



**9th Meeting
of the
European Elasmobranch Association
MONACO**

hosted by the Oceanographic Museum of Monaco

Program and abstracts
November 23rd - 26th, 2005

*in partnership with the Institut océanographique
Fondation Albert I^{er}, Prince de Monaco*



SOCIÉTÉ MONÉGASQUE DE
L'ÉLECTRICITÉ ET DU GAZ



C1

THE ACTION PLAN OF MAP FOR THE CONSERVATION OF CARTILAGINOUS FISHES IN THE MEDITERRANEAN SEA : CURRENT PROGRESS

Daniel CEBRIAN MENCHERO

UNEP-Mediterranean Action Plan. Regional Activity Centre for Specially Protected Areas (RAC/SPA), B.P. 337 - 1080 Tunis Cedex, TUNISIA. [daniel.cebrian@rac-spa.org] [www:rac-spa.org]

The Contracting Parties to the Barcelona Convention adopted at their 13th ordinary meeting, on November 2003, the Action Plan for the Conservation of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea.

The main objectives of the new action plan are the following :

- To limit the general declining trend showed by elasmobranch populations
- To set priorities and activities to be undertaken to protect cartilaginous fish at Mediterranean level
- To co-ordinate the effort among Mediterranean countries to ensure the implementation of these activities
- To gather the co-operation and collaboration among Mediterranean countries in the protection of cartilaginous fish

The main responsibility for the implementation of this action plan falls under the the Contracting Parties to the Barcelona Convention themselves (all the Mediterranean coastal states plus the European Union). Nonetheless, RAC/SPA assist this task whenever possible and/or requested by those countries. On that context, and following the recommendations made by the Contracting Parties, the following activities concerning actions to be undertaken or supported by the SPA Protocol Secretariat regarding the Action Plan Calendar of implementation are being carried out by RAC/SPA:

1. Establishing a network and directory of collaborators

A Regional list of scholars and institutions devoted to research on and conservation of elasmobranchs in the Mediterranean is been prepared. It will be made available in electronic form to facilitate updating, given the necessary dynamism related to such information. Interested Institutions and specialists in the field within the region, which by any reason have not been contacted by RAC/SPA yet are kindly invited to send their e-mail address in order to inform them on the data needed

2. Organising gatherings on Mediterranean chondrichthyan fishes

An International workshop on cartilaginous fish with emphasis in southern and eastern Mediterranean was held in Istanbul on 15-16 October 2005 with the kind collaboration of the Turkish Ministry of Forestry & Environment and the Turkish Marine Research Foundation.

The main objectives of this workshop were: to present and examine the work so far developed by RAC/SPA in the framework of the implementation of this action plan; to

discuss the conservation and management priorities; and to facilitate the exchange of information among scientists and decision makers for the conservation and management of the species of elasmobranches with presence in the Eastern and Southern Mediterranean Sea.

A successful presence of experts from 19 of the 21 Mediterranean countries and from IUCN was achieved. During the workshop, the specialists examined along four thematic sessions the current state of knowledge of critical habitats; the standardisation of information retrieval and diffusion; the possibility to create a network aimed to facilitate scientists coordination and collaboration for the conservation of these species in the Mediterranean; and also the by-catch and discards problem. Conclusions and experts recommendations were drawn upon regarding those subjects.

3. Supporting the defining of Protocols for (I) monitoring commercial landings and discards by species and (II) recording data on rarely observed, endangered and protected species

The protocols were prepared in English, to be offered to fishing fleets in the Mediterranean Sea. So far they have been provided for comments to the experts participating in the last International workshop on cartilaginous fish with emphasis in southern and eastern Mediterranean (Istanbul, November 2005). The same protocols are provided here to the 9th EEA meeting to consider further inputs for improvement from scholars.

4. Contributing to information campaigns and publishing public awareness material

A poster on threatened and rare elasmobranches, their problems and possible solutions has been prepared and will be printed in three bilingual versions, starting from this year. Identification drawings for the elasmobranch species of main concern (endangered and rare ones) have been prepared aimed to produce water resistant plackets for fishermen and divers, as well as other future awareness material. FAO has kindly allowed a set of ink drawings of species met in the Mediterranean which have been attached at the end of the illustrated Action Plan (downloadable from www.rac-spa.org)

5. Elaborating guidelines for reducing the presence of sensitive elasmobranch species in by-catch and releasing them if caught, prepared and published in the appropriate languages

The guidelines are being elaborated and initial draft is expected to be ready along 2005. Difficulties are being encountered regarding thorough identification of feasible and efficient methods to address such issues. Scholars' proposal inputs to RAC/SPA are welcome

6. Supporting the setting up of, or feeding existing, centralized databases

A detailed database already used in some Mediterranean areas to record catch, species, active fleet, effort related to such capture, rare catches, etc. has been identified and its possibilities studied. The Secretariat is negotiating the preparation of a more simplified module to be used only for elasmobranches.

An specific database initiative focused on large elasmobranchs, MEDLEM, has been considered by RAC/SPA a complementary useful tool; so attention will be paid in the general database being developed to make it compatible with MEDLEM.

C2

SHARK FINS IN TAIWAN: TRADITION AND A CHANCE FOR CHANGE - A PRELIMINARY LOOK AT THE CONSUMER'S END OF SHARK FIN TRADE AND USE

Boris Z. FRENTZEL-BEYME (1)

(1) Deutsche Elasmobranchier Gesellschaft D. E. G. Zoologisches Institut und Zoologisches Museum der Universität Martin-Luther-King-Platz 3 D-20146 Hamburg, GERMANY [borisfbeyme@elasmob.de]

Taiwan is a major trader of shark fins mainly for domestic use as a traditional dish. A part of the imported fins are coming from fisheries in Latin America and Costa Rica among others. The author takes a look at the pathway of trade of these fins and the available information of prices of end products and profit margins. Whereas shark fins are still an important part in the arsenal of traditional taiwanese dishes, an alternative product has emerged, which could serve as an opportunity to substitute shark fin soup in more and more occasions: artificial shark fins. Artificial shark fins are already used in many occasions and the cheap price makes it attractive for average consumers, social events and catering services. When made from non-elasmobranch colloid, artificial shark fins could potentially relieve the demand for real shark fins while satisfying consumers at lower costs. The possibility of promoting artificial shark fin products is suggested for discussion.

C3

SHARK RESEARCH PROGRAMME IN LIBYA

Bernard SERET (1) & Abdhallah ben ABDAHALLAH (2)

(1) Muséum National d'Histoire Naturelle, Département Systématique et Evolution, UMS 602 « Taxonomie et Collections », Case postale n° 26, 43 rue Cuvier, 75231 Paris cedex 05, FRANCE [seret@mnhn.fr]

(2) Marine Biology Research Center (MBRC), P.O. Box 30830, Tajura, Tripoli, LIBYA [abdallalibfish@yahoo.com]

Cartilaginous fishes have traditionally been consumed in Libya, mainly sharks, guitarfishes and some stingrays. However, very little is known about the Libyan cartilaginous fishes, and no particular study has been so far dedicated to these fishes. Because of this lack of information on sharks and rays, which apparently constitute an important resource within Libyan fisheries, the Marine Biology Research Centre of Tripoli (MBRC) and the Environment General Authority of Libya (EGA) were willing to jointly undertake a research programme on the cartilaginous fishes of Libya. In this context, the Regional Centre for Specially Protected Areas in Tunis (RAC-SPA) supported an expertise mission in June 2005, in order to consider the conditions of the feasibility of such a study and to determine the content of an adapted research programme to be jointly carried out by MBRC and EGA. As a result of this expertise, a research programme on cartilaginous fishes of Libya has been proposed as an

implementation of the « Action Plan for the conservation of the cartilaginous fishes in the Mediterranean Sea » as defined by RAC –SPA in 2002.

C4

SHARK REEF MARINE RESERVE, FIJI : AN EXAMPLE FOR SHARK CONSERVATION ?

Juerg M. BRUNNSCHWEILER

University of Zurich, Zoological Institute, Winterthurerstrasse 190, 8057 Zurich, SWITZERLAND [juerg@gluecklich.net]

The idea of protecting a reef area that is long known for its shark abundance was launched in 2003. Since then, the Shark Reef Marine Reserve has developed as one of the top shark dive spots and attracts an increasing number of divers from around the world. Species that are regularly encountered include bull sharks (*Carcharhinus leucas*), tiger sharks (*Galeocerdo cuvier*), lemon sharks (*Negaprion acutidens*), silvertip sharks (*Carcharhinus albimarginatus*) and tawny nurse sharks (*Nebrius ferrugineus*). This paper reports fish diversity of Shark Reef Marine Reserve with special emphasis on elasmobranchs, and introduces this reef patch as a site for shark research. Data on habitat use and seasonal movements are essential for designing conservation strategies, yet such data are rarely available for large marine animals such as sharks. We equipped eleven bull sharks at Shark Reef Marine Reserve with popup satellite tags to test the hypothesis that bull sharks migrate into nursery grounds. Individual tags remained attached for two to seven months. The popup locations give insight into movement patterns and distribution of bull sharks in the South Pacific. They further underscore the need for international cooperation in devising conservation plans.

C5

THE GREAT EGGCASE HUNT – ORKNEY EGGCASES CHALLENGE CURRENT TAXONOMY

Ali HOOD (1) & Geoff SWINNEY (2)

(1) The Shark Trust, Rope Walk, Coxside, Plymouth, PL4 0LF, UK [ali@sharktrust.org]

(2) National Museum of Scotland, Chambers Street, Edinburgh EH1 1JF, SCOTLAND

The Great Eggcase Hunt (GEH) is a public awareness and recording project created and managed by the Shark Trust. The GEH encourages the public out onto beaches to search the strandline for spent skate, ray and shark eggcases, identifying and reporting their finds with the aid of a range of tailored resources. In its third season the GEH continues to capture the public's imagination and has expanded both in terms of support and geographic range. Despite being established as a UK project the GEH now receives records from Europe, the Americas and the Southern Ocean. Early in 2005 an extensive collection of eggcases were reported from the Orkneys. These eggcases were especially notable due to their large size (~ 30cm x 20cm when wet) and were initially identified by reference to Clark (1926) as the eggcases of *Raja oxyrinchus* (long-nosed skate). However, as these findings were reported to a wider audience questions were raised as to the validity of the identification of the Orkney eggcases as *Dipturus oxyrinchus*, *Dipturus batis* (common skate) was

proposed as a possible alternative. Considering historical documents, museum collections, aquarium specimens and contemporary finds, the Shark Trust, in collaboration with Dr Geoff Swinney of the National Museums of Scotland, seek to verify the identity of the Orkney eggcases.

