EEA '15

European Elasmobranch Association Scientific Conference

9 - 11 OCTOBER 2015 | PENICHE - PORTUGAL

Escola Superior de Turismo e Tecnologia do Mar

BOOK OF ABSTRACTS

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WELCOME TO THE 19th ANNUAL SCIENTIFIC CONFERENCE OF THE EUROPEAN ELASMOBRANCH ASSOCIATION

The Portuguese Association for the Study and Conservation of Elasmobranchs, MARE – Marine and Environmental Sciences Centre, the Polytechnic Institute of Leiria and Flying Sharks are the proud hosts of the 19th Annual Scientific Conference of the European Elasmobranch Association from the 9th to the 11th of October at the Superior School of Tourism and Maritime Technology, in Peniche, Portugal.

The conference will provide a platform for those involved in international science and policy and aims to help coordinate the information necessary for the development and implementation of management measures for rays and sharks in European waters. EEA 2015 will be of interest to all those who are involved in the study, management and conservation of chondrichthyans (sharks, skates, rays and chimaeras).

We are also delighted to welcome the awesome Dr. Samuel Gruber to our meeting as a key-note speaker!

A kind word of sincere thanks to our wonderful sponsors, **Save our Seas Foundation** and **Sealife**, who have generously donated funds for us to fly Dr. Gruber to Peniche, and also award 10 Student Bursaries for young researchers who are presenting their research at the meeting!

We look forward to welcoming you to Peniche and please do not hesitate to contact us (see contacts below, precede with +351 for Portugal) if there's anything we can do to make your stay more pleasurable.

Kind regards,

The Organizing Committee

GENERAL INFORMATION

VENUE

The conference is being hosted at the Superior School of Tourism and Maritime Technology (ESTM) in Peniche, Portugal. The School is one of the Campus of the Polytechnic Institute of Leiria (IPL). Facing the beautiful Atlantic Ocean, just one hour north of Lisbon. ESTM / IPL is a privileged place to study, with fine people, Berlengas' natural marine reserve as landscape, sandy beaches as well as many diving and surf spots in the vicinity. It is located in Santuário de Nossa Senhora dos Remédios, 2520–641 Peniche.
(GPS: 39º 21' 53" N | 9º 24' 11" W)

HOW TO GET TO PENICHE

The closest airport to Peniche is in Lisbon, approximately 90 Km south.

By bus:
From Lisbon airport, take the subway to Sete Rios/Jardim Zoológico, where you can catch a bus to Peniche.

By car:
From Lisbon:
Follow the A8 to Caldas da Rainha until you arrive to IP6. Then follow IP6 directly to Peniche.

From the North:
Follow A1 until Leiria. In Leiria take A8 and head towards Óbidos until you arrive to IP6. Then follow IP6 directly to Peniche

TRANSPORTATION BETWEEN THE HOTEL AND MEETING VENUE (ESTM)

A bus will shuttle conference participants from Hotel Solei to the school every morning and afternoon during the 30 minutes before and after the meetings. You may walk from Hotel Soleil to the school (north blue path in the map below) but it is an aproximately 45 minute walk, although the scenery is breathtaking. Don't take this walk if the weather is rough, as waves will crash onto the road! Take the "city" blue path instead (60 min. walk) and enjoy a lovely "Pastel de Nata" in one of the many cafés ("Pastelaria").

PRESENTATIONS

Oral communications must not go over 12 minutes for presentation and 3 minutes for questions.
All presentations should be given in advance to the congress secretariat. All presenters should check their presentations ahead of time.
Posters must be placed upon arrival in the poster area (please ask the secretariat where it is). Presenting authors are asked to remain close to their poster during coffee-breaks to answer any questions from the participants.

COFFEE-BREAKS AND LUNCHES

Coffee-breaks are free for all attendees and will be served on the first floor, right outside the conference auditorium. Lunch is available from the school canteen and cafeteria and are paid in the moment. A few nearby cafés offer other alternatives as well.

GALA DINNER

Satuday, the 10th, is gala dinner time, which will take place in Hotel Soleil Peniche. Be sure to bring your sharky items, as well as dancing shoes (!), as we will be auctioning shark-related goodies in our traditional "informal" fashion... ("Informal" might be a bit of an understatement... ;-)
All funds from the auction are used to support student travel to scientific meetings.
Dress code: "casual chick".

LOVELY PENICHE

Peniche is a busy fishing town with a large harbor and some excellent seafood restaurants. The town's most famous building is an imposing 16th century fortress. It was once used as a prison controlled by dictator Salazar's secret police to incarcerate political opponents and today houses a museum about local history. We booked a room for presenter's who go over their time, though.
There are some fantastic sandy beaches nearby, namely Baleal, and Cabo Carvoeiro stands proudly to the west, a rugged cape with bizarrely shaped pinnacles and sea caves offering panoramic ocean views all the way to the islands of Berlengas, a marine protected area and World Natural Heritage where diving is excelent.
Currently, Peniche is recognized as "Wave Capital", due to its phenomenal characteristics for surfing and the world surfing event "Rip Curl Pro". The most mythical contributor is perhaps Supertubos beach, world famous for its powerful waves, which many surfers call "The European Pipeline".

