species commonly taken in fisheries in the region. In the Northeast Atlantic the majority of elasmobranch species are caught as bycatch, and catch controls are non-existent except for basking sharks and porbeagle sharks. The FAO International Plan of Action for the Conservation and Management of Sharks is in urgent need of development and implementation in Europe, and this will be discussed. The Red List status of elasmobranchs in the Northeast Atlantic region and the steps taken towards a finning ban in European waters are also discussed.

16.40
Market demand for shark fin in Hong Kong and the People's Republic of China

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Trade in shark fins is believed to represent one of the most serious threats to shark populations worldwide. Shark fins are served as a delicacy in Chinese communities throughout the world, where tradition holds that they are auspicious or convey health benefits. Hong Kong dealers control approximately 50% of the world trade, with the majority of goods thought to be destined for sale in Mainland China.

An econometric analysis was conducted to determine the role of Hong Kong and Mainland China market demand in driving shark fin trade dynamics. Shark fin imports to Hong Kong (quarterly for 1992-2001) were selected as the dependent variable in the model and served as a proxy for market demand. Explanatory variables considered for the model were limited by data availability but included wages, private consumption, price of marine fish (substitute good), restaurant receipts, exchange rates and interest rates for Hong Kong; disposable income, restaurant receipts, exchange rates and interest rates for the Mainland; and wholesale (supplier) prices of shark fins compiled by FAO's INFOFISH bureaux. Following the Hendry approach, potentially relevant variables, to several lags, were included in preliminary models and diagnostics were evaluated; if the model was valid, it was progressively simplified until only those variables with significant coefficients remained. Due to the presence of serial correlation within and between many of the data sets, two different forms of least squares regression were performed. Both forms produced similar models indicating that more than 40% of the variance in the model (based on adjusted R^2) can be explained by disposable income in Mainland China alone.

These results suggest there is a direct relationship between shark fin imports and Mainland disposable income, with a 1% increase in income corresponding to a 0.25-0.39% rise in imports, depending on the form of the model. Continued growth in disposable income in Mainland China, coupled with reported increased spending on medicinals and tonics, will thus result in increasing pressures on world shark resources unless steps are taken to reduce demand. In the absence of definitive data on the role of the fin trade in shark mortality, these findings point to the importance of consumer education, as well as other consumer-orientated policy measures, as components of precautionary shark conservation initiatives in Asia.

17.00
Coastal renewable energy resources – implications for elasmobranchs?

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Our demand for energy and increasing interest in renewable resources to satisfy this demand has lead to a number of European coastal countries developing plans for offshore energy generation. The sustainability rationale for these developments should be commended as it brings to the fore our concern for the environment. There is however a potential implication of large-scale offshore energy installations for elasmobranchs. The ability of all elasmobranchs to detect electromagnetic emissions and their propensity to utilise coastal habitats brings into question the potential effect of electricity production in our coastal waters. We are only just learning about the electroreceptive ability of elasmobranchs but we do know that different species vary in the range of electric fields that they detect and respond to and that there may be differences with life history stage. Electrical output from offshore electricity cables is predicted to be relatively low but the range is within the detection range of the elasmobranchs. Here I discuss the possible consequences of large-scale electrical energy production in our coastal waters and how we need to bring elasmobranchs into any environmental impact assessment in order that we do not put yet another pressure on our threatened sharks, skates and rays.

Sunday 8th September

Presentation and Poster Abstracts

9.30

The distribution of elasmobranch fishes in the NE Atlantic: The influence of depth, latitude, temperature and disturbance.