C6

SOME REMARKABLE HISTORICAL CHONDRICHTHYAN SPECIMENS IN THE COLLECTIONS OF MONACO'S OCEANOGRAPHIC MUSEUM

Michèle BRUNI

Musée océanographique de Monaco, Service des collections, Av . Saint-Martin, MC 98000,
MONACO [m.bruni@oceano.mc]

The chondrichthyan fishes in the collections of Oceanographic Museum consists of 484 specimens representing 75 species: the oldest was deposited in 1886 by Prince Albert I. Indeed, a quarter of the specimens originate from historical oceanographic expeditions, mainly those conducted by Prince Albert I in the North and Central Atlantic and the Mediterranean sea (1884-1915). In the frame of a valorization and of a detailed evaluation of this collection, a recent taxonomic revision was conducted during the years 1999 and 2000, ultimately producing a provisional catalogue (Bruni & Würtz, 2002). However, until recently, the historical value of some specimens had been forgotten and the specimens were stored in remote parts of the museum. This work presents in details some rare and remarkable specimens that emerged from the samplings made by Prince Albert I and that played an important role in the knowledge of their species. Other rare and near extinction specimens collected in the Mediterranean sea by local fishermen compound additional and precious testimony of Mediterranean species' composition. The next step of this valorization would be a display of all these remarkable specimens to the public in the scope of a restoration of the Museum's natural history legacy.

C7

A NEW REDESCRIPTION OF *GALEUS ATLANTICUS* (VAILLANT, 1888), (CHONDRICHTHYES : SCYLIORHINIDAE) BASED ON FIELD MARKS

Javi REY (1), **Bernard SÉRET (2)**, Domingo LLORIS (3), Rui P. COELHO (4)
& Luis GIL DE SOLA (2)

- (1) Instituto Español de Oceanografía, C/ Muelle pesquero s/n, 29640 Fuengirola, Malaga, SPAIN [javier.rey@ma.ieo.es] [gildesola@ma.ieo.es]
- (2) Muséum National d'Histoire Naturelle, Département Systématique et Evolution, UMS 602 « Taxonomie et Collections », Case postale n° 26, 43 rue Cuvier, 75231 Paris cedex 05, FRANCE [seret@mnhn.fr]
- (3) Institut de Ciències del Mar (CMIMA-CSIC), Departament de Recursos Marins Renovables, Grup d' Ictiologia Marina (GIM), Passeig Marítim, 37 – 49, 08003 – Barcelona, SPAIN [lloris@icm.csic.es]
- (4) Universidade do Algarve, Faculdade de Ciências do Mar e Ambiente, Campus de Gambelas, 8000 – Faro, PORTUGAL

The Atlantic sawtail catshark, *Galeus atlanticus*, has long been synonymized with the blackmouth catshark, *Galeus melastomus*, until the validity of *G. atlanticus* was resurrected by Muñoz-Chapuli & Ortega (1985). Despite this resurrection of *G. atlanticus*, the two species are still often confused because of their close resemblance. Field characters are proposed to distinguish the two sibling species.

C8

**ORIGIN OF THE MEDITERRANEAN RAJID FAUNA :
CONTRIBUTION OF MOLECULAR AND BIOGEOGRAPHIC DATA**

Fausto TINTI, Paola PASOLINI, Matteo BERTOZZI & Stefano TOMMASINI

University of Bologna, CIRSA, via Sant'Alberto 163, 48100 Ravenna, ITALY
[fausto.tinti@unibo.it]

The family Rajidae (skates and rays) has the highest species diversity among chondrichthyan fishes. The rajids are distributed in all oceans, with many endemic species. In the NE Atlantic Ocean and the Mediterranean Sea, rajid fauna includes 32 nominal species with nine endemic species (four in the North-East Atlantic and five in the Mediterranean). This biogeographical pattern suggests that the present rajid faunas likely originated from ancestral forms existing at the beginning of the Tertiary by multiple species radiation processes at the regional level. Alternatively, in some cases, palaeogeographical and palaeoclimatic data suggested that present rajid species could be elements of relict faunas (i.e. the Antarctic fauna). Here, through the phylogenetic analysis of biogeographic and mitochondrial DNA data, we obtained evidence for: 1) a recent origin and rapid dispersal of the Mediterranean fauna, since the present species diversity seems to be arisen in a relatively narrow time window extended from Middle Miocene to Early Pleistocene, likely by speciation processes related to dramatic geological and climatic events in the Mediterranean, and 2) a Gondwanic evolutionary and dispersal pattern of the family that is compatible with the young age of the Mediterranean fauna. A biogeographic and molecular research project focusing on the phylogeny and evolution of the Eastern Atlantic rajid regional faunas will be carried out to empirically validate the Gondwanic origin and dispersal of Rajidae.

C9

**MEDLEM DATABASE APPLICATION :
A TOOL FOR STORING AND SHARING THE DATA COLLECTED BY THE COUNTRIES
PARTICIPATING IN THE MEDLEM PROGRAMME**

**Fabrizio SERENA (1), Monica BARONE, Glauco MAGNELLI, Cecilia MANCUSI (1)
& Marino VACCHI (2)**

(1) ARPAT - Via Marradi, 114 - 57126 Livorno, ITALY [f.serena@arpat.toscana.it]

(2) ICRAM, Università degli Studi di Genova, ITALY [m.vacchi@unige.it]

The MedLem Database Application is a computerized system, based on Open source software, designed as a simple tool to store and share the available data collected in the framework of the MedLem programme. As one of the major intentions of the MEDLEM programme was to collect and share data following a common protocol, the idea was to design a user-friendly application that would allow all participants to insert new data and

making search easily. For that purpose a new data sheet, was designed with standardized fields.

C10

STINGRAY TAIL SPINE CHARACTERISTICS OF ELEVEN MEDITERRANEAN SPECIES (MYLIOBATIFORMES)

Frank SCHWARTZ

University of North Carolina, Institute of Marine Sciences, Morehead City, NC 28557-3209
USA [laura_white@unc.edu]

Man has long been aware of stingray venomous tail spines that can cause injury, pain, and even death from the toxins located along the ventral spine grooves. Presently, 11 native and immigrant (from Red Sea) stingrays (order Myliobatiformes) occur in the Mediterranean that possess serrated tail spines (presented in decreasing total spine serrations): *Dasyatis centroura*, *Pteroplatytrygon violacea*, *Dasyatis pastinaca*, *Himantura uarnak*, *Myliobatis aquila*, *Gymnura altavela*, *Pteromylaeus bovinus*, *Dasyatis chrysonota*, *Taeniura grabata*, *Rhinoptera marginata*, and *Mobula mobular* (additional data is needed to correctly position the latter two species). Means and ranges, by sex are presented for: spine total length, pre-base length, right and left side serrations, presence of serrations on base, and percent dorsal spine groove length. *Pteroplatytrygon violacea* spines are distinct possessing cul-de-sacs medially between serrations. Stingray body size (width) is not correlated with spine length. Total spine serrations are indicative of water column use. No evolutionary primitive to advanced species spine serration relationship is evident: *Dasyatis* - *Himantura* – *Gymnura* – *Myliobatis* – *Rhinoptera* – *Mobula*. Stingray spine characteristics will be helpful to ichthyologists, paleontologists and physicians in determining species. A handout will describe each species' spine characteristics.

C11

TAXONOMIC DISCRIMINATION OF *RAJA POLYSTIGMA* AND *RAJA MONTAGUI* IN THE MEDITERRANEAN SEA BASED ON THE COMPARATIVE ANALYSIS OF MORPHOMETRIC AND GENETIC MARKERS

Cecilia MANCUSI (1), Paola PASOLINI (2), Fabrizio SERENA (1) & Fausto TINTI (2)

- (1) ARPAT - Via Marradi, 114 - 57126 Livorno, ITALY [c.mancusi@arpat.toscana.it]
- (2) University of Bologna, GenMAP Lab, via Sant'Alberto 163 Ravenna, ITALY

In the last years many studies based only on morphological features revealed a diffuse uncertainty in the taxonomic discrimination between individuals of *Raja montagui* (distributed in the NE Atlantic and Mediterranean) and *Raja polystigma* (endemic of the Mediterranean). This could be related to the inappropriateness of the morphological characters reported in the identification keys used to distinct the two species. The achievement of reliable tools for the identification of the two species will be useful for improving life-history traits and species assessment. The nucleotide variation of the species-specific gene marker 16S rDNA was analysed for 115 individuals collected in NE Atlantic and in different areas of the Mediterranean basin (Adriatic Sea, Thyrrenian Sea, Sardinian Channel, Sicily Channel and Algeria) and morphologically recognized as *Raja montagui* and *R. polystigma*. 79 individuals

were identified bearing the *R. polystigma* haplotype and 9 individuals bearing the *R. montagui* haplotype. A second *R. polystigma* haplotype was found in 27 individuals from the Tyrrhenian Sea. Among the 75 individuals collected in the Italian Seas, **none** showed a 16S *R. montagui* haplotype. Many incongruence between morphological appearance and mitochondrial haplotypes were observed in these specimens. Among the 16S-genotyped individuals, dorsal and ventral digital pictures were taken on about 60 individuals. The software used for the shape analysis allowed easy measurement and included advanced graphical capabilities for the visualization of morphometric data and results. 14 and 22 relevant landmarks were chosen, respectively on the dorsal and ventral side of the ray. 33 distances and 5 angles were calculated for each sample. Moreover, the mediodorsal thorns row and the upper and lower teeth rows were measured. No clustering of individuals according to species boundaries was observed. These first preliminary results seem to indicate that *R. montagui* is not probably present in the Italian seas and, within the Mediterranean, it is present along the Algerian coasts.

C12

**GENETIC VARIABILITY AND POPULATION STRUCTURE
OF THE THORNBACK RAY, *RAJA CLAVATA*,
IN THE NORTH-EAST ATLANTIC AND MEDITERRANEAN SEA**

Chiara RAGAZZINI, Paola PASOLINI, Farid HEMIDA, Cecilia MANCUSI,
Malia CHEVOLOT & Fausto TINTI

University of Bologna, GenMAP Lab, via Sant'Alberto 163, 48100 Ravenna, ITALY
[chiara_ragazzini@yahoo.it]

The overexploitation of the marine resources and the increasing fishing efforts, together with a non-specialized fishery are anthropogenic factors that may allow the population decline and local extinction of elasmobranch species. In the last few years, the monitoring of the marine fishery resources, once based only on studies of parameters, was enhanced by integrating genetic analysis with the traditional morphological and bio-ecological studies. Such a multidisciplinary approach may contribute significantly to the inventorying and to the conservation of biodiversity. The thornback ray *Raja clavata* is one of the most common species in the Mediterranean Sea and North-East Atlantic and has a high morphological variability, with several documented morphotypes. Its intraspecific variability was recently investigated using microsatellites nuclear markers which revealed a significant population structure in southern England waters. We have investigated the population structure of *Raja clavata* in the Mediterranean and North East Atlantic throughout the genetic stock structure analysis of more than 200 individuals collected from different geographical areas: Celtic Sea and North Sea (North-East Atlantic), and Adriatic Sea, Tyrrhenian Sea, coasts of Algeria and Turkey (Mediterranean Sea). The genetic variation of samples analysis was carried out through PCR amplification and sequencing of the hyper-variable region D-loop of the mitochondrial DNA. The statistical analysis of molecular variation showed a high polymorphism within and among geographical samples as well as significant genetic differences between samples of the Mediterranean and the Atlantic, except for the Turkish sample that unexpectedly showed an higher Dloop variability and genetic similarity with samples of the Celtic and North Seas.