EMERGENCY CONTACTS

João Correia - mob. 91 947 5411

Nuno Vasco Rodrigues – mob. 91 154 7220

Nuno Queiroz – mob. 96 732 7937

Marco Lemos – mob. 91 948 0570

Luís Alves – mob. 91 153 7738

Sofia Silva – mob. 91 906 6119

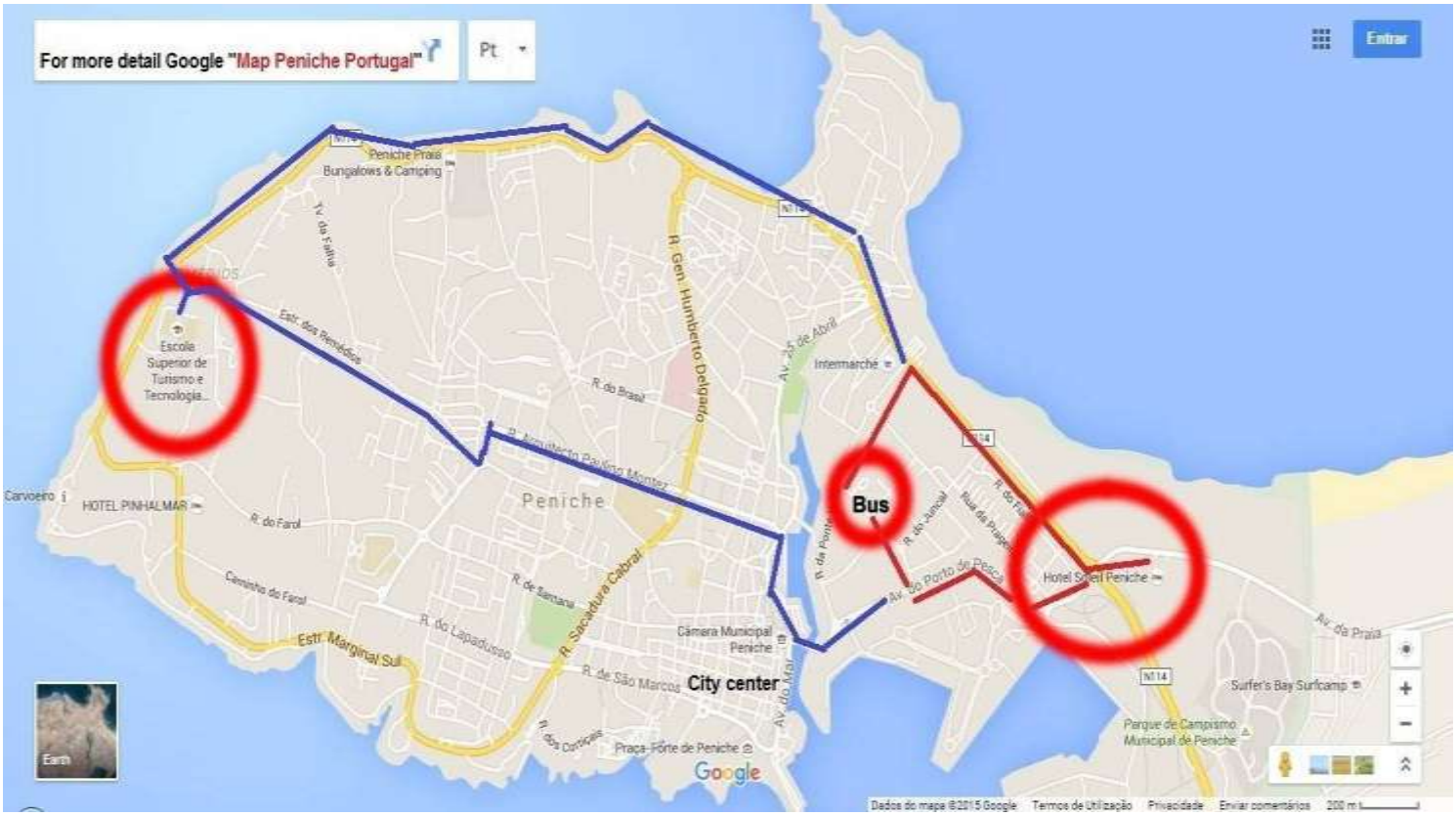
TAXIS IN PENICHE

262 782 687

967 123 500

262 084 867

PENICHE MAP



KEYNOTE SPEAKERS

DOCTOR SAMUEL GRUBER

Picture: Doc Gruber swimming with a shark in Bimini, Bahamas.

Doc Gruber conducted field studies at marine stations at Eilat, Israel, Hurghada, Egypt and Okinawa, Japan. His position was Tenured Full Professor at the Rosenstiel School of Marine and Atmospheric Science (RSMAS), University of Miami; he also serves as Adjunct Professor of Biology with the University of North Carolina (Wilmington) and is founder and director of the Bimini Biological Field Station, Bimini, Bahamas. Dr. Gruber was council member of the Bahamas National Trust and board member of the Uni-versity of Southern Mississippi's College of Marine Science.