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The British Isles lies at a biogeographical boundary, with Lusitanean (Mediterranean) fauna in the south-west and Boreo-Arctic species in more northern waters. The warm waters of the Gulf Stream also enable several southern species to occur up the western sea-board of the British Isles. There are more than 100 chondrichthyan fishes recorded in the CLOFNAM area and more than 50 of these occur around the British Isles. A total of 26 species of chondrichthyan fishes were recorded from the continental shelf during CEFAS groundfish surveys (1990–2000), including 10 sharks and dogfish, 15 skates and rays, and 1 chimaeroid. The most frequently observed species were lesser spotted dogfish (*Scyliorhinus canicula*), thornback ray (*Raja clavata*) and spotted ray (*R. montagui*). Southerly species that were rare/absent from the North Sea included greater spotted dogfish (*Scyliorhinus stellaris*) and smalleyed ray (*R. microocellata*), whereas the Boreo-Arctic starry ray was only recorded in the North Sea. The species with the narrowest depth distributions were undulate ray (*Raja undulata*: 10–72m) and *S. stellaris* (13–100m), whereas spurdog (*Squalus acanthias*) were found in waters of 15–528m depth. *Raja microocellata* had the narrowest latitudinal range (49.6–52.9°N) and cuckoo ray (*Leucoraja naevus*) had the largest latitudinal range (47.4–61.5°N). The distribution patterns of demersal elasmobranchs is discussed in relation to their biogeography, bathymetry, and areas of conservation importance. The importance of indices of relative abundance in interpreting distribution patterns is also discussed.

9.50
Remarkable presence of Basking shark (*Cetorhinus maximus*) in the Adriatic Sea

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Basking shark has seldom been the subject of specific studies in the Adriatic sea, but last year the North-Central Adriatic sea saw a large increase in the number of sightings of this shark at the surface, rising from few sightings in 2000 to more than 60 sightings in March 2001. This gave us the opportunity, with the collaboration of professional fishermen and the Coast Guard, to obtain much information and many images of basking shark. In this work we give some information on basking shark occurrence in space and time within the Adriatic Sea. Basking shark distribution has been analysed taking into account surface currents, temperature and plankton abundance. Many biological samples were taken from specimens caught for other ongoing research. Records revealed the presence of many sizes specimens going from very young individuals to adults (max L_T of 840 cm).

10.10

First record of the longfin mako, *Isurus paucus* (isuridae) off the Algerian coast; confirmation of its occurrence in the Mediterranean.

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According to Cadenat and Blache (1981), *I. paucus* presumably occurs off the western African coast. In the Mediterranean, *I. paucus* is cited by Fergusson (1994) and by Moreno (1995). However, they did not relate captures of specimens in the area where Notabartolo di Sciarra and Bianchi (1998) considered doubtful its occurrence. Two captures, a male and a female from off the coast of Algeria were recently recorded, simultaneously with its closed related species, *I. oxyrhinchus*. They permit us to confirm the occurrence of the species in the Mediterranean. The specimens, a male and a female *I. paucus*, were observed, 17th of October 2001, at the fishmarket of Algiers. It was caught off Beni Saf (400km west from Algiers). The body is elongated, fusiform and rather cylindrical. The head is large ending with a snout broadly pointed but not acute. The eyes are circular with behind them a small spiracle. The narines are rather large with a long and triangular nasal valve. They are rather closed to mouth than end of snout. The pectoral fins are large, as long as head, slightly falcate and brown tipped. The caudal fin is strongly arcuated, with a very long lower lobe. The body colour is blue, rather blackish on the rigdes of the fins. The ventral face is whitish. The undersides of pectoral is parsemed with dark blotches. The undersides of snout and mouth are dusky. The teeth of both jaws present a single pointed medial cusp slightly oblique towards the commissure of the mouth. The ridges of these cusps are without cusplets or serrations. The cusps are more developed in the medial series. The tip of the cusps is not reversed. We have counted 26 teeth in both jaws in both specimen. The dental formula is 13–0–13. The dried jaws of the male specimen are preserved in the collections of the 'laboratoire d'Ecologie et Environnement, équipe halieutique, Université Houari Boumedienne' of Algiers, Algeria and referenced (S/02/2001).

11.00

In deep trouble? Deep-water sharks to the west of the UK: one of the most vulnerable groups of all the elasmobranchs?

