EUROPEAN ELASMOBRANCH ASSOCIATION

11th Annual Science Conference

23rd-26th November 2007
Brest – France

Program & Abstracts

SATURDAY 24TH

11h30-11h50

THE STATUS OF MIGRATORY ELASMOBRANCHS.

Fowler S.

The IUCN Shark Specialist Group has recently undertaken a review of the conservation and management status of migratory species of Elasmobranchs for the Convention on Migratory Species (CMS). This was presented to the CMS Scientific Council earlier in 2007, resulting in a recommendation that all threatened migratory species should be considered for listing on the Convention at the next Conference of Parties. This presentation will summarise the results of the taxonomic review and consider the potential role for CMS in promoting the conservation and management of shared and high seas stocks of migratory elasmobranchs.

SATURDAY 24TH

11H50-12H10

THE SUB-REGIONAL PLAN OF ACTION FOR SHARKS (PSRA-REQUINS) IN WEST AFRICA

Diop M.

In 2001, the West African fishery organisation “Commission sous-régionale des pêches” (CSRP) took the initiative to develop a sub-regional plan of action for the management and the conservation of sharks populations (PSRA-Requins), following the recommendations of the international plan of action elaborated by the FAO in 1999. The CSRP regroups seven West African countries: Mauritania, Senegal, Gambia, Cape Verde, Guinea-Bissau, Sierra Leone and the Republic of Guinea. All these countries have shark fisheries and strong declines have been observed during the last decades. The PSRA objectives, realisations and projects are presented. Despite difficulties in implementing some actions, the PSRA is the unique action plan for sharks in Africa.

SATURDAY 24TH

12H00-12H30

FRENCH ELASMOBRANCH PRODUCTION: PAST AND PRESENT

Séret B.

Sharks and skates are traditionally consumed in France and some species are quite appreciated. Their production increased from 17 000 t in 1950 to about 40 000 t in 1981, and since it has been regularly declining to reach in 2005 about the same level as in the 1950's (# 20 000 t). Most of the production (# 99 %) comes from the NE Atlantic with only a few tonnes from the Mediterranean Sea. The composition of the landings has changed during the last decades: species that were commonly caught in the past are now rare or even absent in the landings. Today, the landings consist of about 54 % of sharks and 43 % of rays; plus 3 % of chimaeras. The main species are the catsharks (*Scyliorhinus canicula* and *S. stellaris*), the skates *Leucoraja narevus, Raja montagui* and *Raja clavata* and the spurdog *Squalus acanthias*. Since the beginning of the 1990's, deep-water sharks are trawled on the continental slopes of NE Atlantic and marketed under the commercial name siki; fishery data seems to show that their production has reached their maximum of yield. Most of the production of elasmobranch fishes consist of bycatches, however there is a seasonal fishery targeting the porbeagle, *Lamna nasus,* off Ile d'Yeu, whose production has been decreasing from about 1000 t en 1978 to less than 300 t today.

SATURDAY 24TH

12h30-12h50

THE PUBLIC AND SHARKS: CHANGING ATTITUDES FOR A SUSTAINABLE FUTURE.

Hood A.

The Shark Trust works to advance the conservation of sharks through science, education, influence and action. Engaging stake holders and the general public in a range of initiatives, campaigns and activities is a vital element of the Trust's work and contributes significantly to the Trust's ability to achieve practical solutions and raise public and political awareness. This presentation will consider a selection of Shark Trust initiatives which profile our work with a range of different stake holders from commercial fishermen, divers and anglers, to the general public.

SATURDAY 24TH

14H00-14H20

ECOLOGY AND BEHAVIOR OF THE SICKLEFIN LEMON SHARK (*NEGAPRION ACUTIDENS*) POPULATION OFF MOOREA ISLAND (FRENCH POLYNESIA).

Mourier J., Buray N., Clua E. & S. Planes

In French Polynesia, shark fishing and finning has been prohibited since April 2006. However, despite its controvesial aspect, shark feeding has been developed involving different species of sharks. The present work describes underwater surveys undertaken to determinate residency and site fidelity of a small shark population of sicklefin lemon shark, *Negaprion acutidens*, in Moorea Island, as well as its long term behavioural evolution in relation to shark feeding activities. We could determine the entire population structure using photo-identification techniques thanks to its small size; a total of 36 animals consisting of 21 females and 15 males were identified. This population occurring around the commercial shark feeding spot on the northern part of Moorea Island, aggregated over the 24 months of survey. A genetic study using microsatellite loci was also initiated on 23 adults and 8 juveniles, to confirm underwater observations, and to assess the population social structure using parentage analysis, and its internal turn over, and thus [0]estimate the vulnerability of such a small population. This aggregation site enabled us to acquire biological and ecological data, such as reproductive cycle, population turnover, mating behaviour, migration and social organisation. These two complementary approaches should allow to propose better management plans for shark conservation.