Dr. Gruber is a recognized authority of shark behavior both as to field studies and in regard to visually guided behavior, and physiology. He was a longtime member of numerous professional societies and founded the American Elasmobranch Society in 1983. He founded the World Conservation Union's (IUCN) Shark Specialist Group and was its Chairperson between 1991 and 1996.

He has presented over 125 meeting and invited lectures on a wide range of topics related to shark biology. He has mentored over 35 graduate students at UM and elsewhere, worked tirelessly to promote conservation of sharks, educational opportunities for teachers and minority high school students, provided professional service as a grant reviewer and has taught advanced courses at UM in animal behavior, tropical marine biology, and the physiology and behavior of marine organisms.

The National Science Foundation, the Office of Naval Research, the State of Florida, the US-Israel Binational Science Foundation and many NGOs have funded Dr. Gruber's nearly 50-year research career. He has been expedition leader and chief scientist on over 50 research cruises around the Atlantic Ocean. His prolific research career has thus far resulted in about 190 peer-reviewed, scientific publications. These ranged from works on shark repellants (including natural repellants such as that secreted by the Moses sole); shark maintenance in the laboratory; the visual, olfactory, and acoustic system of sharks; bioenergetics, age and growth, productivity, survival and nutrition in sharks; telemetry studies including habitat selection and homing of lemon sharks and eagle rays; circulating steroid hormones; commensal behaviors of stingrays and cleaner wrasses; and a number of anatomical studies on sharks. His recent emphasis has been on the behavior, ecology and conservation biology of sharks.

LEWIS COCKS

Picture: Lewis Cocks (Left) preparing for a dive with Red Sea dive pioneer Hagan Schmid

Despite the young age of 25, Lewis has over 10 years of Aquatic experience in professional and academic areas spanning three continents. Landing his first job in an aquarium store in the UK when he was just 14, he secured a intern placement at Melbourne Aquarium in Australia at 17 as a part of his studies. Lewis focused his educational goals around marine studies including a top grade in Ornamental Fish Management Diploma from Sparsholt College (UK), a Bachelor of Science (Hons) in Marine Conservation and a Master of Science in Sustainable Aquaculture Systems from the University of Plymouth, UK. During his time in Plymouth, Lewis became a fully qualified commercial HSE Part IV Pro SCUBA diver which enabled him to become involved in many research projects across the South of England including surveys of seagrass beds and *Sepia officinalis* egg recruitment for CRESH (Cephalopod Recruitment from English-Channel Spawning Habitats).

Throughout his Master's program, Lewis focused his research on conservation related studies of the European Lobster (*Homarus gammarus*) with analysis of the lipid nutrition within the diets of juvenile lobsters with a publication (pending) entitled 'Enhancement of formulated diets for juvenile European lobsters (*Homarus gammarus*) regarding various levels of quality fish oil and fatty acids in conjunction with the National Lobster Hatchery, Padstow.'

Since 2013, Lewis has worked in Saudi Arabia as a Marine biologist/Senior Aquarist for Issham Aquatics who are the largest aquarium design, operation and maintenance company based in the Middle East, and are responsible for some of the most unique and bespoke aquariums in the region. At Issham Aquatics, Lewis is part of a team of 50 other aquatics staff, where he and Project Manager Alex Shepherd oversee aquarium husbandry and ensure that it is being carried out to public aquarium standards.

Lewis's current primary work site is at one of Issham's oldest projects known as AAA Aquarium. Located on the central Red Sea coast, this facility is a privately owned site with various aquatic exhibits including the 'Shark Lagoons' which will be detailed in the EEA presentation. This facility has been working with elasmobranchs and other aquatic species for over 20 years and has proudly had several captive breeding successes which Lewis is working on documenting and developing further, alongside the facility Director Jonathan Mee.