C13

TOTAL MERCURY CONCENTRATIONS IN TWO SPECIES OF SHARK, *SQUALUS ACANTHIAS* AND *MUSTELUS MUSTELUS*, FROM THE MEDITERRANEAN SEA

Vasiliki KOUSTENI (1), Eleni STATHOPOULOU (2), Manos DASSENAKIS (2),
& Persefoni MEGALOFONOU (1)

- (1) Department of Biology, Section of Zoology-Marine Biology, University of Athens, Panepistimiopolis, 15784 Athens, GREECE [pmegalo@biol.uoa.gr]
- (2) Department of Chemistry, Section III, Lab of Environmental Chemistry, University of Athens, Panepistimiopolis, 15771 Athens, GREECE

Total mercury levels in various tissues of two shark species were determined since sharks as apex predators represent good indicators of the extent of mercury contamination in the marine ecosystems. A total of 55 specimens of spiny dogfish (*Squalus acanthias*) ranged from 430 to 729 mm in total length and 18 specimens of smooth-hounds (*Mustelus mustelus*) ranged from 428 to 720 mm in total length were collected in the Eastern Mediterranean Sea, around the island of Crete. Total mercury was determined with Cold Vapor Atomic Absorption Spectrometry (CVAAS). Analysis was validated with two certified reference materials: DORM-2 and IAEA 350 with recovery percentages $100 \pm 1,19$ and $100 \pm 3,18$ respectively. In the spiny dogfish total mercury levels ranged: from 0,31 to 5.79 mg/kg w.w in muscle, from 0,03 to 4,52 mg/kg w.w in gonads, from 0,01 to 3,93 mg/kg w.w in liver and from 0,01 to 0,46 mg/kg w.w in lecith of the mature oocytes. In the smoothhound shark total mercury levels ranged: from 0,22 to 1,83 mg/kg w.w in muscle, from 0,01 to 0,07 mg/kg w.w in gonads and from 0,01 to 0,85 mg/kg w.w in liver. Statistically significant differences were found among the concentrations of mercury in the various tissues examined, while there was a statistically significant difference of the concentration of mercury in muscle and liver between the two species.

C14

SATELLITE-TAGGING WHITE SHARKS, *CARCHARODON CARCHARIAS*, BEYOND SOUTH AFRICA : PRELIMINARY RESULTS FROM THE CHATHAM ISLANDS EXPEDITION (NEW ZEALAND)

Ramón BONFIL (1), Clinton DUFFY (2), Malcolm FRANCIS (3), Shannon O'BRIEN (1)
& Michael MANNING (3)

- (1) Wildlife Conservation Society, 2300 Southern Blvd. Bronx, New York, NY 10460, USA [rbonfil@wcs.org]
- (2) New Zealand Conservation Authority, DoC, 59 Boulcott Street, PO Box 10-420, Wellington, NEW ZEALAND
- (3) NIWA, National Institute of Water and atmospheric Research, P.O. Box 14-901, Kilbirnie Wellington, NEW ZEALAND

Fuelled by WCS's success with satellite-tagging studies of great white sharks in South Africa, we began a new collaborative satellite tracking study in New Zealand in partnership with the NZ Department of Conservation (DoC) and the National Institute to Water and Atmospheric Research (NIWA). The goals of the first-ever study of shark movements with satellite tags in New Zealand are to unveil the meso and macro-scale movements, use of

habitat in New Zealand waters, the migratory patterns, and the interactions among Southern Hemisphere white shark populations. A pilot tagging expedition to evaluate the feasibility of this study was carried out in April 2005 at the Chatham Islands. We deployed four pop-up archival transmitting (PAT) tags and three conventional gamefish tags in just four days at sea. The tags were scheduled to release from the sharks over a 3–6 month period and transmitted data on light intensity (which can be used to calculate geographic location), depth and temperature to satellites. Preliminary results from these tags show long distance movements over relatively short periods of time to sites 1,000 – 3,000 km away from the tagging site in areas previously unknown to be habitat for great white sharks. An enlarged tagging programme is expected to be developed in 2006, when we hope to deploy further PAT tags, begin deployment of SPOT and SPLASH tags (which transmit data to satellites whenever the shark surfaces), and extend the study to other parts of New Zealand.

C15

LIFE HISTORY TRAITS AND ABUNDANCE TREND RELATIONSHIP IN ELASMOBRANCHS OF THE BRITISH ISLES

Alicia CRUZ-MARTINEZ (1), Jim R. ELLIS (2), Nick K. DULVY (2)
& John D. REYNOLDS (3)

- (1) School of Biological Sciences, University of East Anglia, Norwich NR4 7TJ, UK
[A.Cruz@uea.ac.uk]
- (2) Centre for Environment, Fisheries and Aquaculture Science, Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk NR33 0HT, UK
- (3) Department of Biological Sciences, Simon Fraser University, Burnaby, BC, V5A 1S6, CANADA

The commercial exploitation of elasmobranchs in the Northeast Atlantic has caused decline in their populations. Some skates are locally extinct in the northwest and northeast Atlantic, i.e. the barndoor skate *Dipturus laevis*, the common skate *Dipturus batis*, the white skate *Rostroraja alba* and the long-nose skate *Dipturus oxyrinchus*. However, most of the elasmobranchs in the British waters are taken as by-catch, which makes it difficult to evaluate the abundance of their populations. This study examined the relationships between life history traits and population trends from time series data of 29 demersal elasmobranch populations (13 sharks and 16 skates) in both cross-species analysis and phylogenetic comparative analysis. These populations comprise 11 species. The information was collected by CEFAS research vessel surveys (1982-2003) with heterogeneous gears. As a consequence, the data are highly heterogeneous. In addition, fishing mortality rates are not available. The results indicated that the declines in abundance in some populations have been accompanied by the apparent increase of smaller-bodied species. Eighteen populations have declined in abundance (62%) whereas 38% of populations were stable. Longer-lived species with late age at maturity and low fecundity decline more than short-lived species with early maturing and high fecundity; e. g. the North Sea and Celtic Sea spurdog and Celtic Sea cuckoo ray. Additionally, species such as the Irish Sea painted ray *Raja microocellata*, Celtic Sea starry smoothhound *Mustelus asterias* and tope *Galeorhinus galeus* maintained a stable population with a very slightly increase. In addition, cross-analysis and phylogenetically comparative analysis did not reveal any other relationships with maximum length, asymptotic length, growth rate and length at maturity. This study provides evidence of the use of life history traits on population abundance as a proxy measure of species resilience and response to exploitation in locations with limited survey data.

C16

TROPHIC SPECTRUM OF THE PELAGIC THRESHER, *ALOPIAS PELAGICUS*, IN ECUADORIAN WATERS

Carlos Julio POLO (1), Álvaro BAIGORRI (1), **Felipe GALVÁN-MAGAÑA (2)**,
Marcela GRIJALBA (1) & Adolfo SANJUÁN (1)

- (1) Facultad de Biología Marina, Universidad de Bogotá Jorge Tadeo Lozano, Carrera 2 # 11-68, Edificio Mundo Marino, Rodadero, Santa Marta, COLOMBIA [carlosjpolos@yahoo.es] [baygopa25@yahoo.es] [marcela.grijalba@utadeo.edu.co] [adolfo.sanjuan@utadeo.edu.co]
- (2) Centro Interdisciplinario de Ciencias Marinas. Av. I. P. N. s/n Colonia Playa Palo de Santa Rita, Apartado Postal 592. La Paz, Baja California Sur, C.P. 23000, MEXICO [fgalvan@ipn.mx]

While examining the trophic spectrum of pelagic thresher *Alopias pelagicus* in Ecuadorian waters during July to December of 2003, 111 sharks were caught close to Manta, Ecuador. To establish possible seasonal changes in prey diversity, the diet was analyzed considering aspects such as sex and stage of maturity. Of the 111 sharks, 53 were mature (36 females and 17 males), 26 were gravid females, and 32 were immature (22 females and 10 males). Analyses using number, weight, and frequency occurrence methods and relative importance index (IRI). No difference in prey by sex or stage of maturity was observed. We identified 24 items. The main preys of *A. pelagicus* were the Humbolt squid *Dosidicus gigas* (IRI = 5864), the mesopelagic fish *Benthoosema panamense* (IRI = 2693), and the squid *Sthenoteuthis oualaniensis* (IRI = 262). According to the Levin index, *A. pelagicus* is a specialized predator, consuming more preys in coastal waters.

C17

EXPERIMENTAL STUDY OF BIOACCUMULATION FROM SEAWATER OF HEAVY METALS AND RADIONUCLIDES IN JUVENILES AND EMBRYOS OF THE SPOTTED DOGFISH, *SCYLIORHINUS CANICULA*

Ross A. JEFFREE (1), Jean-Louis TEYSSIE, Michel WARNAU
& Francois OBERHAENSLI

- (1) IAEA Marine Environment Laboratory (MEL), 4 Quai Antoine, MC 98000, MONACO [R.Jeffree@iaea.org]

The bioaccumulation of selected heavy metals and radionuclides (^{241}Am , ^{109}Cd , ^{57}Co , ^{51}Cr , ^{134}Cs , ^{54}Mn and ^{65}Zn) from seawater were experimentally compared in the Chondrichthyan *Scyliorhinus canicula* (spotted dogfish) and the Actinopterygian Teleost *Psetta maxima* (turbot), of comparable size and benthic feeding habits. The uptake rates, measured over 14 days in Monaco seawater at MEL (2005), varied greatly among isotopes and between species. Concentration factors (CFs) in *P. maxima* varied 5-fold between ca. 0.2 for ^{51}Cr and 2.5 for ^{65}Zn and ^{134}Cs , whereas in *S. canicula* they varied by a much greater factor of 350, with CFs for ^{51}Cr and ^{241}Am ranging from ca. 0.4 to 140, respectively. With the exception of ^{134}Cs , all radiotracers were accumulated at a faster rate in *S. canicula* than in *P. maxima*, particularly for ^{241}Am and ^{65}Zn where the CFs attained during the uptake phase were, two and one order of magnitude greater in *S. canicula*, respectively. In contrast, ^{134}Cs reached a

CF of about 2.5 in *P. maxima*, which is 5-fold greater than in *S. canicula*. The elevated uptake rates and higher CFs for most radioisotopes indicate that *S. canicula* is more susceptible than *P. maxima* to exposure and contamination by these metals and radionuclides in seawater. Encased embryos of spotted dogfish *Scylliorhinus canicula* absorbed six radioisotopes (^{241}Am , ^{109}Cd , ^{57}Co , ^{134}Cs , ^{54}Mn and ^{65}Zn) directly from seawater during experimental exposure, demonstrating the permeability of the egg-case to these contaminants. Embryo to water concentration factors (CFs) ranged from 0.14 for ^{134}Cs to 7.4 for ^{65}Zn . The ^{65}Zn and ^{57}Co CF's increased exponentially with embryo length, whereas the CF for ^{109}Cd declined with length. Among different components of the encased embryo the egg case was the major repository (69-99%) of all six radioisotopes that were evenly distributed throughout its wall. Egg case CF's were as high as 10^3 for ^{57}Co and ^{65}Zn , making it the major source of gamma radiation exposure to the embryo and potentially of radioisotopes for continued absorption by the embryo, following the uptake phase of the experiment. Within the embryo initial data on radio isotopic distribution show that the skin is their major site of uptake, as previously demonstrated for juveniles.