SATURDAY 24TH

14h40h15h00

POPULATION STRUCTURE OF THE GREAT WHITE SHARK (CARCHARODON CARCHARIAS) IN SOUTH AFRICAN: AN INSURMOUNTABLE OPPORTUNITY FOR CONSERVATION?

Gubili C., Oosthuizen H., Meyer M., Johnson R., Kock A.,de Sabata E., Jones C. & Les Noble.

We present the first description of population genetic structure among great white sharks (*Carcharodon carcharias*) in South African waters using mitochondrial DNA (mtDNA) control region sequences (n=51), restriction fragment length polymorphisms of the same region (RFLPs, n=133), and microsatellite markers (n=183). RFLP analysis revealed two distinct haplotypes, one of which was very common and widespread along the South African coast (Haplotype C), whilst the second was limited to the south west coast, implying a possible local population (Haplotype D). This trend of localised subdivision is consistent with phylogeographic analysis, suggesting that the least common haplotype D originated/evolved from haplotype C. One individual from the Mediterranean clustered with type C, whilst another, reported in a previous study (Bonfil *et al*., 2005, SCIENCE 310 (5745): 100-103), made a return trip from South Africa to Australia was shown to belong to the same common South African haplotype C. This implies some type of philopatry to at least oceanic basins, and perhaps more local areas. Such findings have important implications for understanding the pressure from fisheries activities, including by-catch, trophy hunting, and disturbance from anthropogenic impact, and highlight the need for management at an international level.

SATURDAY 24TH

15H00-15H20

LEARNED HOOK AVOIDANCE OF LEMON SHARK (*NEGAPRION BREVIROSTRIS*) BASED ON ELECTRORECEPTION AND SHOCK TREATMENT.

Spät J.L.Y.

Long–line surveys, conducted for the past 24 years in Bimini, Bahamas suggest a decline of 83% in the number of lemon sharks caught annually compared to catches for the same period 20 years ago. It is therefore suggested that lemon sharks might have learned an avoidance mechanism to the long-line equipment based on their ability to detect electric fields by electroreception. It might be possible that the trauma and stress of capture on long-lines could evoke an avoidance based mechanism in these animals, as they learn to associate the electrical field surrounding a metal hook with the ordeal they have previously experienced. Therefore, I tested if juvenile lemon sharks were able to learn avoidance of baited metal hooks. Six sharks were individually presented with two visually indistinguishable, baited hooks. One of these hooks was a circle hook, used for long-line fishing in Bimini, the other one was a plastic copy of the metal hook. If the sharks attempted to feed from the control hook (plastic) they were undisturbed and allowed to take the bait. If the sharks attempted to feed from the metal hook, they were mechanically shocked by the observer. This caused the sharks to release the bait and provided negative reinforcement. To test for learning, the correct response (plastic hook) of the sharks was correlated with the number of experimental sessions. No evidence for significant learning behaviour in any of the sharks could be produced. Although in total the choices for the plastic hook outweigh the ones for the metal hook, with the limited amount of data available it is not possible to demonstrate the ability of lemon sharks to avoid long-line hooks using electro reception. Power analyses indicated that only two out of the six sharks, assuming similar future hook choices as their past choices, would have been able to learn hook discrimination if the experimental sessions were to be farther continued.

SATURDAY 24TH

15H20-15H40

DETERMINATION OF THE RESPONSE OF BENTHIC ELASMOBRANCHS TO ELECTRIC FIELDS GENERATED BY OFFSHORE WINDFARMS: A LARGE SCALE EXPERIMENT.

Gill A.B., Gloyne-Phillips I., Huang Y., Metcalfe J., Smith D., Spencer J. & V. Wearmouth

The issue of the environmental implications of electromagnetic fields associated with offshore wind farms have recently been a focus for COWRIE (Collaborative Offshore Wind Research into the Environment), which represents the UK offshore wind farm industry, NGO's, UK Government Offices and Departments and statutory conservation agencies. To address this issue the Environmental Technical Working Group of COWRIE has identified as priority research definitive determination of whether electromagnetic sensitive organisms respond to the anthropogenic electromagnetic fields (EMF) generated by offshore wind farm cables. The research is being addressed through COWRIE EMF Phase 2.0 which has the specific aim to conduct an experimental study which will determine the response of electroreceptive fish to controlled EMFs of the magnitude associated with offshore wind farm power cables. The focus of the research is the electrical component of the EMF and those species most sensitive to electric fields, namely the elasmobranchs (sharks, skates and rays). The study is currently ongoing. The project and the preliminary results will be presented.

SATURDAY 24TH

15H40-16H00

SHARK PREDATION ON CETACEANS OFF THE BALEARIC ISLANDS (NW MEDITERRANEAN)

Morey G., Navarro O., Martinez M., Brotons J.M, Fernandez G., Cantallops M.