PROGRAM

	9 October :: Friday
8:00 - 10:00	EEA Board Meeting (EEA Board members only)
08:30	Buses start departing from Hotel Soleil to ESTM - Registration opens
10:30	Welcome address
10:45	Samuel Gruber - War on Ignorance: My 55 year Battle to Understand and Explain Sharks
11:30	Pedro Afonso - Dynamics of whale shark and Chilean devil ray at their north Atlantic fringe habitat
11:45	Frederic Vandeperre - Essential pelagic habitat of juvenile blue shark (*Prionace glauca*) in the North Atlantic
12:00	Marisa Vedor - Behavioural shift of blue sharks in Oxygen Minimum Zones
12:15	James Thorburn - Site fidelity, connectivity and distribution of tope (*Galeorhinus galeus*) in the North East Atlantic: a multidisciplinary study
12:30	Eva Meyers - Understanding connectivity and movement patterns of angel sharks (*Squatina squatina*) in the Canary Islands
12:45	Liam Dickson - Does spatial distribution of lemon sharks (*Negaprion brevirostris*) in the wild correlate with temperament in semi-captivity?
13:00 - 14:00	Lunch break
14:00	Emilio Sperone - Do the behaviour of white shark change with age and sex of individuals?
14:15	Robert Bullock - Diary of a shark: Using accelerometry to reveal fine-scale patterns in behaviour and activity
14:30	Martin Romain - Integrating distribution and behavioral patterns of the juvenile blacktip reef shark (*Carcharhinus melanopterus*) in the framework of the global management lan of Moorea coral reef, French Polynesia
14:45	Jeffrey de Pauw - Notes on hatching, rearing and medical treatment of zebra shark (*Stegostoma fasciatum*) juveniles
15:00	Jeffrey de Pauw - Husbandry and transportation of the scalloped hammerhead shark (*Sphyrna lewini*)
15:15	Jean-Denis Hibbitt - Managing the genetics of a captive species (Episode 2): *Raja undulata*
15:30 - 16:00	Coffee break
16:00 - 17:15	Session by PONG-Pesca
17:15 - 18:00	EEA groups present their delegation and yearly report
18:00 - 18:30	General assembly (EEA members only)
18:30 - 19:00	APECE General assembly (APECE members only)
19:00	Ice-breaker at the Soleil Hotel

	10 October :: Saturday
09:00	Lewis Cocks - Introduction to the 'Shark Lagoons' – a review of a unique elasmobranch and teleost exhibit emphasizing captive breeding successes over 17 years
09:45	Rui Rosa - Neuro-oxidative damage and aerobic potential loss of sharks under climate change
10:00	Ana Couto - Seasonal occurrence of basking sharks in the south of Portugal
10:15	Henriette Grimmel - Abundance and residency patterns of whale sharks (*Rhincodon typus*) at a provisioning site in Oslob, Philippines
10:30	Rui Coelho - Distribution patterns of blue shark in the Atlantic and Indian Oceans
10:45	Juerg Brunnschweiler - Occurrence of juvenile bull sharks (*Carcharhinus leucas*) in the Navua River in Fiji
11:00	Rui Rosa - 'Hotspot' of occurrence of smooth hammerhead (*Sphyrna zygaena*) in the temperate NE Atlantic
11:15 - 11:45	Coffee break
11:45	Ana Filipa Sobral - Azores seamounts as hotspots of *Mobula tarapacana* aggregations
12:00	Hemida Farid - Revised list of the sharks and rays from the Algerian basin
12:15	Cat Gordon - Searching for Sawfish in the UK: identifying rostra holdings
12:30	Simone Strandvad - Physiological and behavioural stress response in *Scyliorhinus canicula* following trawling
12:45	Paulo Torres - Trophic ecology and bioindicator potential of the North Atlantic tope shark
13:00	Sara Andreotti - New insights into the genetic structure of South African white sharks, *Carcharodon carcharias*
13:15 - 14:15	Lunch break
14:15	Elena Tamburin - Food preference and size hierarchy in captive sand tiger sharks
14:30	Pablo Garcia Salinas - An unexpected predation strategy: feeding mechanism on elasmobranch egg cases by the angular rough shark *Oxynotus centrina*
14:45	Colombo E.-Montano - Ontogenetic dietary of three species of pelagic sharks: *Alopias pelagicus* , *Carcharhinus falciformis* and *Prionace glauca* in the Marine Reserve Galápagos Island, Ecuador
15:00	Ana Veríssimo - Biodiversity of dogfishes (genus *Squalus*) in the eastern Atlantic and Mediterranean Sea – a molecular perspective
15:15	Simone Rizzuto - Evaluation of a biopsy system to collect white shark (Carcharodon carcharias, Linnaeus 1758) muscle
15:30	Alexis Simon - Species delimitation of carcharhinid sharks using next-generation sequencing and its implications for management
15:45	Claudia Junge - Comparative population genomics of two highly mobile whaler shark species caught in commercial and recreational fisheries
16:00 - 16:30	Coffee break
16:30	Ana Ferreira - Breeding and juvenile growth of the ribbontail stingray *Taeniura lymma* at Oceanário de Lisboa
16:45	Luís Alves - Assessment of blue shark (*Prionace glauca*) and Atlantic waters contamination through biochemical endpoints
17:00	Juanita Gutierrez - Mercury in muscle and liver of silky shark *Carcharhinus falciformis* from the Gulf of Tehuantepec, México
17:15	Jaime Penades Suay - Composition and diversity of helminth fauna of the shortfin mako (*Isurus oxyrinchus*) and the blue shark (*Prionace glauca*) in the NE Atlantic
17:30	Dawn Watson - Colour change in the Small Spotted Catshark (*Scyliorhinus canicula*)
17:45	Joana F.-Carvalho - Habitat use of bigeye thresher and smooth hammerhead sharks in the eastern Atlantic Ocean based on satellite electronic tagging
18:00	Ilena Zanella - Conservation of scalloped hammerhead shark (*Sphyrna lewini*) and its critical habitat in Golfo Dulce, Costa Rica
18:15	Andres Lopez - Habitat use of bull shark (*Carcharhinus leucas*) in Islas Murcilelago, Golfo de Papagayo, Costa Rica
20:00 - 23:30	Gala dinner