C18

WANDERING WOBBERGONGS : THE MOVEMENTS OF WOBBERGONG SHARKS, *ORECTOLOBUS HALEI*, IN NEW SOUTH WALES, AUSTRALIA

Charlie HUVENEERS & Rob HARCOURT

Marine Mammal Research Group, Graduate School of the Environment, Macquarie University, North Ryde, NSW, 2109, AUSTRALIA [charlie.huveneers@gse.mq.edu.au] [rharcour@ecosys.gse.mq.edu.au]

Wobbegong sharks are bottom-dwelling sharks found in warm temperate to tropical continental waters of the western Pacific and are commercially targeted in NSW, Australia. Total catches have declined dramatically, circa 50%, over the last decade. This reduction has led to wobbegongs being listed as vulnerable in NSW on the IUCN Red List of Threatened Species. Movements and residence time within a specific location may affect wobbegong resilience to fishing pressure. Acoustic tags were used to investigate the movements and residency patterns of wobbegongs within a small geographical area in northern NSW. Seven large ornate wobbegong (*Orectolobus halei*) were tagged at Fish Rock, NSW for a period between eight and twenty two months. Six listening stations were deployed around the same rock during that time. Four out of the seven sharks were only detected for a relatively short period of time following tagging (14 to 30 days) and never heard from again. Three 'resident' sharks were detected for a longer period (up to 20 months), within which they showed a mean residence time of 6.3 days (present without excursions longer than 24 hours). No monthly pattern could be observed. However, although detection rate was not significantly different between day and night (T-test, $P > 0.05$), a daily pattern was observed with resident sharks being detected significantly more often during the day (present about 40% of the time) than at night (present about 30% of the time) (T-test, $P < 0.05$). No distinctive periodicity in the diel pattern could be distinguished. Most sharks were detected more frequently around the South East side of Fish Rock (mean: 75%) than around the North West side (mean: 35%). Home range sizes were highly variable around Fish Rock with some transient sharks detected 100% of the time at one listening station and some resident sharks detected 67% of the time at one listening station while others were detected at relatively equal rates at all listening stations. The residency pattern observed by some of the tagged sharks shows that fishing could potentially deplete wobbegong

populations at specific sites and that marine parks or aquatic reserves could help protect wobbegongs from fishing pressure. However, equipment failure and limited spatial distribution of listening station led to limited data and results should be interpreted with caution.

C19

FEEDING HABITS AND STABLE ISOTOPE RATIOS ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) IN THE MAKO SHARK, *ISURUS OXYRINCHUS*, FROM MEXICO

Paula VELASCO-TARELO & Felipe GALVÁN MAGAÑA

Centro Interdisciplinario de Ciencias Marinas. Av. IPN s/n. Apartado Postal 592. La Paz, Baja California Sur, C.P. 23000, MEXICO [paulatarello@hotmail.com] [fgalvan@ipn.mx]

Muscles and stomach contents of mako sharks from traditional fisheries on the western coast of Baja California Sur, Mexico were analyzed to discover feeding habits and carbon and nitrogen stable isotope ratios. Of 269 stomachs dissected, 135 had food (131 juveniles and 4 adults), and 31 prey species were identified. The most important prey fish were *Prionotus albirostris* (65 % relative importance index) and *Scomber japonicus*. Of the cephalopods, *Dosidicus gigas* (23%) and *Ancistrocheirus lesueuri* (4%), were found most often. The mako shark was classified as a selective predator ($B_i = 2.7$). Both sexes of shark fed on similar prey ($C\lambda = .99$), but the males had a less selective diet ($B_i=3.4$) than females ($B_i=2$). The prey consumed by adults were mainly pelagic, whereas juveniles fed mainly on benthic prey such as *P. albirostris*. Using isotopic nitrogen ($\delta^{15}\text{N}$), juveniles and adults of mako shark had higher trophic levels ($\mu=18.10 \text{ ‰} \pm 0.82$ and $\mu= 18.72 \text{ ‰} \pm 0.57$ respectively). The most important preys were *S. japonicus* ($\delta^{15}\text{N}$: 17.36 ‰) and *P. albirostris* ($\delta^{15}\text{N}$: 16.73 ‰), which had trophic positions similar to the mako shark. However the prey *Coryphaena hippurus* ($\delta^{15}\text{N}$:17.82 ‰) had a lower trophic level. Using carbon isotopes ($\delta^{13}\text{C}$), the most important preys had their origins in oceanic waters: *C. hippurus* (-16.11 ‰), *S. japonicus* (-16.92 ‰), *P. albirostris* (-17.53 ‰), and *D. gigas* of 30 g and 11 kg (-17.94 ‰ and -16.24 ‰ respectively). The less important preys were *M. cephalus* ($\delta^{13}\text{C}$: -10.01 ‰) from coastal waters and *P. planipes* ($\delta^{13}\text{C}$: -19.03 ‰) from oceanic waters. By geographic area, there were differences in nitrogen isotopic value among mako sharks. Differentiating by age, adults had higher nitrogen isotopic values than juveniles, whereas by sex, males had higher nitrogen isotopic values than females in some locations.

C20

COMMON DEEP-BENTHIC SKATES OF THE NORTHWESTERN PACIFIC: BASIC ECOLOGICAL AND BIOLOGICAL FEATURES

Alexei ORLOV (1), Alexei TOKRANOV (2) & Raf FATYKHOV (3)

- (1) Russian Federal Research Institute of Fisheries and Oceanography (VNIRO), 17, V. Krasnoselskaya, Moscow, 107140, RUSSIA [orlov@vniro.ru]
- (2) Kamchatka Branch of Pacific Institute of Geography, Far East Branch of Russian Academy of Science (KB PIG FEB RAS), 6, Partizanskaya St., Petropavlovsk-Kamchatsky, 683000, RUSSIA [tok@mail.iks.ru]
- (3) Sakhalin Research Institute of Fisheries and Oceanography (SakhNIRO), 196, Komsomolskaya St., Yuzhno-Sakhalinsk, 693016, RUSSIA [raf@sakhniro.ru]

Deep-benthic rajid skates represent an important component of bottom ichthyofauna of the western North Pacific. In some areas they comprise up to 10% of the fish biomass. Skates play significant role in food webs, consuming variety of fish and invertebrates including commercially important species. Russian fishery for skates in the northwestern Pacific is poorly developed due to lack of domestic demand. Though skates are very promising target of inshore fisheries with export to Asian fish markets. Their fishery should be based on an intimate knowledge of their ecology and biology, which are still poorly understood even for most common species inhabited the northwestern Pacific. The data on some ecological parameters and biological features of the seven most abundant and common species (Aleutian skate *Bathyraja aleutica*, white-blotched skate *B. maculata*, dusky-purple skate *B. matsubarai*, whitebrow skate *B. minispinosa*, Alaska skate *B. parmifera*, Okhotsk skate *B. violacea*, and mud skate *Rhinoraja taranetzi*) were sampled in the Pacific waters off the northern Kuril Islands and southeastern Kamchatka (47°50 N - 52° N, depth range 85-850 m) during 1993-2001 bottom trawl surveys and commercial fishing operations. The spatial and vertical distributions are presented, bottom temperature preferences are shown, and dynamics of relative abundance are considered. Data on length frequencies, length-weight relationships, and sex-ratios in different size classes are presented. Data on sexual dimorphism in skate sizes are given as well. The study of vertical ontogenetic shifts of skate species considered was attempted.

C21

USE OF A MOBILE MAGNETIC RESONANCE IMAGING (MRI) UNIT TO SURVEY THE VERTEBRAL COLUMN OF A LIVE FEMALE SAND TIGER SHARK, *CARCHARIAS TAURUS*, FOLLOWING THE ACUTE ONSET OF A SPINAL DISTORTION

Graham HILL & Marc GEACH

The Deep, Tower Street, Hull HU1 4DP, UK [graham.hill@thedeep.co.uk]

X-rays and MRI scans of vertebral columns removed from sharks post-mortem have provided significant information into the structural changes that occur during chronic scoliosis events in sand tiger sharks. This procedure as far as can be ascertained has not been attempted on a large live shark. Following an acute onset a spinal distortion, dissimilar to chronic scoliosis it was decided the problem would be investigated using X-rays. This allowed to locate the problem posterior to the dorsal fin but higher resolution was required for definitive diagnosis. This presentation will overview the logistics of this procedure with regards to capture, transport and monitoring of the animal during the scan and the results gained from it.

C22

ELASMOBRANCH CAPTURES IN THE TRAMMEL NET FISHERY ASSOCIATED TO MARINE RESERVES IN THE BALEARIC ISLANDS

Gabriel MOREY (1), (2), Joan MORANTA & Francisco RIERA

- (1) Direcció General de Pesca. Govern de les Illes Balears. C/. Foners 10, E-07006 Palma de Mallorca, SPAIN [gmorey@dgpesca.caib.es]
- (2) CSIC/UIB-Institut Mediterrani d'Estudis Avançats. C/. Miquel Marquès 21, E-07190 Esporles, SPAIN

The incidence of elasmobranchs in the trammel net fishery operating associated to three marine reserves in the Balearic Islands was analysed from 14 surveys. Within these three marine reserves the commercial fishery is allowed but some restrictions have been established referred to effort (number of nets and hooks or mesh size) and fishing area closure. Between 2000 and 2004, 684 hauls (205.2 km of net) were performed over *Posidonia oceanica*, rocky and bare sand mixed bottoms, at depths ranging from 8 to 46 meters. 698 elasmobranch specimens were caught, belonging to 12 species (10 batoids and 2 sharks), and they represented 9.9% in abundance and 28.5% in biomass of the total fish catch. The most abundant species were the common stingray *Dasyatis pastinaca*, the rough ray *Raja radula* and the spotted torpedo *Torpedo marmorata*, making up 48.3%, 24.6% and 15.3%, respectively, of the elasmobranch capture. Overall, both the abundance and biomass of some elasmobranch species presented differences between inside and outside the marine reserves, and also some seasonal trends were detected. Data of elasmobranch biomass in relation to the total fish catch from the fishery-independent surveys were compared with those from official landing statistics, revealing a high rate of elasmobranch discarding.