In the Balearic Islands a monitoring program of cetaceans strandings has been carried out since 1998. The data compiled from 1998 to 2006 were analysed in order to determine the shark incidence on marine mammals in the area. Owing to the difficulty in distinguishing between true predation and scavenging, we referred to all the shark-inflicted injuries as "predation". A total of 236 cetaceans were found dead or fatally injured along the Balearic coasts. These belonged to 8 species, although in some cases (n=33) they could not be identified to the species level. From both *in situ* examination and photographs analyses, 36 predation cases attributable to sharks could be ascertained, involving 5 cetacean species at least (the long-finned pilot whale *Globicephala melas*, the Risso's dolphin *Grampus griseus*, the sperm whale *Physeter macrocephalus*, the striped dolphin *Stenella coeruleoalba* and the common bottlenose dolphin *Tursiops truncatus*) and 3 taxa of sharks (the bluntnose sixgill shark *Hexanchus griseus*, the white shark *Carcharodon carcharias*, and Fam. Carcharhinidae). The Family Delphinidae showed the highest values for strandings (83,4%) and for predation cases (86,1%), in accordance with its population status within the Mediterranean, although the predation ratio on these Family did not differ significantly from that when pooling all the cetaceans species. The monthly distribution showed that during the January-March period both strandings and predation cases were more common (49% and 58%, respectively).

SUNDAY 25TH

9H30-9H50

FOSSIL SHARKS AS INDICATORS OF HOW MODERN ELASMOBRANCHES WILL BE AFFECTED BY CLIMATE CHANGE

Nicholls Emma-Louise

In the Cretaceous (# 100 MA), there was a rise of sea-level that can be compared to what is predicted today due to the ongoing climate change. Sharks have a long evolutionary history during which they had to face similar changes. In studying fossil records of sharks, the impact of past climate changes could be estimated and such studies could provide perspectives on how the current rise of sea-level could affect the modern shark populations and their ecosystems.

SUNDAY 25TH

10H10-10H30

OBSERVATION OF THE SIXGILL SHARK, HEXANCHUS GRISEUS, IN THE STRAITS OF MESSINA (CENTRAL MEDITERRRANEAN SEA).

Potoschi A., Ilaria G. & N. Spanò

In the Straits of Messina, the deep water sixgill shark, Hexanchus griseus, has been observed by divers near the surface, in 15-30 m depth, during particular moon and tide phases. In 2007, specimens of this shark were caught in an upwelling area south of the Straits of Messina (Giardini Naxos), under the framework of EU project POR SICILIA 2000-2006. It is hypothesized that there is a strong correlation between vertical migrations of H. griseus and the presence of a large concentations of organic matter and benthic organisms, in relation to the northern upwelling currents present in the area.

SUNDAY 25TH

14H00-14H20

PRELIMINARY RESULTS OF A TAGGING PROGRAM ON THE COMMON STINGRAY, *DASYATIS PASTINACA*, OFF THE BALEARIC ISLANDS (NW MEDITERRANEAN).

Morey G., Navarro O. & F. Riera

A tagging program on the common stingray, *Dasyatis pastinaca*, was carried out off Mallorca (Balearic Islands, NW Mediterranean) between December 2006 and July 2007. A total of 195 specimens caught with trammelnets at a mean depth of 24.7 m were tagged. To date, two of them were recaptured. Their minimum distance traveled while at liberty were 2,2 km and 4,2 km over a 1 day and a 43 days period respectively. Although the low number of recaptures did not allow to estimate the population size of *D. pastinaca* in the study area, its seasonal abundance could be determined showing a continuous increase from December to July. Juveniles under 20 cm disc width were very abundant in June and July, accounting for 36,7% and 64,8% of the stingrays captured respectively. New-borns were not present in the catches because of the large mesh size of the trammel net. Additional observations of pregnant females, aborted foetuses and courtship behaviour suggest that both parturition and mating should start at mid-June in shallow waters less than 25 m depth. Other 7 batoid species were also tagged: 1 spiny butterfly ray *Gymnura altavela*, 13 common eagle ray *Myliobatis aquila*, 1 bull ray *Pteromylaeus bovinus*, 15 blonde ray *Raja brachyura*, 19 spotted ray *Raja montagui*, 98 rough ray *Raja radula* and 17 marbled electric ray *Torpedo marmorata*, of which only two *R. radula* specimens were recaptured.