	11 October :: Sunday
09:00	Sarah Fowler - Measuring and mitigating extinction risk in European Chondrichthyans
09:15	João Correia - Can public aquaria help change the World?
09:30	John Richardson - The Bristol Channel Skate Fishery (ICES Division VIIf): investigating sustainability and responsible consumption
09:45	Claudia Junge - Combining forces: a multidisciplinary approach to unravel population structure in a heavily bycaught deepwater shark
10:00	Linda Planthof - Discard survival of European skates: the need for species-specific data
10:15	Simon Dedman - Spatial management of data-poor elasmobranchs using Boosted Regression Tree modelling
10:30	Ali Hood - Elasmobranchs & the E.U.: advocating for effective science-based management
10:45	Pierpaolo Brena - Environmental impact and management perspectives for shark and ray provisioning tourism
11:00 - 11:30	Coffee break
11:30	Irene Kingma - Introducing Save our Sharks – a campaign for shark & ray management in the Dutch Caribbean
11:45	Jorge Fontes - Can Deep Sea Sharks respond to short term protection? Looking into the deep
12:00	Katherin López - Reproduction of Velez ray (Raja velezi, Chirichigno 1973) in the Mexican Pacific
12:15	Alba Martin-Lázaro - The study of the relationship between squamation pattern and lifestyle as a potential tool for ecological inferences in deep water sharks
12:30	Bernardo Cota - Age and growth of the butterfly ray Gymnura marmorata (Cooper, 1864) in the southern occidental coast of Baja California Sur, México
12:45	Daniela Rosa - Age and growth of the smooth hammerhead shark, *Sphyrna zygaena* , in the Atlantic Ocean
13:00	Ana Hacohen-Domené - Seasonal variability in the distribution of giant manta rays *Manta* cf. *birostris* in the Mexican Caribbean Sea and evaluation of habitat suitability
13:15 - 13:30	Closing remarks

ABSTRACTS

War on Ignorance: My 55 year Battle to Understand and Explain Sharks

Samuel Gruber[1]

[1]Bimini Biological Field Station

Sharks are still as mysterious to me as they were when I first met them in the late 1940s. Yet after 55 years as a marine scientist, I have lived through a great battle to understand sharks and wish to tell this story as I saw it. As a youngster growing up in New York City in the 1940s I was already exposed to the marine world through the magic of the American Museum of Natural History. Later When I move to Florida In 1947 the ocean was at my doorstep. In the intervening years my focus was always on the sea, whether it be through sports, hobbies or study. With the audience's indulgence I would like to take them through this journey of great discovery covering what I saw and did during the interim between then and now.

Presentation type: Oral

Dynamics of whale shark and Chilean devil ray at their north Atlantic fringe habitat

Pedro Afonso[1]

[1]MARE/IMAR, University of the Azores

The highly migratory, large sized, filter feeder elasmobranchs are important yet substantially unknown components of marine biodiversity worldwide, mostly in tropical and subtropical seas. Their importance is grounded on the increase in scientific and public concern about the sustainability of their populations and integrity of their habitats. W hale shark (*Rhincodon typus*) and Chilean devil ray (*Mobula tarapacana*) have become to be two very important species for the emerging ecotourism in the Azores, north Atlantic, which they visit in the summer, presumably as destination for their annual large scale migrations. Very little is known of both species in their oceanic habitats. Here, we report findings of long-term monitoring programs (underwater visual census, fisheries observer, marine tourist operators) and biotelemetric studies conducted in the Azores. These findings shed new light on the importance of oceanic habitats for both species, in particular those located at the limit of their distribution range in the north Atlantic.

Presentation type: Oral

Essential pelagic habitat of juvenile blue shark (*Prionace glauca*) in the North Atlantic

Frederic Vandeperre[1]*, Pedro Afonso[1], Alex Aires-da-Silva[2], Marco Santos[1], Alan Bolten[3] and Ricardo Serrao Santos[1]

[1] Department of Oceanography and Fisheries, University of the Azores, PT-9901-862 Horta, Portugal

[2] Inter-American Tropical Tuna Commission, 8604 La Jolla Shores Drive, La Jolla CA 92037-1508, USA

[3] Archie Carr Center for Sea Turtle Research, University of Florida, PO BOX 118525 Gainesville, Florida, USA

In the North Atlantic (NA), the accessory capture of blue shark has become a key component of the longline fisheries traditionally directed at swordfish. Even so, the management and conservation of the species remains hampered by the poor knowledge of the complex life history of the species. In fact, like other pelagic sharks, the species is characterized by a dynamic and intricate segregation of sex and life stages in space and time. Insight in these dynamics is important as survival of particular life stages, in this case of juveniles, is essential for the sustainability of the population. The objective of this research is to define the essential pelagic habitat utilized by these juvenile life stages in terms of environmental variables (environmental space) in order to delineate sensitive areas for management purposes. This is achieved through the statistical modeling of both fisheries independent, i.e. satellite telemetry, and fisheries dependent data as both data sources provide complementary information, individual movement patterns vs. population abundance patterns respectively. The telemetry dataset consisted of tracks (up to 950 days) from 36 blue sharks of different sexes and life stages tagged with satellite transmitters (SPOT, PAT, mini-PAT) during successive cruises near the Azores archipelago. This area is located near the center of the blue shark distribution in the NA, i.e. where all life stages overlap, but the blue shark showed extensive movements, covering large parts of the NA. The fisheries data consist of data from different sources (research cruises and observers) from the central NA. We will present a novel analysis framework based on generalized additive mixed models (GAMM) and developed for our particular case study. The results will be discussed as well as their applicability for management.