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In response to declining coastal commercial fisheries a deep-water fishery developed in the early 1990s in the Northeast Atlantic. Although this fishery mainly targets grenadiers and ling, several species of deep-water elasmobranchs are taken as either directed landings or by-catch. It is suggested that deep-water elasmobranchs are especially vulnerable to over-fishing as they mature at a late stage in life, have long gestation periods and have relatively few young in comparison to other deep-water teleosts. Data on length, sex and maturity was examined for 30 species of deep-water elasmobranch from 4 research cruises to the west of the British Isles, with additional information collected on geographical distributions and depth. Other areas of the study involved collecting data on the commercial fishery from a group of French bottom trawlers working to the west of the British Isles. This included a three-year market sampling program monitoring deep-water landings, and further studies of discard composition and rates through commercial observer trips at sea. Archived pre-fishery survey data, taken from the northeast Atlantic, was also made available on several species of deep-water elasmobranch. Through analysing data on the activities of the commercial fishery and comparing pre-and post fishery survey data, an attempt has been made to determine which elasmobranch species are most at risk.

11.20

Diet of *Chimaera monstrosa*, L. 1758, in the Sicilian Channel (western Mediterranean Sea).

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The intestine contents of 163 specimens of *C. monstrosa*, or ratfish, from the bathyal bottoms of the Sicilian Channel were examined. The fish were caught with bottom trawls at depths ranging from 500 to 700 m between ’97 and ’98. The pre-anal length and the sex of each specimen were noted. The prey found in the guts had been cut and crushed by the specialised dentition of the ratfish, comprising three pairs of toothplates. The items of prey were identified to the lowest possible taxon. The results show that *C. monstrosa* behaves like a generalist and feeds all day on a large spectrum of species belonging to various groups of benthic invertebrates, often infauna, and only occasionally on bony fish. Crustaceans and molluscs were found in the intestines of the largest number of specimens, echinoderms and polychaetes in a smaller number of cases, with sipunculids and bony fishes in only a few cases. Some differences in diet composition were noted and related with the ratfish size: in the longest fish diet was in the main hardshelled prey, such as *Monodaeus couchii* (Brachyura) and *Nassarius limatus* (Gastropoda), while in the shorter fish amphipods or delicate bivalves such as *Allogramma formosa*, predominated. No differences were found between males and females.

11.40

Sharksuckers, *Echeneis naucrates*, attached to blacktip sharks, *Carcharhinus limbatus*: what body regions do they choose?

Juerg M. Brunnschweiler., Green Marine, Miami, USA

Sharksuckers, *Echeneis naucrates*, are known to attach to various shark species. Nevertheless, it has never been investigated if sharksuckers attach to specific body regions. This study focusses on sharksuckers attached to blacktip sharks, *Carcharhinus limbatus*, with special emphasis on the body regions on which sharksuckers can be observed. Possible costs and benefits regarding the different attachment sites for both sharks and sharksuckers are discussed.

12.00
Informal presentation

Sharks feeding on the sardine 'run' in South Africa.
S.Dudley

Transport of sand tiger shark (Carcharias Taurus) from France to Italy, and its introduction to a new environment.

13.00-14.00
Poster session

Elasmobranch species from the Celtic Sea and the North Sea: Relative trophic levels determined through stable isotope analysis