SUNDAY 25TH

14H20-14H40

ANALYSIS OF UK BLUE SHARK (PRIONACE GLAUCA) DATA FROM VOLUNTEER ANGLER PROGRAMMES

Collins K., Wren E. & S. Williams

Two UK volunteer angler catch and release programmes routinely record and tag blue sharks (Prionace glauca): the Shark Angling Club of Great Britain (SACGB), Looe, Cornwall and the national UK Shark Tagging Programme (UKSTP). The majority of captures are females, made off SW England and SW Wales. From 1988 to 2005, SACGB tagged 885 blue sharks (734 females, 76 males) and obtained 65 recaptures. From 1988 to 2005, UKSTP tagged 479 sharks (389 females, 51 males), and obtained 30 recaptures. The length/weight relationships from all capture data were : Log10Wt (g) = Total length(cm)*0.00625 + 3.23 (r2 = 0.88, n = 724) for the females and Log10Wt (g) = Total length(cm)*0.00623 + 3.23 (r2 = 0.82, n = 75) for the males. The catches per unit effort (CPUE) were calculated for the SACGB specimens. These figures were correlated against the yearly sea surface temperatures (SST), the weights of potential prey landed during commercial fishing and the gender ratios both in length and weight. Results showed that there has been a decline in the apparent abundance of P. glauca and that there is a high correlation between the CPUE, the numbers of pilchards and squid landed and the mean SST. There is a consistently very high percentage of females but their length and weight remains relatively constant. Recaptures have been made across the Atlantic Ocean, ranging from the coasts around the UK and Spain, down to the coasts of Africa and across to Brazil and the USA. Larger animals moved further than smaller.

SUNDAY 25TH

14H40-15H00

THE VISUAL IDENTIFICATION OF THE GIANT MANTA (*MANTA BIROSTRIS*) IN THE CENTRAL MALDIVES ATOLLS

Kitchen-Wheeler A.-M.

Giant Mantas (*Manta birostris)* occur worldwide in tropical and subtropical regions and occasionally migrate into temperate waters. Despite this worldwide distribution, there is very little published information on the distribution or biology of *M. birostris*. In order to undertake studies on the migration and behaviour of individual *M. birostris* animals it is essential to develop a system for identification which can be used at any site where mantas are regularly observed. In common with population, migration and ecology studies of other charismatic fauna including whalesharks and cetaceans, the first step was to develop a reliable method to identify individual animals. Species appear to be identified by different characteristics depending on specific physical characteristics which show variation in the species. Whalesharks are identified by the spot pattern between the gill slits and pectoral fins, humpback whales are identified by the ventral aspect of the tail fluke and left and right aspects of the dorsal fins. In mantas it appears that each individual has a characteristic pattern of dark markings on the ventral side. This pattern has been used by Homma and Yano to identify individual mantas in the Yaeynama and Ogasawara Islands, Japan. In addition, Manta Bay Resort in Yap, Micronesia have kept records of the ventral side of the mantas which regularly visit cleaning stations nearby as do the Manta Pacific Research Foundation , based in Kona, Hawaii . Although there is a consensus that the markings can be used to aid individual identification there is no stated method for the process. The purpose of this paper is to document the development and testing over five years of a formal method for the visual

SUNDAY 25TH

15H00-15H20

BASKING SHARK PHOTO-ID: MAXIMISING THE POTENTIAL.

Reeve A.

Basking Sharks are the shark most are one of the UK's most accessible and widely viewed shark species. Spending much of its time in surface waters, Basking Sharks have proved to be an interesting candidate for study using photo-identification techniques. A Basking Shark photo-id project run over the past 8 years has provided a vast amount of data, led to some intriguing points of focus and provided many opportunities for further investigation. With the creation of a new online database the data is easily accessible lends itself to further interrogation.

SUNDAY 25TH

15H20-15H40

SIZE FREQUENCY DISTRIBUTION OF JUVENILE LEMON SHARKS (*NEGAPRION BREVIROSTRIS*) AROUND SOUTH CAICOS, TURKS AND CAICOS ISLANDS.

Calosso M.C., Parson S K.T. & S.P. Newman

Juvenile lemon sharks (*Negaprion brevirostris*) have been studied extensively in only a few locations in the Western Atlantic region, with limited work conducted in the Turks & Caicos Islands (TCI). Adequate management and conservation of shark populations is dependant on identification of essential fish habitats such as nursery grounds that are often vulnerable due to their proximity to land and exposure to human activities. The aim of this study was to investigate the size range of immature lemon sharks found in shallow near shore habitats around South Caicos, TCI, an island currently facing unprecedented coastal development. Between August 2006 and September 2007 juvenile lemon sharks were caught using monofilament gillnet deployed perpendicular from shore at selected sites around South Caicos. In 2006, sharks were tagged using external T-bar anchor tags. Due to a high proportion of partial or total tag loss, and severe fin infection and damage observed in recaptured sharks, passive integrated transponder tags were used in 2007. Over 88% of sharks tagged with T-bars and subsequently recaptured showed presence of fin damage, often with up to 5 cm of skin area inflamed and covered with visible bloody patches. However, less than 44% of all other individuals caught displayed the disease. Preliminary results indicate that only juveniles of an intermediate size class (mean PCL 63.8 $\pm$ 1.02 cm S.E.; range 50.5 - 91.0 cm; n = 79) used the study areas. All individuals caught had healed umbilical scars and no adult lemon sharks were observed during the study period, suggesting that pupping may occur elsewhere and neonates may use alternative areas until they reach larger sizes. This contrasts observations elsewhere in the Western Atlantic, where newborns and intermediate juveniles use the same habitats. As island development increases, it is critical to assess the nursery function of habitats around South Caicos and to identify pupping grounds. Current understanding of lemon sharks originates mostly from studies in the Bahamas. Further research in alternative locations such as the TCI would greatly enhance this understanding and improve conservation throughout this threatened species' range.