Presentation type: Oral

Behavioural shift of blue sharks in Oxygen Minimum Zones

Marisa Vedor[1]

[1]CIBIO-UP

Oxygen Minimum Zones (OMZs) are hypoxic layers delimited vertically by sharp oxyclines present in several regions of the World's oceans. Off Cape Verde, in the eastern tropical Atlantic, a resident OMZ is found between 200 and 700 m depth, reaching minimum core oxygen levels of 40 μmol_{O2}/l. However, below 90 μmol_{O2}/l many aerobic processes are compromised and with less than 70 μmol_{O2}/l of dissolved oxygen in the water only few marine organisms are able to survive like cephalopods, for instance.

Blue sharks are active swimmers with an expected high energetic requirement, and thus have a high oxygen demand. Previous studies on billfishes have described a behavioural shift to shallower, more oxygenated waters when in the OMZ. In the present study, the movements of satellite tracked blue sharks within the OMZ show sharks spend up to 40% of their time in depths with less than 90 μmol_{O2}/L of dissolved oxygen, experiencing hypoxia at a minimum of 50 μmol_{O2}/L. Furthermore, sharks present in the OMZ shift their behaviour, shoaling more often to less than 500 m depth.

The population of blue sharks has been declining over the past decade due to longline fisheries. Longliners incidence is high in the OMZ, where 47% of all the fishing effort in the tropical eastern Atlantic occurs. Future climate change scenarios suggest both vertical and horizontal expansion of the OMZ. A proposed loss of 20 μmol_{O2}/L by 2100, will cause a shift of nearly 15 m in depth, increasing the overlap between blue sharks and fishing vessels by a maximum of 35% in the first 100 m. This study aims to draw effective conservation action plans to mitigate climate change consequences on the vulnerable population of blue sharks.

Presentation type: Oral

Site fidelity, connectivity and distribution of tope (Galeorhinus galeus) in the North East Atlantic: a multidisciplinary study

James Thorburn[1]

[1]Aberdeen University

Tope (*Galeorhinus galeus*) is a common elasmobranch in the North East Atlantic (NEA) where previous studies on mark and recapture (MR) data have struggled to find consistent movement patterns. Here, we combine survey and MR data to investigate the distribution of immature tope, and use deployed data storage tags (DST) to investigate depth distribution and finer scale movement to test those hypotheses forwarded by previous MR studies. Survey and MR data showed immature tope (less than 40 cm) were caught exclusively in continental shelf waters less than 45 m deep. Most tope remained within 500 km of their tagging site, although some mature females had a larger, more southerly range, including connectivity with the Mediterranean (MED), this connectivity was further evidenced by using molecular markers to look at population structure within the NEA and MED. Groups of mature males show limited range overlap while mature females have common ranges. Evidence of site fidelity was found in tope of all age and sex classes. Data from one DST showed that mature females move off the continental shelf to depths >800 m in the Bay of Biscay, while other DSTs showed that some tope remained in southern Scottish waters for several weeks, during which males appeared to synchronize behaviour for several days, suggesting exploitation of similar habitats. This study lends support to the hypothesis that tope in the NEA undertake seasonal movements southwards and strengthens the evidence for some regionalization, but does not support the concept of sex biased use of offshore habitat. There is no evidence that southerly movements represent a mass event, and it appears some tope remain on the continental shelf all year.

Presentation type: Oral

Understanding connectivity and movement patterns of angel sharks (*Squatina squatina*) in the Canary Islands

Eva Meyers[1,2], Joanna Barker[3], David Jimenez Alvarado[2], Ricardo Haroun[2], Dennis Rödder[1]

[1] ZFMK, Zoologisches Forschungsmuseum Alexander Koenig, Adenauerallee 160, 53113 Bonn, Germany
[2] ULPGC, Universidad Las Palmas de Gran Canaria, 35001 Las Palmas de Gran Canaria, Spain
[3] ZSL, Zoological Society of London, Regent´s Park, London, NW1 4RY, UK