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Sharks are marine consumers believed to occupy generally high trophic positions in marine food webs. Surprisingly, trophic level estimates for these predators are relatively scarce. In this study, stable isotope ratios have been determined in muscle and hepatic tissues of five species of commercial sharks from the Celtic Sea and the North Sea: the tope *Galeorhinus galeus*, the black-mouthed dogfish *Galeus melastomus*, the spiny dogfish *Squalus acanthias*, the lesser spotted dogfish *Scyliorhinus canicula* and the starry smooth hound *Mustelus asterias*, in order to determine their relative trophic position and to obtain information on the ecosystem in which the animals feed. Differences in stable nitrogen (δ^{15}N) and carbon (δ^{13}C) isotope ratios have provided valuable insights in the trophic ecology and movements of many species. For the Celtic sea, tope sharks display the highest δ^{15}N and δ^{13}C values, reflecting their more piscivorous diet, their higher trophic position and their coastal feeding habits. The other species display lower values according to their diet of invertebrates. These results are compared with trophic levels calculated from those obtained by stomach content analysis. δ^{15}N and δ^{13}C results match the stomach contents, except for spiny dogfish. Indeed, spiny dogfish have the lowest δ^{15}N and δ^{13}C, although this species is known to be a teutophagous/piscivorous species. This suggests a more oceanic feeding for this species as it is known that oceanic food is usually depleted in δ^{15}N and δ^{13}C compared to coastal ones.

13.00-14.00
Poster session

Life History Aspects of Freshwater Stingrays (Chondrichthyes: Potamotrygonidae)

Maria Lúcia Góes de Araújo[1]; Mauricio Pinto de Almeida[2] & Patricia Charvet-Almeida[3]
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The characteristics that affect elasmobranch life history are more peculiar to analyse when freshwater stingrays (Potamotrygonidae) are included in the study group. Differently from their marine counterparts, potamotrygonid stingrays are restricted to freshwater environments. Some of these species are endemic, apparently require very specific habitat conditions and it is suggested they present a very narrow limit of tolerance to both natural and anthropogenic environmental impacts. Since life history knowledge is important to fisheries assessment and management, a data bank containing basic biological and ecological information about species of freshwater stingrays has been developed since 1996. Approximately 15 valid species are listed for the Amazon Basin, and some population parameters are either known or are currently being studied, for at least seven of these species (*Paratrygon aiereba*, *Plesiotrygon iwamae*, *Potamotrygon motoro*, *P. schroederi*, *P. orbignyi*, *P. scobina* and *Potamotrygon* spp.). The latter species, known locally as “cururu”, is currently being described. The information collected involves aspects related to habitat, distribution, reproductive biology, feeding habits, growth and mortality rates, and fisheries in the Brazilian Amazon. All information available contributes to assist in decision-making related to public policies, procedures involving sustainable fisheries management, as well as the conservation of freshwater stingrays and their habitats.

13.00-14.00
Poster session

Research opportunities and benefits for undergraduate students

C. Huveneers
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The value of different ways of learning is increasingly recognisable and no longer can anyone assume that learning in the lecture theatre is better than learning from experience. Gaining work experience is now seen as an excellent way for students to acquire the skills that employers seek. Virtually all students have completed some form of experiential education beyond that which is offered at their university. However, the different types of experiential learning available can be confusing. Shark related experiential learning can be divided into 3 classes which will be developed and illustrated by personal experience:

(1) Pay-to-Volunteer: accessible to anybody willing to pay to join a team of shark scientists.
(2) Volunteer: Unremunerated work but more hands-on experiences with the chance to get important contacts for the future.
(3) Internship: Usually the best experiential learning available; constituted of a highly structured placement offering graduate-level work.

Of the programs that do offer reflective work, student-centred programmes are more likely to help for the future. This includes internships that give students projects or papers rather than those that teach classes.

13.00-14.00
Poster session

The elasmobranch fauna of Moreton Bay, Queensland, Australia: ecology, threats, conservation, management and research.