POSTERS

WEIGHT AND LENGTHS RELATIONSHIPS OF THE TOPE SHARK (GALEORHINUS GALEUS) IN UK WATERS.

Collins K. & L.Whiston

The UK Shark Tagging Programme (www.ukshark.co.uk) supports volunteer anglers around the British Isles recording, tagging and releasing their catches. Over 7000 sharks have been tagged since the start of the programme in 2000, the majority being Tope (Galeorhinus galeus) which has given an insight into the seasonal distribution of the species around the UK. The weights, total and fork lengths, girth have been analysed for both males and females. The relationships found include: Fork length = 0.894* Total length - 1.078 (r2 = 0.953, n = 1565) and Log10 weight (g) = 2.484 * Log10 fork length (cm) - 1.099 (r2 = 0.78, n = 1461) for all specimens, males and females. Comparisons with other populations have been made.

UPPER JURASSIC NEOSELACHIANS FROM SPAIN IN THE EUROPEAN CONTEXT.

Pigowske A. & S. Klug

Fossil neoselachians (sharks, skates, and rays) are primarily recognized by their teeth and, consequently, the evolution and ecology of neoselachians through time is still obscure. Knowledge of Late Jurassic neoselachian diversity is fundamental to our understanding of their early evolutionary history and radiation. Despite the development of diverse neoselachian faunas within the Jurassic, the palaeoenvironmental specificity of the taxa has generally been ignored. The project focuses on Late Jurassic neoselachians from NE Spain. In the Late Jurassic (ca. 150 million years ago) to the Early Cretaceous (ca. 125 million years ago) climatic 'green-house' conditions prevailed with minor diversity gradients. Conversely, paleogeographic (ammonides), isotopic ($\delta^{18}O$ of neoselachian tooth enameloid) and sequence stratigraphic evidence supports a global cooling for this period. We assume that the distribution of Late Jurassic fishes is strongly environmentally controlled. Extensive sampling from a range of facies within the Late Jurassic marine platform of the Iberian Basin allowed to assess the palaeoenvironmental distribution of sharks and rays within the basin but also to reconstruct faunal exchanges between European Late Jurassic neoselachian faunas and discriminate Tethyal and boreal influences. Geochemical tracer analyses (δ18O, δ13C,) performed on selected teeth from a range of different facies and ages helped establishing a stratigraphic and palaeoecological framework. The results are compared to other Late Jurassic neoselachian assemblages and general diversity patterns are reconstructed, which, in turn, can be used as proxies for modern neoselachian distribution.

MITOCHONDRIAL HAPLOTYPE ANALYSIS OF THE BULL SHARK (*CARCHARHINUS LEUCAS*) CONTROL REGION.

Gulak S.J.B., Gubili C., Jones C.S. & L.R. Noble

A phylogeography study, using mitochondrial DNA (mtDNA) analysis, was carried out on the bull shark, *Carcharhinus leucas*. Tissue samples were collected from commercial fisheries and with the help of research programs in three distinct areas: Australia, South Africa and the United States of America. A product of 750 base pairs from the highly variable control or D-loop region was isolated and sequenced. The results were used to predict sizes of fragments produced by restriction fragment length polymorphism (RFLP) analysis. This amplicon was a much larger part of the D-loop than that used in the previous study conducted by Kitamura *et al.* (1996). A number of haplotypes were found and new reverse primers were designed in an attempt to increase the product size. Further investigation will include complete sequencing and comparison of all the samples.

PRELIMINARY RESULTS OF SIGHTING OF THE ANGEL SHARK, *SQUATINA SQUATINA*, BY DIVERS OFF GRAN CANARIA ISLAND, EASTERN CENTRAL ATLANTIC.

Narváez K., Osaer F. & R. Haroun

From May 2006 to September 2007, we asked recreational divers and diving centres to register the sightings of angel sharks in the waters around Gran Canaria. So far, the number of responses was very low considering the amount of local divers and the frequency with which they dive. Nevertheless, the potential of this sighting program as a monitoring mechanism is obvious as it has low cost and easy application in areas with recreational diving practices is obvious. The highest numbers of sightings were recorded in El Cabrón (Arinaga) on the east coast, and in Sardina and Caleta (Galdar) on the northwest coast.