C23

A NEW TECHNIQUE FOR SHARK TAGGING

Riccardo STURLA AVOGADRI & Fabrizio GIOELLI

Shark Academy - Onlus, Piazzale Olimpia 52, 37138 Verona, ITALY
[riccardosturla@sharkacademy.com] [fabrizio@sharkacademy.com]

Shark tagging is a common method to study shark movements and migrations. Different kinds of tagging systems are nowadays available. In general, tags are attached to shark's body by means of metallic tips penetrating deeply into the animal tissues and therefore they cannot be easily removed without damaging the shark tissues. A new system of tagging has been developed in order to make the removal of the tag easy and without injuring the tagged shark. Furthermore, it is likely to be used by scuba divers to fix the tag underwater. It consists of a thin plastic tag that is attached to the dorsal fin using a purpose built applicator. The tag can be equipped with P.I.T. (passive integrated transponder tag) and Logger to record various parameters (depth, temperature, etc). The new system was tested in Durban (South Africa) : 2 specimens of *Galeocerdo cuvier* and 2 of *Carcharias taurus* were tagged in 2004, one ragged tooth shark was seen again in 2005 and the tag was successfully removed underwater without damaging the shark fin. Other tests were successfully performed on several specimens of silky sharks (*Carcharhinus falciformis*) in Cuba and of Caribbean grey reef sharks (*Carcharhinus perezi*) off Grand Bahamas Island. The new system and the tests are presented.

P1

HEAVY METALS IN *SQUALUS ACANTHIAS* FROM THE ADRIATIC SEA

Marco AFFRONTI (1), Paolo FONTI (2) & Alessandra MASI (3)

- (1) Fondazione Cetacea Onlus, via Ascoli Piceno, 47838 Riccione (RN), ITALY
[ambientemare@fondazionecetacea.org]
- (2) Istituto di Ricerca Gruppo C.S.A. S.p.A, Via al Torrente, 22, 47900 Rimini, ITALY
[info@csaricerche.com]

(3) University of Bologna, Faculty of Biological Sciences, ITALY

Heavy metals are strong potential contaminants in different species. In the Adriatic Sea, a semi-closed system, the levels of different metals are becoming relatively high. Samples of liver, spleen, brain and muscle from 31 spiny dogfish *Squalus acanthias* were collected during the summer of 2004. Specimens were 13 females and 18 males, and the total length range was from 21 to 80 cm. The heavy metals concentrations searched, were cadmium, chromium, lead, and mercury. Mercury levels were found to be high, especially in brain and muscle, and furthermore a positive correlation was found between mercury concentration and the length/weight of the animals. Lower concentrations were found respectively for chrome, lead and finally cadmium. Concentrations of chrome, lead and cadmium in muscle never exceeded the levels defined by the Italian law that regulates food for human beings, whereas the mercury concentrations exceeded them in 33,3 % of the muscle samples (n=15).

P2

FEEDING HABITS OF THE SILKY SHARK, *CARCHARHINUS FALCIFORMIS*, IN THE EASTERN PACIFIC

Zullette ANDRADE-GONZÁLEZ & Felipe GALVÁN-MAGAÑA

Centro Interdisciplinario de Ciencias Marinas. Av. Instituto Politécnico Nacional S/N. Apdo. Postal 592. La Paz, B.C.S. C.P. 23000, MEXICO [zullette@yahoo.com] [fgalvan@ipn.mx]

The diet of the silky shark *Carcharhinus falciformis* from the eastern Pacific Ocean was analyzed during 1992 to 1994. From a total of 324 silky shark stomachs, 258 showed stomach contents (79.6%) and 66 were empty (20.3%). Four principal trophic groups were found in the eastern Pacific Ocean: cephalopods, crustaceans, marine mammals, and fishes. Applying the index of relative importance (IRI) it was found that silky shark fed preferentially on yellowfin tuna *Thunnus albacares* (66.7% IRI) in the entire study area consisting of 6 sub-areas A-F. The most important prey species by area were: in area A, fishes of the family Carangidae (59.8%) , in area B, *Thunnus albacares* (38.3%), in area C, *Cubiceps pauciradiatus* (59.2%), in area D *Thunnus albacares* (72.8%), in area E, *Dosidicus gigas* (21%), and in area F, *Katsuwonus pelamis* (65.1%). Applying the ecological index of trophic niche breadth, low values were observed in the total area by sex and stage of maturity (juvenile or adult, 0.05-.49), meaning that sharks select their prey. Analyzing by area, however, showed that areas A,C, E, and F had high values (generalists); whereas areas B and D were low (specialists). Higher values of prey diversity index were registered in areas D and E (2.30-2.38), than in the other areas A (0.189), B (2.18), C (1.17), and F (1.98).

P3

ELECTRORECEPTION OF EMBRYONIC THORNBACK RAY, *RAJA CLAVATA*

Rachel BALL & Andrew GILL

Institute of Water & Environment, Cranfield University, Silsoe, MK45 2LR, UK
[r.e.ball.s05@cranfield.ac.uk] [a.b.gill@cranfield.ac.uk]

Elasmobranchs are well known for their ability to detect bioelectric stimuli for the purpose of prey detection and mate location, and their electro-sense also functions in the relatively unknown behavioural context of predator avoidance. Embryos of oviparous elasmobranchs, which spend embryonic life encapsulated in an eggcase on benthic substrata, are very vulnerable to predation, yet there is evidence to suggest that the electric sense of developing skates can efficiently mediate predator detection and avoidance. The relatively constant ventilatory movements of near hatching skate embryos have been shown to be interrupted by phasic electric stimuli of 1-2Hz which matches the frequency produced by large fish predators. This behaviour momentarily removes sensory cues which facilitate the embryo's detection by predators and thus may represent an important mechanism to enhance survival. Here we describe some preliminary results of an investigation which examined the behavioural responses of 3 different age groups of thornback ray *Raja clavata* embryos (1/3 developed, 2/3 developed and near hatching) to low frequency AC electric fields. Treatments were presented as continuous or intermittent E-fields in order to explore the likelihood of habituation to stimuli. This is of particular significance when considering the potential interactions of embryonic skates with E-fields in the coastal environment such as those likely to be produced by sub sea cables of offshore renewable energy developments. This research will provide important information regarding the electrosensory abilities of a crucial life history stage of a vulnerable elasmobranch species.

P4

FIRST RECORD OF THE BULL SHARK, *CARCHARHINUS LEUCAS*, IN AN ATLANTIC OCEANIC INSULAR SHELF, THE AZORES ARCHIPELAGO, PORTUGAL, WESTERN NORTH ATLANTIC

João Pedro BARREIROS (1) & Otto Bismarck FAZZANO GADIG (2)

- (1) Universidade dos Açores/ IMAR-Açores, Departamento de Ciências Agrárias, Azores, PORTUGAL [jpedro@mail.angra.uac.pt]
- (2) Unesp, Campus do Litoral Paulista, São Vicente, São Paulo, BRAZIL [gadig@csv.unesp.br]

The Azores archipelago, North eastern Atlantic, is a group of nine volcanic islands situated on the Mid-Atlantic ridge. There are few shark studies in the area, most of them included in other works considering commented list of the entire fish fauna from the Archipelago. In the present study are reported the occurrence of the bull shark, *Carcharhinus leucas*, in the Azorean waters, based on a single specimen caught in March 1994 in São Mateus Bay, Terceira Island (38°39'N; 27°13'W). The shark was sighted swimming in shallow waters and was caught by a fisherman using a hand harpoon near the surface. The shark was eviscerated for commercialization and its carcass was discharged in the bay, where its head was recovered by the senior author 12 hours later. The jaws were cleaned and are about to be deposited at the collection of Museu Carlos Machado, Ponta Delgada, Azores, Portugal (provisional number CARLEU 1/94/05). Additional photos of the head were taken. The characteristic blunt snout and jaws analysis (teeth counts and morphology) were sufficient to shark identification. Dental formula was 13-1-13 in upper jaws and 12-1-12 in lower jaws, with upper teeth exhibiting strong serration and lower teeth finely but clearly serrated. The bull shark is a large Carcharhinidae commonly associated to coastal, estuarine and even freshwaters of tropical regions. There is no data concerning the occurrence of the bull shark in insular platforms of small oceanic islands in the Atlantic Ocean, such as the Azores, although several records are known from the Pacific. The present report is the first

record of a bull shark in the Azores, and the northernmost record for this species in the NE Atlantic. Unfortunately, the scarcity of environmental data do not allow a more consistent explanation about the factors related to so an unusual occurrence. It would be expected that a coastal tropical shark could visit Azorean waters during the Northern Hemisphere summer, when the Gulf Current arrives bringing some tropical faunistic elements from the western North Atlantic, namely the Caribbean. Also its cosmopolitan distribution could lead some individuals to stop in oceanic islands during transoceanic migrations.

P5

CHONDRICHTHYAN DIVERSITY FROM THE AZORES ARCHIPELAGO, PORTUGAL

João Pedro BARREIROS (1) & Otto Bismarck FAZZANO GADIG (2)

- (1) Universidade dos Açores/ IMAR-Açores, Departamento de Ciências Agrárias, Azores, PORTUGAL [jpedro@mail.angra.uac.pt]
- (2) Unesp, Campus do Litoral Paulista, São Vicente, São Paulo, BRAZIL [gadig@csv.unesp.br]

The Azores archipelago, North eastern Atlantic, is a group of nine volcanic islands situated on the Mid-Atlantic ridge. The islands and their shelf have an estimated area, which represents only 0.4% of the Azores Economic Exclusive Zone (EEZ) of about one million km². The fisheries are dominated by tuna landings, although several demersal and deep-water species are also caught. Studies about cartilaginous fishes are restricted to a few papers on fishery biology of commercially important species. Faunistic studies are included in other works considering commented list of the entire fish fauna from the Archipelago. In the present study are reported 9 orders, 21 families, 27 genera and 46 Chondrichthyes species in the Azorean EEZ. Sharks comprise the most species, represented by 5 orders (55.5% of Chondrichthyes orders from Azores), 15 families (71.4% of families), 15 genera (55.5% of genera) and 31 species (67.4% of total). Squaliformes is the most numerous (14 species = 45.2% of all shark species and 30.5% of total cartilaginous fishes of Azores), with demersal or bathypelagic habits. Carcharhiniformes (with eight shark species = 25.8% of sharks) and Lamniformes (six species = 19.3% of sharks), are remarkably oceanic-pelagic. Concerning rays, three orders were recorded (33.3% of all Chondrichthyes orders from Azores), five families (23.8% of families), 11 genera (40.7% of total genera) and 13 species (28.3% of total). Both Rajiformes and Myliobatiformes have six species (together represents 92.3% of Azorean ray species and 26.1% of total cartilaginous fishes). Rajiformes have demersal species from deeper waters, and Myliobatiformes are represented by demersal species from shallow waters from insular shelf as well as oceanic-pelagic. Chimaeras are represented in Azores by two species belonging to Chimaeridae and inhabit deeper demersal areas. Demersal species associated to deep waters represent 58.7% of total species (= 27 species), and demersal species from shallow waters or oceanic-pelagic are 41.3% of total (=19). The small insular shelf (0.4% of the Azores EEZ), and the importance of the fisheries on deep demersal resources explain the most representative occurrence of cartilaginous fishes from such habitats.