Peter M. Kyne[a], Simon J. Pierce[a], Richard D. Pillans[b], Jeff W. Johnson[c] & Michael B. Bennett[a]
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Moreton Bay comprises a large, shallow, subtropical bay with tidal estuaries in south-eastern Queensland, Australia, encompassed by a Marine Protected Area of ~306,000 ha. The Bay is close to three major urban centres (Brisbane, the Gold Coast and the Sunshine Coast), whose greater region has over 1.5 million human inhabitants. Moreton Bay is a unique natural system, combining temperate and tropical communities with a diversity of habitats including mangrove communities, mudflats, seagrass beds, sandy beaches and coral reefs. The bay is subject to considerable pressure through the effects of both commercial and recreational fishing, changes in water quality and habitat loss due to development. At least 54 elasmobranch species have been recorded from the bay, but the effects of human activities on elasmobranch populations is largely unknown, however, declines in the relative abundance of some species have been noted. For example, the longcomb sawfish, *Pristis zijsron*, has not been recorded in Moreton Bay since the 1960s; the estuary stingray, *Dasyatis fluviorum*, is under pressure from incidental fishing and habitat modification and loss; Colcloughs shark, *Brachaelurus colcloughi*, may be a naturally rare species restricted to a small geographic area centred around Moreton Bay, which appears under increasing pressure from fisheries bycatch and seagrass loss. Estuarine and inshore environments of Moreton Bay appear to serve as important nursery areas for a number of species including members of the families Orectolobidae, Triakidae, Carcharhinidae, Sphyrnidae, Rhinobatidae, Dasyatididae and others. The current Zoning Plan of the Moreton Bay Marine Park and state legislation fails to significantly protect populations and suitable habitats, with only the white shark, *Carcharodon carcharias*, and the grey nurse shark, *Carcharias taurus*, protected. Current research at the University of Queensland is focusing on the life histories of common species, the importance of various habitats as feeding grounds and nursery sites and the effects of habitat modification, particularly canal estate developments on *D. fluviorum* and other species. Tracking studies of inshore elasmobranchs, together with movement patterns and habitat use of the euryhaline bull shark, *Carcharhinus leucas*, are being actively pursued.

13.00-14.00
Poster session

Preliminary information on the stomach contents of the Caribbean sharpnose shark, *Rhizoprionodon porosus* (Poey, 1861), off Pernambuco State, Brazil.

Sérgio Macedo Gomes de Mattos[1] and Fábio HissaVieira Hazin[2],
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This paper presents preliminary information on the stomach contents of the Caribbean sharpnose shark, *Rhizoprionodon porosus* (Poey, 1861), off Pernambuco, Brazil, during April 1996 to July 1997. A total of 189 stomachs were analysed, 121 being from adult specimens and 68 from juveniles. Stomachs with contents were found only in 29 adults. Five degrees of repletion were identified, with the degree of repletion I (empty) being the most frequent (84.7% of the total and 76% among adults). For the 4 digestion levels considered, contents with no digestion were found in 6.1% of the analysed stomachs; in 12.1%, they were at the beginning of the digestion process; in 36.4%, they were digested but identifiable; and in 45.4% they were digested and not identifiable. Teleosts were found in 90% of the stomachs with contents. Cephalopods were present in 13.3% and crustaceans in 3.3%. The hepatosomatic index - HSI was calculated, for males and females, for the whole period studied and grouped bimonthly and by maturational stage. A statistical analysis of the HSI showed that no significant difference occurred between sexes or periods of the year.

13.00-14.00
Poster session

The biology of the African angel shark, *Squatina africana*, from net catches off KwaZulu-Natal, South Africa

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Between 1978 and 2001, 755 African angel sharks, *Squatina africana*, were caught in the nets which protect 42 swimming beaches spanning 326 km of coastline in South Africa. The species was caught throughout the year, mainly in the winter months of April to September, with an average annual catch of 33 sharks. Catch was distributed in the southern region of the netted area with a sex ratio of 1 male to 3 females. Both males and females matured at around 700 mm precaudal length (PCL) with the highest gonad indexes (GI) found in January for male and female sharks with females showing a second maximum GI in December. Only two sharks were caught mating in April and May suggesting mating takes place between January and May. December showed the highest hepatosomic index (HSI) for pregnant females with the lowest value in June. This corresponded with the onset of maturity and parturition, respectively. The average litter size was 6 with length at birth between 209 and 240 mm PCL. Pregnant sharks were caught in two main areas, a main one in the south with a smaller one to the north. Males preyed mainly on teleosts with females preying on both teleosts and cephalopods.