REPRODUCTIVE BIOLOGY AND SEXUAL DIMORPHISM OF THE ALASKA SKATE, BATHYRAJA PARMIFERA (RAJIDAE) IN THE NORTH-WESTERN PACIFIC.

Orlov A.M. & A.A. Smirnov

Sexual dimorphism and some features of reproductive biology of the Alaska skate, Bathyraja parmifera, were studied from samples caught in 2004 in the western Bering Sea from bottom trawl catches and in 2005 in the northern Sea of Okhotsk from catches of bottom gill nets. To compare some characters of external morphology 134 males and 98 females from the Sea of Okhotsk were examined. In the Bering Sea, cloaca lengths were measured in 41 females; clasper lengths and stages of gonad maturity were determined in 67 males. In the Sea of Okhotsk, stages of gonad maturity were examined in 33 females and 11 males; clasper lengths were measured in 31 males. Comparative analysis of total length, body weight and 11 external morphological characters showed that male Alaska skates were considerably longer (mean 68.5 vs. 66.8 cm) and heavier (2.8 vs. 2.6 kg) than females. Males and females significantly differed statistically in length and width of disc, head length, mouth and internasal widths, and tail length. The analysis of ovarian maturity showed that in the western Bering Sea half of females become mature at total length 84.5 cm. In the Sea of Okhotsk, relationship between cloaca length (CL) and total length (TL) was well pronounced and can be described by formula CL = 59.305 TL-0.65. Study on sexual maturity and relative clasper length showed that 50% of males become mature at length 90.2 and 81.7 cm in the Bering Sea and 83.8 and 80.8 cm in the Sea of Okhotsk respectively. It the former area mass maturation occurs when claspers reach 17.9%TL, while in the latter area at 15.9%TL. The differences observed while using different methods are probably related to small sample size and also to more subjective character of visual examination of sexual maturity. Males dominated among small skates (<45 cm), female share increases with growth, sex ratio is quite equal among individuals with length 60-80 cm, males prevail again among the largest specimens (>80 cm).

ROLE OF THE MARINE PROTECTED AREAS IN THE CONSERVATION OF CHONDRICHTHYAN FISHES.

Bottaro M., Consalvo I. & M. Vacchi

The presence of the uncommon skates *Raja brachyura* and *Raja polystigma* inside the marine protected area (MPA) of Tavolara at Punta Coda Cavallo (NE Sardinia, Mediterranean Sea) is regularly reported. Inside the MPA, there are suitable habitats for these skates. Also, the fishing pressure is low as only a few artisanal boats are allowed to fish inside the MPA with trammel nets. Furthermore, the fishermen retain only the large adult specimens and discard the smallest ones with a high survival rate since the skates are often still alive when the net is lift up on board. These observations suggest that MPAs could be used as tools in the conservation of chondrichthyan fishes; they could play both the role of refuges for threatened species and of privileged sites for scientific studies and educational actions.

NOTES ON SEXUAL DIMORPHISM IN EXTERNAL MORPHOLOGY IN FIVE NORTH ATLANTIC DEEPWATER SKATES (RAJIDAE).

Orlov A.M. & C. F. Cotton

Skates and rays (Batoidea) are sexually dimorphic, with certain morphological characters having various appearances. Despite a notable number of publications dealing with sexual dimorphism in skates, this phenomenon remains insufficiently studied, especially with regard to deepwater species. During 2005 and 2006, the authors examined 67 specimens of 5 species of North Atlantic deepwater skates (12 Amblyraja jenseni, 9 Bathyraja pallida, 26 B. richardsoni, 12 Rajella bigelowi, and 8 R. kukujevi) from European and North American museums (MCZ, ZMUB, NMCZ, ZISP, BMNH, and NMHN). External morphology was analyzed to reveal sexual dimorphism, with 45-47 morphometric and 2-15 meristic measurements taken from each specimen, depending on the skate species. Male and female skates differ significantly in 9 characters in A. jenseni, 13 characters in B. pallida, 11 characters in B. richardsoni and R. bigelowi, and 10 characters in R. kukujevi. Sexual dimorphism was most commonly observed in the following characters: length of the first gill slit (4 of 5 species); length of nasal curtain, mouth width, and length of the third gill slit (3 of 5 species); disc width, lengths of the first and second dorsal fin bases, length of the fifth gill slit, spaces between the first and fifth gill slits, interspiracular width, distance between the snout and center of the anus, distance between the snout and the maximum disc width, and interorbital width (2 of 5 species). These results will further our understanding of morphometric variations in these species, which will help assure the proper identification of these rare species in the future. Also these observations lend insight into which factors may be affecting ontogenetic development and sexual maturation in these skate species.

EFFECT OF SALINITY ON THE RESPIRATION OF THE NURSEHOUND, SCYLIORHINUS STELLARIS.