The critically endangered angel shark (*Squatina squatina*) has suffered a vast fragmentation of its former distribution range, leaving the Canary Islands as a unique "hotspot". Here, angel sharks are present all year around, showing a spatial abundance gradient from the easternmost towards the westernmost islands of the archipelago. Local recreational SCUBA divers have reported seasonal encounters of all life stages through an online database. However, the movement patterns, connectivity and habitat use of angel sharks in the Canary Islands are still poorly understood. We have developed an underwater and land-based tagging and tissue sampling methodology to investigate connectivity and movement patterns of this species within and between islands. So far, we have successfully tested the underwater tagging methodology and tagged 54 adult and juvenile angel sharks in 4 islands using colour and numbered coded T-bar Floy Tags. Most sharks were detected and tagged at night. Tagging efforts have focused on the main aggregation sites identified in a previous study, particularly in nursery areas. Recaptures in dedicated surveys and re-sightings of tagged sharks have revealed that some individuals remained in the area for a period of time. We suggest that angel sharks show a temporal site fidelity to certain sites, e.g. nursery areas at a certain life stage and then most probably move on the vertical axis to deeper areas. Understanding movement patterns and connectivity of populations is crucial for the implementation of conservation strategies for this critically endangered shark species.

Presentation type: Oral

Does spatial distribution of lemon sharks (*Negaprion brevirostris*) in the wild correlate with temperament in semi-captivity?

Liam Dickson[1]

[1]Bimini Biological Field Station

Whether through predator-prey dynamics, interactions with conspecifics, or reactions to its environment, temperament (or behaviour) has a significant effect on the ways in which an individual interacts with its surroundings, and must be taken into consideration for effective management and conservation of a species. Behavioural studies in elasmobranchs have received little scientific attention, in part due to the difficulty of maintaining individuals in captivity, their conservation status, and often their large size. This study examines behavioural assay results from one of the first novel environment assays of a large-bodied elasmobranch, the lemon shark (*Negaprion brevirostris*), and compares these results to spatial distribution in the wild, using acoustic telemetry techniques. We used passive acoustic telemetry to determine home range SURs at 95% of total detections. Data from active acoustic telemetry was used to calculate home range estimates at 50% and 90% using minimum convex polygon (MCP) and fixed kernel estimators. We found a significant positive correlation between activity score (novel open environment assay) and the total number of SURs on which a shark was detected. Exploratory behaviour was correlated to number of home range SURs (95% of total detections). Analysis of active tracking results showed a significant correlation between activity score and mean distance to shore of tracking points, with a greater distance to shore for sharks with high activity scores. There was no significant correlation between shark size (PCL) and activity score, total number of detected SURs, or number of home range SURs. Our sample size was small (n=7 after filtering), and warrants repeated trials with a larger sample, however our mortality matched that of previous experiments. Through our results, we conclude that the behaviour of lemon sharks during novel environment tests for exploration are significantly correlated to their spatial use of habitat and their behaviour in the wild.

Presentation type: Oral

Do the behaviour of white shark change with age and sex of individuals?

Emilio Sperone[1], Gianni Giglio, Giuseppe Camigliano, Giuseppe Rjillo, Francesca Riviello, Mirko Della porta, Sharon Chiriaco, Laura Bevacqua, Armando Santoro, Marco Minervino, Sandro Tripepi, Primo Micarelli

[1]University of Calabria, Department of Biology, Ecology and Earth Sciences

Ten research expeditions were conducted at Dyer Island Marine Reserve (South Africa) to observe the surface behaviour of white sharks in the presence of bait. Observations were made from a commercial cage-diving boat. We observed 220 white sharks that exhibited 9 different types of behaviour: parading, bait following, visual inspection, breach, tail slap, tail stand, spy hop, repetitive aerial gaping, and head-up vertical emerging. Breach and tail slap were most often performed by male sharks, and tail slap and tail stand were more often performed by mature animals. The general ethogram consisted of an average of 20 behavioural units, with a significant transitional pattern from bait follow to parading and from parading to bait follow. The comparison of the ethograms between males and females did not revealed significant correlations, but the ethograms of female white sharks were more complex with more transitions between behavioural units. A significant correlation was observed comparing ethograms of mature and immature white sharks: young sharks performed more complex ethograms with a higher number of behavioural units.

The collected data suggested that the individual surface behaviour of white sharks is not a simple stimulus–response reflex, but rather a complex tactical situation in which animals show plastic responses. In particular, young sharks showed complex ethograms and this could be related to their low expertise. Probably, with the grow, white sharks define their individual behaviour and need less behavioural units to interact with the environment.

Presentation type: Oral

Diary of a shark: Using accelerometry to reveal fine-scale patterns in behaviour and activity

Robert Bullock[1], Cowx I.G., Elliott M., Guttridge T.G. and Gruber S.H.