13.00-14.00
Poster session

Foraging strategy of a planktivorous marine predator, the basking shark (*Cetorhinus maximus*).

E.J. Southall, [1]., D.W. Sims[1] and J.D. Metcalfe[2]
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The factors influencing the distribution and behaviour of highly migratory fish in the sea remain poorly understood. This lack of knowledge is surprising given that understanding the type of habitats fish select at certain times, and what factors affect migration routes are central questions relevant to animal behaviour, climate change and fisheries management. In this research the migratory movements and preferred habitat of a model open-ocean species (the plankton-feeding basking shark) were determined using satellite tracking and remote-sensing technology. These data were used to examine how shark behavioural strategies changed in response to variations in ocean productivity and thermal regime.

13.00-14.00
Poster session

Historical analysis (1993-2000) of the thematic exhibitions of natural history collections concerning elasmobranchs in Italy, with a proposal for the future.

Tiiziano Storai, Marco Zuffa, Gildo Gavanelli

A synthesis of didactic-educative activities (the thematic exposure of naturalistic collections concerning elasmobranches) realized in Italy during last decade is proposed. The main objective of these activities is to provide correct information on elasmobranches for the general public. Some tables show the most significant events occurred during this period, with attention on findings kind and collaborators. Particular leading principles about planning, organization and realization of events are also quoted. The collected data explain the substantial interested of people and particularly children, on the matter. On the basis of these experiences, an embryonic project named EVME (European Virtual Museum of Elasmobranches) is suggested, as a desirable tools of naturalistic education and to raise an ecological awareness. The present study hypothesis that the annual EEA Meeting may demonstrate the ideal situation where a temporary, thematic exhibition of cartilaginous fishes findings could be realized, allowing a considerable contact between scientific researchers and general public.

14.00
U.S. Initiatives to Conserve Northwest Atlantic Skates.

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In just the last five years, conservation and management attention to skates of the Northwest Atlantic Ocean has intensified and yet these vulnerable species remain completely unprotected with some stocks facing potential endangered status. Skates in US Atlantic waters, caught primarily as bycatch in groundfish fisheries for decades, are now the subject of growing European markets for wings as well as domestic demand for bait. In recent years off the New England coast, retention of skates has reached record high levels while skate discards are estimated to be at least twice the level of skate landings. A 1998 paper in Science by Casey and Myers that suggested the barndoor skate *(Dipturus laevis)* was in danger of extinction spurred intense attention from conservationists including two petitions to list the species under the United States Endangered Species Act. Although not yet answered, petitions prompted population assessments for the entire regional skate complex (seven species) and "overfished" determinations for several stocks. Populations of barndoor and thorny skate *(Amblyraja radiata)* were shown to be particularly depleted with thorny skate indices at record low levels. Various scientific panels have highlighted both as species of concern. Although US fisheries law mandates timely and relatively stringent rebuilding of overfished stocks, the regional fishery management council's draft skate fishery management plan is seriously flawed and nearly two years behind schedule. On an international level, US scientists and policy makers have spearheaded efforts to assess skate populations and establish skate quotas under the Northwest Atlantic Fisheries Organization (NAFO), as consistent with the 1999 United Nations Fish and Agricultural Organization (FAO) International Plan of Action for Sharks. There is however not much support outside the US for these proposals, nor are skates a high priority issue for the US at NAFO meetings. The latest developments on all these management fronts will be reviewed with an eye toward fostering cooperation and conservation support from European elasmobranch experts.