Micarelli P., Canetti D., Sperone E. & S. Spinetti

The nursehound, Scyliorhinus stellaris, is frequently hosted in public aquaria because it is easily maintained in captivity. However, its biology is poorly known. In order to improve its husbandry, 6 juveniles of 1 year old were exposed to different salinity levels (29,5?, 33,5? and 37,5?) and the effects on the respiration rate were observed.

OCCURRENCE OF THE SMALLTOOTH SANDTIGER SHARK, *ODONTASPIS FEROX* (RISSO, 1810), IN NIGERIAN WATERS.

Zaera D., Alvheim O. & C. E. Isebor

During a bottom trawl survey of the R/V 'Dr. Fridtjof Nansen' in the Nigerian waters, a specimen of smalltooth sandtiger shark, *Odontaspis ferox,* was accidentally captured. It was a maturing male of 314 cm TL caught at station 1296, 3º41'N, 7º40'E, 443 m depth, on 21st June 2006. Its stomach was empty. This specimen is described and the occurence of this species on the Gulf of Guinea is commented.

THE GULF OF GABÈS (TUNISIA): A NURSERY AREA FOR SEVERAL SHARKS.

Saïdi B., Bradaï M. & A. Bouaïn

Shark nurseries are habitats where females give birth to their young and where juveniles spend their early life history. Hypotheses concerning nurseries suggest that they provide the young a better source of food and protection against predation. Primary nurseries are habitats where parturition occurs and in which the young live for a short time and secondary nurseries are habitats in which juveniles are found after leaving the primary nursery and before reaching maturity. The Gulf of Gabès as a year-round primary and secondary nursery *for Mustelus mustelus*, *M. punctulatus*, *Cacharhinus plumbeus* and *C. brevipinna* use, with juveniles remaining in it up to the size at maturity. Adult *M. mustelus* and *M. punctulatus* stay in the area around the year, a behavioural pattern possibly explained by their biology. Although adult *C. plumbeus* appeared during late Spring and early Summer in the area, adult *C. brevipinna* are rare. Identification and conservation of essential fish habitat are an important tool to manage shark populations. However, little is known on the spatial distribution of juvenile sharks in nursery areas, and further research is required in this field to delimit nursery areas.

AGGREGATION OF BATOID FISHES AROUND A SEA CAGE FISH FARM OFF GAN CANARIA, EASTERN CENTRAL ATLANTIC.

Osaer F., Narváez K., Haroun R. & R. Guirao

Using visual underwater census, we determined the abundance, size, sex, biomass, activity, condition and reaction towards the investigator of the different species of batoid fishes aggregated under a sea cage fish farm in Gran Canaria Island. During our sampling, 6 species of batoids were sighted: *Dasyatis centroura* (Roughtail stingray), *D. pastinaca* (Common stingray), *Gymnura altavela* (Spiny butterfly ray), *Myliobatis aquila* (Common eagle ray), *Taeniura grabata* (Round stingray) and *Torpedo marmorata* (Spotted torpedo). Most individuals were swimming in fixed directions, not being disturbed by the presence of the investigator. The roughtail stingray and the round stingray showed malformations and damages. This contribution shows that the cages play a role in the attraction of batoid fishes which aggregate around them.

FOSSIL RECORD SUPPORTS MOLECULAR EVIDENCE OF THE SYSTEMATIC POSITION OF RAYS AND SKATES.

Dummasch J., Kriwet J. & S. Klug

Although the monophyly of the batoids (skates and rays) is well-established, its sytematic position has been recently debated, opposing the Hypnosqualean hypotesis based on morphological analysis to the basal sieser group hypotheis based on genetic analysis. If batoids were the basal sister to all remaining neoselachians, they would have preceded the first appearance of any extant shark group, and would hence indicate an origin within the basal Jurassic or Triassic, which is more or less in accordance with their stratigraphic distribution. But if batoids are considered to be derived squaleans, their first appearance should have been later, or the fossil record of neoselachian sharks is very incomplete requiring quite long "ghost-lineages", which seems less parsimonious. Our comprehensive analysis supports previous molecular interpretations and identifies Batoidea to be sister to all remaining neoselachians. The most basal batoids are a new taxon from the Early Jurassic (180 Ma) of Holzmaden displaying plesiomorphic features (elongated body with long caudal region), a suite of apomorphic batoid features (presence of a synarcual), and a very unspecialized dentition very similar to that of orectolobiforms, and *Asterodermus*/*Spathobatis* from the Late Jurassic lithographic limestones of southern Germany. One of the uniting features is the presence of spines supporting the dorsal fins, a feature that is plesiomorphic for batoids, but homoplastic within Neoselachii.