P6

STABLE ISOTOPE RATIOS ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) IN MANTA RAYS (BATOIDEA : MOBULIDAE) AS TROPHIC INDICATORS

Florencia CERUTTI & Felipe GALVÁN-MAGAÑA

Centro Interdisciplinario de Ciencias Marinas. Av. IPN s/n. Apartado Postal 592. La Paz, Baja California Sur, C.P. 23000, MEXICO [flo_cepe@yahoo.com] [fgalvan@ipn.mx]

Manta rays (Mobulidae) are highly vulnerable to exploitation due their slow growth rates, late sexual maturity, long gestation periods, and very low fecundities. Their biological and ecological characteristics are necessary to develop plans for their management and conservation. In this scope, feeding ecology and feeding behavior have been studied using stomach content analysis; this technique gives taxonomic information about diet over a short period of time. In contrast, the stable isotope technique is a tool to trace diet over longer periods of time, and during migrations and movement patterns, due to isotope accumulation in tissues. The objective of this study is to compare the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotope ratios among three manta ray species caught in southwest Gulf of California. Sex, age, fishing season, and study period (2002 and 2004) were compared. Differences in age were found between *Mobula japonica* and *Mobula munkiana*, but not between *Mobula japonica* and *Mobula thurstoni*, probably because the latter species is found year round and its prey changes according to season. There was no difference in trophic level of Mobulas between the years 2002 and 2004, probably because they were feeding from the same prey in the area. At the beginning of the fishing season, there was a change in the isotopic ratios supporting a migration hypothesis. Vertical (benthic-pelagic) and horizontal (coastal-oceanic) changes were found among species in the area due to movements associated with feeding behavior, which might be influenced by sex and age.

P7

FIRST RECORD OF THE BIGEYE THRESHER SHARK, ALOPIAS SUPERCILIOSUS, FROM THE EASTERN MEDITERRANEAN SEA

Simona CLO' (1), Ramón BONFIL (2) & Eleonora DE SABATA (1)

(1) Medsharks, via Ruggero Fauro 82, 00197 Roma, ITALY [info@medsharks.org]

(2) Wildlife Conservation Society (WCS), 2300 Southern Blvd. Bronx, New York, NY 10460, USA [rbonfil@wcs.org]

The bigeye thresher shark, *Alopias superciliosus*, is distributed worldwide in tropical and temperate seas. In the Mediterranean Sea the bigeye thresher shark is only known from the western and central Mediterranean. We present evidence of two *Alopias superciliosus* caught by tuna nets off the coast of Turkey during April and May 2005. Morphometric measurements were taken of the tail of one specimen, and deep-frozen tissue samples were also collected. This is the first report of the presence of *Alopias superciliosus* in Turkish waters and extends the range of distribution of the species into the eastern Mediterranean Sea.

P8

**REPRODUCTIVE BIOLOGY OF MAKO SHARK, *ISURUS OXYRINCHUS*,
ON THE WESTERN COAST OF BAJA CALIFORNIA SUR, MEXICO**

Mauricio CONDE-MORENO & Felipe GALVÁN-MAGAÑA

Centro Interdisciplinario de Ciencias Marinas. Av. IPN s/n. Apartado Postal 592. La Paz, Baja California Sur, C.P. 23000, MEXICO [anahacohen@yahoo.com] [fgalvan@ipn.mx]

The mako shark is an important target for commercial and sport fishing in Baja California Sur, Mexico, but few biological studies exist. A sample of 301 individuals (153 females and 148 males) was taken from the landings of the traditional fishery along the west coast of Baja California Sur. Their sizes ranged from 69 cm and 290 cm TL. The sex ratio was 1.03 ♀:1 ♂. The males were found in three stages of maturity: immature, sub-adult, and mature, while the females were found in only the first two stages: immature and sub-adult. Male mako sharks mature at about 180 cm TL. Males showed radial type spermatocyst development, of which seven stages were differentiated. Females showed an internal type ovary, and only three stages of ovarian follicle development were differentiated. Most sharks caught were juveniles or even neonates, so the middle and north of the west coast of Baja California Sur are considered nursery areas for mako sharks.

P9

**A COMPARATIVE STUDY OF THE ROSTRUM
AND THE INHERENT SENSORY SYSTEMS OF THREE SPECIES OF SCYLORHINIDAE**

Corinna ENDERES (1), Peter BARTSCH (1), Samuel IGLÉSIAS (2) & Daniel SELLOS (2)

(1) Museum für Naturkunde der Humboldt Universität, Invalidenstrasse 43, 10115 Berlin, GERMANY [corinna.enderes@museum.hu-berlin.de] [peter.bartsch@museum.hu-berlin.de]

(2) Station de Biologie Marine, Muséum National d'Histoire Naturelle, BP 225, 29182 Concarneau Cedex, FRANCE [sellos@mnhn.fr] [iglesias@mnhn.fr]

The taxon Scyliorhinidae hosts morphologically divergent representatives. In this study in particular the rostrum is concerned and the inherent sensory systems, the electroreceptive system (ES) consisting of Lorenzian ampullae and the rostral parts of the lateral line system (LLS). Three species (*Scyliorhinus canicula*, *Apristurus aphyodes*, *Galeus melastomus*) that widely diverge in the rostrum's shape, size and development were investigated histologically and digital 3D-reconstructions of the ES were made. Although the general organization of the Lorenzian ampullae in clusters, aggregations and complexes is preserved in all three species, several unique features were found in each. Most similarities were found between *G. melastomus* and *A. aphyodes*, supporting the taxon Pentanchidae (Iglésias et al. 2005). Elongation and magnification of the rostrum in *A. aphyodes* and *G. melastomus* apparently result in a correlated elaboration of the ES and LLS as compared to *S. canicula*. The general pattern of superficial pores distribution is preserved in all three species. These fields, however, are in parts established by different complexes, that is differently innervated proximal capsular parts of the Lorenzian ampullae, a fact that questions homology of the superficial pattern of pore fields.

P10

STABLE ISOTOPE ANALYSIS ($\delta^{13}\text{C}$ AND $\delta^{15}\text{N}$) OF PACIFIC ANGEL SHARK, *SQUATINA CALIFORNICA*, IN THE SOUTHERN GULF OF CALIFORNIA, MEXICO

Ofelia ESCOBAR-SÁNCHEZ, Felipe GALVÁN-MAGAÑA,
& Leonardo Andrés ABITIA-CÁRDENAS

Centro Interdisciplinario de Ciencias Marinas. Av. IPN s/n. Apartado Postal 592. La Paz, Baja California Sur, C.P. 23000, MEXICO [Ofelia@iemanya.org] [fgalvan@ipn.mx]

Stable isotopes and stomach contents were used to determine the origin of food consumed by Pacific angel shark *S. californica*, and the variation in origin with sex, size, season, and location in the southern Gulf of California. A total of 414 stomachs were analyzed, of which 190 (46%) contained food and 224 (54%) were empty. Due to the high percentage of empty stomachs, we examined the isotopic composition of nitrogen ($\delta^{15}\text{N}$) and carbon ($\delta^{13}\text{C}$) in angel shark tissues. The stomach contents showed that the main preys were demersal fishes including *Decapterus macrosoma*, *Porichthys analis*, *Synodus evermanni*, *Myripristis leiognathus*, and the crustacean *Sicyonia penicillata*. Stable isotope analysis of angel shark muscle showed $\delta^{13}\text{C}$ values of -16.55 to -15.06‰ ($\mu = -15.94\text{‰} \pm 0.34$); whereas $\delta^{15}\text{N}$ values were from 18.30 to 19.52 ‰ ($\mu = 18.90\text{‰} \pm 0.27$). These results show that angel sharks feed on benthic organisms in coastal areas, and the carbon isotope values indicate differences in feeding locations, but none in sex, size, or season.

P11

DIVER UNDERWATER SIGNALS FOR SHARK IDENTIFICATION

Fabrizio GIOELLI & Riccardo STURLA-AVOGADRI

Shark Academy Onlus, Piazzale Olimpia, 52, 37138 Verona, ITALY
[fabrizio@sharkacademy.com]

Underwater signals are the common way for scuba divers to communicate underwater. Divers use signals for emergency purposes, routine communication and for general reasons such as to indicate a marine life form to the buddy. In this latter case, the range of available underwater signals is very limited. The present work proposed an innovative series of 20 underwater signals specifically developed to indicate the most common shark species encountered by divers. The proposed signals are species specific; they may be useful for research, teaching and recreational purposes in areas where several shark species can be encountered in a single dive.

P12

Abundance of whale shark preferred preys in THE southern GULF OF California, Mexico

Ana HACOHEN-DOMENE & Felipe GALVÁN- MAGAÑA

Centro Interdisciplinario de Ciencias Marinas. Av. IPN s/n. Apartado Postal 592. La Paz, Baja California Sur, C.P. 23000 MEXICO [anahacohen@yahoo.com] [fgalvan@ipn.mx]

It is believed that many whale shark migratory movements are associated with high productivity zones. Studies concerning whale shark feeding habits and preys are rare, especially in Mexico, so the objective of this study was to identify and quantify the preferential prey of whale shark in the Gulf of California close to La Paz Bay, where whale sharks feed mainly on the copepod group of zooplankton. During May, June, and November of 2001 and 2002, horizontal surface trawls were conducted in areas known as aggregation zones during both the presence and absence of whale shark. Data on size, sex, scars, location, and environmental parameters were taken. The sharks were often found near the coast (La Palmita and Punta Prieta); while in oceanic areas (El Bajo Espiritu Santo and La Paz Bay), there were fewer sightings. A total of 12 genera of copepods were registered in oceanic areas, the most abundant being *Acartia sp.*, *Undinula sp.*, *Corycaeus sp.*, and *Calanus sp.*, while in coastal areas the most abundant copepods were *Acartia sp.*, *Undinula sp.*, and *Corycaeus sp.* It is noteworthy that all zooplankton samples taken in the presence of whale shark had high biomass densities, with the copepod *Acartia sp.* as the main genera in samples (ml/1000 m³).