14.20
2001-2002 Educational programs by Uno Squalo Per Amico

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Education about sharks is very important in the area where the USPA (Uno Squalo Per Amico) association is based. In fact, San Marino is just 20km away from the Adriatic Sea, where sport angling is very strong and the blue shark and thresher shark populations have been overfished, as reported in many papers. Indeed, the Adriatic Sea is a nursery area for blue and thresher sharks. The educational programs have been developed at a variety of levels:

- Presentations in secondary school (generally a 2 hour slide show)
- Occasional lectures addressed to the general public
- Monthly lectures to divers and "shark-fans"
- Elasmobranch biology courses (3 days) for University students
- Attendance to Nautic and Diving shows with exhibits (posters, videos, tools, etc.) on sharks
- Web site (www.unosqualoperamico.org)
- Quarterly USPA-News circulation

Public response to these activities has been very good and is helping to increase public awareness regarding shark conservation, so that public opinion may help to drive the Italian Fishery Department to pass new rules about shark angling.

14.40

The Longline Shark Excluding Device (LSED): Proposal for a new method of selectively reducing shark bycatch in longline fisheries.

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In virtually all longline fisheries worldwide sharks are caught as a bycatch, and may even dominate the overall catch. The resulting mortality is a massive impact on shark populations on a large scale, further affecting ocean ecology. The need to counteract these circumstances is increasingly understood by elasmobranch biologists as well as fisheries managers and reduction of shark bycatch is called for in many national and international conservation proposals and action plans for shark management and conservation. Various approaches have been made to develop methods for reducing shark bycatch, however promising progress has been achieved mainly in demersal and bottom longline fisheries, with pelagic longlining bycatch reduction methods still working suboptimally.

The present proposal offers a technically more intensive, but ultimately effective principle to selectively reduce or exclude the shark bycatch in longline fishing as executed anywhere by applying the Longline Shark Excluding Device (LSED). The LSED is a small, self-sustained electric device attached to the leader directly above the longline hooks, emitting a distinct and locally effective pulsed electric field from two spaced electrodes and posing an electric barrier exclusively for the electrosensitive sharks. The bait is protected from sharks and accessible for target species (i.e. pelagic tuna and billfish). This is based on the fact that sharks have electrosensitive capabilities that allow the use of a specific electrical field with barrier characteristics without affecting the targeted teleost species. The principle is proven to work in various experimental and commercial applications and is the logical and optimal approach for reducing bycatch in longline fisheries.

This concept is at a planning stage and partners are sought for co-operation in R&D as well as production and promotion. The concept includes socio-economic implications and perspectives, as broad application of LSEDs is necessary to be effective, and support from national and international conservation institutions will be needed. This could lead to a new eco-label to certify ocean-friendly caught tuna being established. International co-operation in the realization of this concept may enable fisheries to reduce fishing effort for the same yield, reduce overall bycatch as well as costs. Furthermore, overfished shark populations could find a mid- to longterm recovery window as bycatch mortality is reduced substantially.

15.30
How the media portray sharks

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Intuitively, public opinion of sharks is most likely to be influenced by their exposure to information which is available in a variety of formats via the media eg. newspapers, TV, film, Internet. Opinions based on the media will also depend on the regularity of the information provided and its content bias. Newspapers provide information on a daily basis in an easily accessible, often visually arresting and readily available format. We therefore decided to undertake a study looking at how sharks were portrayed by newspapers. In this pilot study we concentrated on three broadsheet newspapers owing to the availability of archive material either on the internet or CD-Rom. We categorised the content, general nature and length of the article and the species of shark concerned. We then scored each article firstly on their headline message and then on the basis of positive (eg. conservation topic) or negative (eg. shark attack) content in the article to allow comparison between the newspapers. We found that the broadsheet newspapers portrayed sharks in a positive light as much as a negative. The main species mentioned were the Great White and Basking shark with other species only occasionally the subject. Following the main study of the newspapers we conducted a short questionnaire study of a group of students to determine how readers generally perceive the information given in the newspapers. Interestingly, although the newspaper had a similar occurrence of stories of positive and negative content only 50% of the group were likely to read the story about conservation. It appears that although the newspapers are providing both conservation and shark attack type articles the readers are grabbed by the sensationalist headlines and therefore are not getting the more important conservation information. Future research in this area is obviously very important for those of us working for shark conservation.