THE FOSSIL LAMNIFORM SHARK, *CARCHARODON ESCHERI,* AND THE EVOLUTION OF THE GREAT WHITE SHARK, *CARCHARODON CARCHARIAS*

Mewis H. & S. Klug

In 1989, a partially articulated skeleton of a specimen referable to *Carcharodon escher*i including 42 slightly disarticulated teeth and 49 vertebrae was recovered from Miocene clays during an excavation of fossil whales in Groß Pampau (northern Germany). The specimen proves to be important for reconstructing the relationships of fossil lamniform sharks because it allows for the first time to reconstruct the dentition of *Carcharodon escheri*, which is an important character for phylogenetic studies of fossil sharks. Here, we present results of our new phylogenetic analysis including four of five extant Lamnidae as well as taxa from two families only known by fossil remains, Otodontidae and Cretoxyrhinidae, which include the most debated taxa close to the lineage of the great white shark. Our study is also the first phylogenetic analysis that includes both *Carcharodon escheri* and *Cosmopolitodus hastalis*. The results indicate that *Carcharocles megalodon*, related to *Isurus* lineage, belongs to the family Otodontidae. In addition, the analysis confirms that the mako and great white lineages are separate from each other. In fact, Isurinae and Carcharodontinae must have split up during the early Miocene and *Carcharodon carcharias* possibly evolved during the late Miocene. *Carcharodon escheri* seems to be the closest relative of the Great White Shark, but presumably went extinct during the early Pliocene. Similar to the Great White, *Carcharodon escheri* was probably scavenging on whale carcasses, which are rather abundant in Groß Pampau. This could have been its fate, because the Great White might have been better adapted to its environment. It is even possible to suggest that, because teeth of *Carcharodon escheri* look very similar to those of juvenile *Carcharodon carcharias*, that there is a peramorphosic interrelation between these two species.

FIRST RECORD OF *GALECERDO CUVIER* (CARCHARHINIFORMES : CACHARHINIDAE) OFF THE ATLANTIC COAST OF FRANCE.

Séret B., Stéphan E. & J-Q. Quéro

In July 2007, a 303 cm TL female tiger-shark, *Galeocerdo cuvier*, was caught by anglers in a trammel-net set near a mussel bed off Fouras (Charente Maritime). This specimen constitutes the first record of this species off the Atlantic coasts of France. This record is analysed and compared to previous ones in the North-eastern Atlantic and in the Mediterranean Sea.

SEXUAL MATURITY AND FECUNDITY OF *SCYLIORHINUS CANICULA* (LINNAEUS, 1758) IN THE AEGEAN SEA

Kousteni V., Kontopoulou M., Amorginos G. & Megalofonou P.

A total number of 325 small-spotted catsharks (*Scyliorhinus canicula*) ranging from 184 to 488 mm in total length (TL) and from 62 to 617 g in total weight (W) were sampled by the trawl fishery in the Aegean Sea during the years 2005-2007. The overall ratio of males to females was 1.06:1. Sexual maturity was assessed by macroscopic observation of the reproductive organs and Gonadosomatic indices were estimated. Almost 60% of the specimens were mature (68% of males and 51% of females). Gonad observation revealed that females larger than 364 mm TL had mature ovaries with visible yolked oocytes. Ovary weight varied from 0.12 to 25.41 g and maximum oocyte diameter was 18 mm. Gonadosomatic indices ranged from 0.10 to 7.28 in female fish and from 0.18 to 5.90 in male fish. Males larger than 352 mm were all mature. Size-at-first-maturity L_{50} was determined using the logistic curve and males were found to be mature in a smaller size than females. Fecundity was assessed numbering the ripe oocytes in the ovary reaching 30 in a 460 mm TL female. In 27 mature females, one egg capsule in each of the oviducts was found.
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SHARKS OF GREECE : DATA SOURCES AND DESIGN OF A REGIONAL DATABASE

Sigunis P., Dilintas G. & Megalofonou P.

"Sharks of Greece" is a regional database containing all the data derived by a national research project conducted at the University of Athens in Greece since 2005. The main aim of the project was to the study the fishery and pollution impact on certain demersal shark species in the Hellenic waters using population characteristics and concentration levels of heavy metals on edible tissues. Among the monitored species are included *Scyliorhinus canicula, Galeus melastomus, Squalus acanthiaw, Squalus blainvillei, Centrophorus granulosus, Mustelus mustelus*. All the information collected is presented through statistical tools. The summary statistics table provides a comprehensive projection of the population characteristics using descriptive statistics. The length, age and sex distributions are used to provide a more detailed sight of the data. Length-weight relationships and the relative graphs are presented using linear regression analysis. The same technique describes the heavy metals concentration compared with the total length of the samples. The scientific team of the project is updating the data as soon as new samples are being processed. In conclusion "Sharks of Greece" could be a very useful tool for scientists as much as for people that want to obtain information on the main shark species caught by the trawl and small-scale coastal fisheries in the Hellenic waters.