P13

POPULATION GENETIC STUDIES OF THE LEMON SHARK *NEGAPRION BREVIROSTRIS* : A COMPARISON OF DIFFERENT LOCATIONS IN THE WESTERN ATLANTIC, THE CARIBBEAN AND THE GULF OF MEXICO

Claudia JUNGE (1), Samuel H. GRUBER (2) & Kevin A. FELDHEIM (3)

- (1) Department of Biological Sciences, University of Rostock, Wismarsche Str. 8, 18055 Rostock, GERMANY [claudia.junge@uni-rostock.de]
- (2) Division of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami, FL 33149, USA
- (3) Pritzker Laboratory for Molecular Systematics and Evolution, Field Museum of Natural History, 1400 S. Lake Shore Drive, Chicago, IL 60605, USA

The lemon shark, *Negaprion brevirostris*, is one of the best-studied shark species. Despite this, we still know little about its migratory patterns and stock structure. The little we do know comes from a study of lemon sharks from four locations, Gullivan Bay and Marquesas Key in Florida, USA, Bimini, Bahamas, and Atol das Rocas, Brazil. In this study, an additional site, Glovers Reef, Belize, was added and the collected DNA-samples were scored for seven microsatellite loci. Genetic comparisons, including F-statistics and relatedness, were made between and within the five populations. Calculations of relatedness revealed siblings of different years and therefore underlined philopatry of the females. Estimated F_{ST} values range from 0.0047 to 0.0503, with the highest value also representing the longest geographical distance. These data indicate that lemon sharks caught at Belize are more closely related to the northern populations with gene flow occurring between all studied locations.

P14

**HABENULAR NUCLEI STRUCTURE AND THEIR NERVOUS CONNECTIONS
IN SOME ELASMOBRANCH SPECIES**

Daniela MINELLI (1), Raffaele GATTELLI (2), Bruno SABELLI (1), Stefano TOMMASINI (1)
& Violetta COLLEVECCHIO (1)

- (1) Department of Experimental Evolutionary Biology of the University of Bologna, Via Selmi 3, 40126 Bologna, ITALY [daniela.minelli@unibo.it]
- (2) Scientific didactic centre "Aequae mundi", Via Mozambico 5, 48026 Russi (Ra), ITALY

The structure of the habenular nuclei of the diencephalon, which included the bilateral habenulae nuclei, and the habenular commissure, composes a part of the nervous system which connects the telencephalon to the ventral mesencephalon. In the cartilaginous fishes the connections between telencephalon-diencephalon and mesencephalon are not well known, but from the examination of several species, the habenulae result almost constantly asymmetric (Kemali and Miralto, 1979; Smeets *et al.*, 1983). This asymmetry does not regard only the size, but it is reflected also on the cellular organization and the fibers myelination: the right habenula is normally the smaller one, the left one is larger, has a cells disposition similar to the right nucleus, but with immunoreactivity for calbindin-D 28k (absent in the right habenula), and a lateral nucleus with large neurons associated to myelinated fibers (Concha and Wilson, 1982). We have found a marked habenular asymmetry in various species of sharks (*Squalus acanthias*, *Mustelus mustelus*, *Scyliorhinus canicula* and *Scyliorhinus stellaris*) and rays (*Raja asterias* and *Myliobatis aquila*) and we will continue these morphologic studies, analyzing the ultrastructure of the two habenulae, and the *pars medialis* and *lateralis* of the left habenula of the various species. With the use of a fluorescent tracer, a fat-soluble indocarbocyanine (DiI)(molecular probe), we have been able to put in evidence the habenular connections and to better understand the asymmetry of the epithalamic region: this fluorescent tracer has a molecular structure which makes it able to insert in the phospholipidic double layer of nervous cells plasmatic membranes, and to diffuse to the axonic extension (Giuliani *et al.*, 2002). After DiI application in some brains of *Scyliorhinus canicula* and *Raja asterias* we have evidenced that the diencephalic habenular nucleus receives fibers from the telencephalon through the stria medullaris and projects it to the interpeduncular nucleus through the fasciculus retroflexus.

P15

**DEEPWATER SKATES COLLECTED DURING 2004 R/V G.O. SARS AND MS LORAN
CRUISES IN THE MID-ATLANTIC RIDGE AREA**

Alexei ORLOV (1), Charles COTTON (2) & Ingvar BYRKJEDAL (3)

- (1) Russian Federal Research Institute of Fisheries and Oceanography (VNIRO), 17, V. Krasnoselskaya, Moscow, 107140, RUSSIA [orlov@vniro.ru]
- (2) **Virginia Institute of marine Science, P.O. Box 1346, Rt. 1208 Great Road, Gloucester Point, Virginia 23062, USA [chip@vims.edu]**
- (3) Museum of Zoology (Bergen Museum), University of Bergen, Muséplass 3, N-5007 Bergen, NORWAY [ingvar.byrkjedal@zmb.uib.no]

The fauna of deepwater skates of the North Atlantic is insufficiently studied. Many deepwater batoids were discovered rather recently (second half of XXth century) and are known from a few records only. In the summer 2004 studies of bottom ichthyofauna were conducted aboard Norwegian R/V G.O. Sars (bottom trawls, depths down to 3,500 m) and longliner MS Loran (bottom longlines, depths down to 4,500 m) off the Mid-Atlantic Ridge (MAR) area from Azores to Charlie-Gibbs Fracture Zone. Skate samples were not diverse. Only four species were identified, these were Richardson's ray *Bathyraja richardsoni*, pale ray *Bathyraja pallida*, Jensen's skate *Raja (Amblyraja) jenseni*, and Bigelow's ray *Raja (Rajella) bigelowi*. Richardson's ray has until present been considered a rather rare species. It was described in the earlier 1960s from waters off New Zealand and subsequently found occasionally at great depths in the western and eastern North Atlantic, including MAR area. According to published data, only about 60 records of this species are known to date. Our study showed that Richardson's ray is a common skate in the area surveyed. The 11 specimens captured by the R/V G.O. Sars and about 150 captured by MS Loran allowed us to obtain new data on external morphology, spatial distribution, size composition, sex ratio, maturation and sexual dimorphism of this species. A capture of a single specimen of pale ray represented a first record for the MAR area. This skate, which was also described in the 1960s, has been known until present by seven records only in the North Atlantic from the Bay of Biscay to Rockall Trough. Jensen's skate was also captured for the first time in the MAR area (several specimens). This species is distributed off the coasts of Canada and USA and only a single record had previously been known from the Northeast Atlantic, off the Rockall Trough. The captures of juveniles, and adults in postspawning condition, testify that the MAR area is a regular part of the range of Jensen's skate, which is not limited to coastal North American waters but extends far into the open central North Atlantic. Bigelow's ray was represented in catches by two neonates but both specimens had some morphological characters similar to those of congeneric deepwater ray *R. bathyphila*. Moreover, some morphological characters of the specimens examined neither fitted the original description nor published data that probably related to limited number of neonates of both species examined to date.

P16

BEHAVIOUR OF THE GREY REEF SHARK, *CARCHARHINUS AMBLYRHYNCHOS*, IN THE TIPUTA PASS, RANGIROA (FRENCH POLYNESIA)

Danilo PACIFICI

Via delle Betulle 117, 00171 Roma, ITALY [danilo.pacifici@libero.it]

The most common sharks in the waters surrounding the Rangiroa atoll (Tuamotu archipelago, French Polynesia) are the grey reef shark, *Carcharhinus amblyrhynchos*, the blacktip reef shark, *Carcharhinus melanopterus*, and the silvertip shark, *Carcharhinus albimarginatus*. A vertical distribution of these sharks has been observed in the Tiputa Pass of Rangiroa: *C. melanopterus* most commonly occurred in the superficial layers, from surface to about 30 m depth, *C. amblyrhynchos* was observed in deeper water down to 70 m, mainly outside the pass, but near the reef, and *C. albimarginatus* was constantly in deep water over the external reef slope. In the pass I observed aggregations up to about 200 individuals of *C. amblyrhynchos*, swimming against the drifts induced by the alternating tidal movements: penetrating into the lagoon in the afternoon and going out in the morning. It is suggested that this behaviour is aimed to improve oxygenation. Furthermore it is common knowledge that the large aggregations observed in the pass are due to the breeding ground of the lagoon; it has been observed that some females were so exhausted that looked almost dead because

of brutal mating with several males. However I noticed that some young sharks (males and females) were lying motionless too, even if they were not in reproductive age; so I speculate that some complementary phenomenon, in addition to the sexual activity, is involved in the induction of sharks motionless. In conclusion I suggest that in the Tiputa Pass sharks aggregate is in order to improve oxygenation, which helps them in different situations, as during the reproduction, and some sharks are motionless not only because of the sexual activity.

P17

ENDOCRINE CONTROL OF VITELLOGENESIS IN *TORPEDO MARMORATA* : ROLE OF 17BETA-ESTRADIOL AND PROGESTERONE

Marina PRISCO, Salvatore VALIANTE, Loredana RICCHIARI, Giuseppina DEL GIUDICE
& Piero ANDREUCETTI

Dipartimento delle Scienze Biologiche, Università degli Studi di Napoli Federico II, Via Mezzocannone 8, 80134 Napoli, ITALY [maprisco@unina.it]

Vertebrate vitellogenesis is a process under multihormonal regulation, up-regulated by 17beta-estradiol and inhibited by progesterone. This work is focused on 17beta-estradiol role in induction and regulation of hepatic vitellogenesis in males and females of *Torpedo marmorata*. We demonstrated that in males of *Torpedo marmorata* 17beta-estradiol induces in the liver the synthesis of a molecule that is then secreted in the blood stream as a 205 kDa polypeptide, that reacts with an anti-VTG antibody and correspond to the female vitellogenin (VTG). In the females at different stages of the reproductive cycle (immature, mature non-pregnant, mature pregnant) a close correlation between the estradiol and progesterone plasma levels and hepatic vitellogenesis has been shown. In particular, in mature vitellogenic females, with high plasma levels of estradiol and lower levels of progesterone, the liver is engaged in the synthesis and secretion of VTG; in immature and pregnant females, with low levels of estradiol and higher levels of progesterone, on the contrary, the liver shows no evidence of VTG synthesis. The present data indicate that 17beta-estradiol and progesterone regulate the synthesis of hepatic VTG in *Torpedo marmorata*.

P18

GALEUS ATLANTICUS DISTRIBUTION PATTERN AND BIOLOGY ASPECTS IN THE ALBORAN SEA. SEXUAL DIVERGENCES WITH ITS RELATIVE *GALEUS MELASTOMUS*

Javi REY (1), Domingo LLORIS (2), Bernard SÉRET (3), Rui P. Andrade COELHO(4)
& Luis GIL DE SOLA (1)

- (1) Instituto Español de Oceanografía (IEO), Muelle pesquero s/n, 29640 Fuengirola, Malaga, SPAIN [javier.rey@ma.ieo.es] [gildesola@ma.ieo.es]
- (2) Institut de Ciències del Mar (CMIMA-CSIC), Departament de Recursos Marins Renovables, Grup d' Ictiologia Marina (GIM), Passeig Marítim, 37 – 49 08003 – Barcelona, SPAIN [lloris@icm.csic.es]
- (3) Muséum National d'Histoire Naturelle, Département Systématique et Evolution, UMS 602 « Taxonomie et Collections », Case postale n° 26, 43 rue Cuvier, 75231 Paris cedex 05, FRANCE [seret@mnhn.fr]
- (4) Universidade do Algarve, Faculdade de Ciências do Mar e Ambiente, Campus de Gambelas, 8000 – Faro, PORTUGAL [rpcoelho@ualg.pt]

GALEUS ATLANTICUS IS A SINGULAR SPECIES LIVING ON THE ALBORAN SEA SLOPE BOTTOMS. IT HAS BEEN USUALLY MIXED UP WITH ITS COMMON RELATIVE *GALEUS MELASTOMUS*, DUE TO ITS EXTERNAL SIMILARITY. A SLIGHTLY DIFFERENT PATCH PATTERN ALLOWS THE SEPARATION OF THE INDIVIDUALS. MORE USUAL THAN GENERALLY THOUGHT, IT HAS BEEN CAPTURED IN THE TRAWL SURVEYS CARRIED OUT IN THE ALBORAN WATERS. A FEW INDIVIDUALS OF *G. ATLANTICUS* APPEAR SPORADICALLY, AT ALL TIMES AMONG THE ABUNDANT CAPTURES OF *G. MELASTOMUS*. A TOTAL OF 248 INDIVIDUALS CAPTURED FROM 2000 TO 2002 SURVEYS ARE ANALYSED. *G. ATLANTICUS* OCCURS IN THE WHOLE ALBORAN SEA, BETWEEN GIBRALTAR STRAIGHT AND CAPE OF GATA, INCLUDING THE ALBORAN ISLAND SLOPE. ITS BATHYMETRIC RANGE EXTENDS FROM 330 TO 710 M. NO SIZE-DEPTH TRENDS HAVE BEEN OBSERVED.

P19

ASPECTS ON DISTRIBUTION AND BIOLOGY OF THE MAIN DEMERSAL SHARKS ON THE ALBORAN SLOPE (SOUTH-WESTERN MEDITERRANEAN)

Javi REY, Cristina GARCÍA & Luis GIL DE SOLA

Instituto Español de Oceanografía. Centro Oceanográfico de Málaga. Muelle pesquero s/n. 29640 Fuengirola, Málaga, SPAIN [javier.rey@ma.ieo.es] [cristina.garcia@ma.ieo.es] [gildesola@ma.ieo.es]

In the Alboran slope, three demersal chondrichthyans species, *Galeus melastomus*, *Etmopterus spinax* and *Chimaera monstrosa*, reach the highest biomass and densities values for the whole Mediterranean (Baino *et al.*, 2001, Bertrand *et al.*, 2000). *G. melastomus* is the most abundant amongst them and some studies about their biology in the area (Rey *et al.*, 2005) and elsewhere in the Mediterranean (Tursi, 1993) have been undertaken. For *E. spinax* and *C. monstrosa* information is scarce (Ungaro *et al.* 1997) and for the first time we show here some results about its bathymetric distribution, size frequencies and reproduction in the Alboran sea (western Mediterranean).

P20

CULTURAL IMPORTANCE AND DECLINE OF POPULATIONS OF THE SAWFISHES (PRISTIDAE) IN WEST AFRICA

Marine ROBILLARD (1), Bernard SERET (2), Candice YVON (3) & Antoine CADI (4)

- (1) Muséum national d'Histoire naturelle, Département Homme, Nature et Sociétés, 43 rue Cuvier, 75231 Paris cedex 05, France [m.robillard@laposte.net]
- (2) Muséum national d'Histoire naturelle, Département Systématique et Evolution, UMS 602 « Taxonomie et Collections », Case postale n° 26, 43 rue Cuvier, 75231 Paris cedex 05, FRANCE [seret@mnhn.fr]
- (3) Université de Genève, Faculté des Sciences, Section de Biologie, CH-1211 Genève 4, SUISSE
- (4) Noé Conservation, 5 bis avenue Edouard Herriot, 91440 Bures-sur-Yvette, FRANCE

For a few decades, the decline of populations of sawfishes has been observed in all parts of their distribution range. Sawfishes are particularly sensitive to exploitation and habitat destruction because of their large size and their coastal and river habitats. In West Africa, sawfishes were relatively common in the past, but nowadays, they are rarely caught or observed. A group of West African countries, under the leadership of the Commission Sous-Régionale des Pêches, was willing to submit an application for the listing of the sawfishes in CITES appendix 1. This caused the necessity to assess the present status of the species and populations of sawfishes occurring in West Africa, and to collect data on the cultural importance of the sawfishes for some ethnics. In this scope, a field study was carried out from March to June 2005, in Mauritania, Senegal, Gambia Guinea Bissau, and Guinea Conakry. This study confirms the strong reduction of the distribution range of sawfishes in West Africa: they are mainly limited to the Bissagos archipelago (Guinea Bissau), where cultural practices related to sawfish symbolism are still in use.

P21

CHECK-LIST OF THE SHARKS IN THE SARDINIA'S WATERS (CENTRAL MEDITERRANEAN SEA)

Tiziano STORAI (1), Benedetto CRISTO (2), Marco ZUFFA (3), Antonello FLORIS (4)
& Riccardo STURLA (5)

- (1) Museo Civico di Scienze Naturali della Valdinievole, P.zza Leonardo da Vinci 1, I-51017 Pescia (PT), ITALY [tstora@tin.it]
- (2) Istituto di Scienze Naturali e Biologia Marina Via Vulcano 44 I-07026 Olbia, ITALY [bencris@aliceposta.it]**
- (3) Shark Academy Onlus Via Prunaro 1, I-40064 Ozzano nell'Emilia (BO), ITALY
- (4) Dipartimento di Zoologia ed Antropologia Biologica dell'Università degli Studi di Sassari, C.so Regina Margherita 15, 07100 Sassari (SS), ITALY**
- (5) Shark Academy Onlus P.zza Olimpia 52, I-37138 Verona (VR), ITALY [direzione@sharkacademy.it]**

The biodiversity of the cartilaginous fishes of Sardinia (Central Mediterranean, Italy), is known since ancient times (Cetti, 1777). The S.L.E.D. (Sardinian Large Elasmobranch Database) project is a private project carried on by I. Sn. Bm. (Istituto di Scienze Naturali e Biologia marina) of Olbia with the cooperation of the Sassari University and other researchers, having as main object the historical and recent data records, collecting and the monitoring of the Elasmobranch species in the Sardinia's waters. During the last two years, in this sphere of search, beginning in 2003, 24 species of sharks have been checked. These species are relating to 12 families: Hexanchidae, Squalidae, Oxynotidae, Squatinidae, Odontaspidae, Alopidae, Cetorhinidae, Lamnidae, Scyliorhinidae, Triakidae, Carcharhinidae, Sphyrnidae. Other species (2) have been considered as not surely present in the area because the local fishermen know them also with dialectal name but there are no official reports from the data sources examined. As first result of S.L.E.D. project, the checked shark species are presented. At the end of the project (estimated time five years) the resulting database could be an useful instrument of investigation as to biodiversity and environmental monitoring for the coastal Sardinian waters.

P22

**FOOD HABITS OF SCALLOPED HAMMERHEAD, *SPHYRNA LEWINI*,
FROM MAZATLÁN, MEXICO**

Yassir TORRES-ROJAS (1), Agustín HERNÁNDEZ-HERRERA (1),
Felipe GALVÁN-MAGAÑA (1) & Ramón Enrique MORAN-ANGULO (2)

- (1) Centro Interdisciplinario de Ciencias Marinas. Av. IPN s/n. Apartado Postal 592. La Paz, Baja California Sur, C.P. 23000, MEXICO [fgalvan@ipn.mx]
(2) FACIMAR – UAS. Av. Claussen s/n. Mazatlán, MEXICO

The scalloped hammerhead shark (*Sphyrna lewini*) represents a high percentage of the traditional shark fleet catch off the coast of Mazatlan, Sinaloa. The objective of this study is to determine the food habits of *Sphyrna lewini* near Mazatlán, Mexico, and to describe the seasonal and spatial availability of prey and the habitat in which it is consumed. Samples were taken in the fishing area Playa Sur during the four years from 2000 to 2004. Of the 558 stomachs of *Sphyrna lewini* we analyzed, 480 had food contents comprising 58 prey species. Using the number method, we counted 520 prey organisms, of which 325 were fish, 145 were cephalopods and 50 were crustaceans. In general analysis, the diet consisted mainly of the cephalopod *Loliolopsis diomedea* with index of relative importance (IRI) of 38.18 %, followed by fish of the Carangidae family with 26.75 %, the pelagic crab *Pleuroncodes planipes* with 11.19%, and *Decapterus sp.* with 4.75%. The diet of females was mainly *Loliolopsis diomedea* with an IRI of 32.17 %, followed by fish of the Carangidae family with 25.28 %, and *Selar crumenophthalmus* with 8.04%. The males presented a wide trophic spectrum, including *Ophichthus triserialis* (1.12 %) and *Sicyonia disdorsalis* (0.18 %) in addition to the prey observed for females. According to the trophic niche width of 8.08, the scalloped hammerhead shark presents a pattern of generalist feeding, from which we infer that its feeding behavior is not selective, and that the type and the amount of prey are determined by their abundance and availability.

P23

DISTRIBUTION OF DEEP-WATER SHARKS OFF ANGOLAN WATERS

Diana ZAERA

Havforskningsinstituttet, Nordnesgaten 50, P.O.Box 1870 Nordnes, 5817 Bergen, NORWAY
[diana.zaera-perez@imr.no]

Angolan waters are poorly known relatively to their deepwater biodiversity, specially at depths greater than 500 m, and sharks are not an exception. The distributional records are often inexact and given as ranges (broad geographical and bathymetric limits with no details on the distribution). With this work, we hope to contribute to a better knowledge of the deep-water sharks of the area and of the distribution of some species. This non-exhaustive list of 19 deep-water shark species, as the surveys were targeted to the commercial fauna, is a collection on 268 stations, during 7 cruises of Dr Fridtjof Nansen conducted between 2002 and 2005. The area surveyed stretches from Congo River (06°00' S) to Cunene River (17°15' S), respectively in Northern and Southern Angola, covering a depth range between 20 and 820 m. Summaries of geographic and bathymetric distribution are presented. The surveys revealed the same range extensions for several groups of the described species, with similar depth and latitudinal distributions. These groups were identified and analyzed; including sympatry and allopatry for related species. A relative measure of species diversity by depth

was calculated. A diversity index as the average number of species at each station by depth was generated to compare species diversity at different depths and latitudes.