[1]Hull International Fisheries Institute

Behaviour and activity in juvenile sharks are influenced by a range of factors including prey acquisition, predator avoidance and physiological performance. Understanding how sharks behave within a particular environment is requisite to understanding their requirements from it; however, due to logistical constraints few studies have investigated the compilation of specific behaviours that influence routine behaviour. Advancements in compact tagging technology now offers a sophisticated means to collect the quantitative behavioural data necessary to assign causality to observed patterns of movement and activity. This study used novel externally mounted tag packages to measure behaviour and activity in juvenile and sub-adult lemon sharks *Negaprion brevirostris*, developing quantified maps of space use in a mangrove nursery habitat. 24 sharks (86-169 L^T) were caught and tagged with fin mounted accelerometer/acoustic transmitter devices (CEFAS G6A accelerometer with Sonotronics PT4 acoustic transmitter). Accelerometer tags recorded fine-scale acceleration data (30Hz), temperature and depth (1Hz) over a 5 day period. Active and passive acoustic telemetry were used to provide spatial data. Findings demonstrated highly specialised use of available mangrove nursery habitat by young lemon sharks whereby tidal phase proved to be a primary driver for both behaviour and activity levels. The study further gives insight into the behavioural decision making processes of these sharks and considers the relevance of this research with regard to conservation and management policy.

Presentation type: Oral

Integrating distribution and behavioral patterns of the juvenile blacktip reef shark (C*archarhinus melanopterus)* in the framework of the global management plan of Moorea coral reef, French Polynesia

Martin Romain[1]

[1]Centre de recherches insulaires et observatoire de l'environnement (CRIOBE)

Global decline in shark populations leads to uncertainty in the future status of many species and conservation efforts are urgently needed. Marine protected areas are used increasingly as conservation tools around the world, although their benefits to sharks remain unclear. This study attempted to integrate the population size, life history (growth rate and mortality) and behavioral patterns (home range and homing abilities) of juvenile blacktip reef shark (*Carcharhinus melanopterus*) populations in the framework of the global management plan of Moorea Island, French Polynesia. From January to May 2012, 141 blacktip reef sharks were caught and tagged (125 juveniles, 5 sub-adults and 11 adults) within 14 sites spread throughout the island. Using the mark-recapture approach, we provided evidence of a significant decrease in relative juvenile population abundance throughout the period of study. We identified sites with higher abundance than others, characterizing nursery areas or occasional foraging areas. Based on recapture data, we refined growth rate estimate for the blacktip reef shark species; a step forward in the knowledge of such life stage life history. Sub-sampling within a specific site allowed the first estimation of juvenile blacktip reef sharks' home range within the island of Moorea and evidence of home range overlap with at least another species, the sicklefin lemon shark (*Negaprion acutidens*), was found. Finally, we attempted to integrate these results within the current global management plan of Moorea coral reefs.

Presentation type: Oral

Notes on hatching, rearing and medical treatment of zebra shark (*Stegostoma fasciatum*) juveniles

Jeffrey de Pauw[1]

[1]De Jong Marinelife

We would like to give an oral presentation because of our high amount of information we collected about the Stegostoma fasciatum juveniles. This information contains water parameters, growth rates (weight & length), high quality pictures, important tactics to avoid problems, early born neonates, picture of an embryo, pictures of symptoms caused by a bacterial infection, video of shown behaviour if infected and much more. All this information will be very useful for other institutions who have Stegostoma fasciatum juveniles or will have juveniles in the future.

In 2013 De Jong Marinelife imported a large Stegostoma fasciatum female from the Babuyan Channel. After one week she laid 3 egg capsules in our circular tank of 200.000 litres. A yolk sac was visible inside of the egg cases. To create perfect circumstances for the development of the neonates we prepared an incubation tank containing 2000 litres of water and a LSS.

After two months a strange behaviour was observed at some of the juveniles. These individuals were breathing faster and showing a paler colour. During this behaviour these individuals were still eating normally. Within 3 days the edges of the pectoral fins were getting inflamed and showing white mucous on the edges. At this moment 5 individuals were showing these symptoms. A variety of swabs for bacterial research from the infected group were taken. The swabs were sent to the Faculty of Veterinary Medicine in Utrecht. During the waiting time the symptoms got worse and at some individuals the caudal fin was showing tissue necrosis on the bottom side. The result of the bacterial research concluded the bacteria: Photobacterium damselae. The research also gave a list of antibiotics the Photobacterium damselae should be sensitive to.

Within 13 months all 23 healthy juveniles were transported to other public aquaria throughout Europe.

Presentation type: Oral

Husbandry and transportation of the scalloped hammerhead shark *(Sphyrna lewini)*

Jeffrey de Pauw[1]

[1]De Jong Marinelife

The Sphyrna lewini is one of the hardiest species during shark husbandry and do not forget about the transportation. Only 6 institutions throughout Europe are keeping the Sphyrna lewini on display (Survey by Reef HQ aquarium, June 2014). This makes getting new information about this species in captivity hard and are mainly behaviourism and observation researches.

First the hammerhead sharks are kept for several months at De Jong Marinelife before they are shipped to the institution. During this acclimatisation period knowledge has been gathered about their behaviour and feeding, but sadly also pathology reports from sharks that died. During the presentation these pathology reports will also be a topic to inform about possible threats which could show up at the Sphyrna lewini.

De Jong Marinelife has supplied the Sphyrna lewini to institutions throughout Europe and Israel. This results in a lot of expertise and information that has been gathered during the husbandry and transportation of the Sphyrna lewini. During this presentation information will be shared about the transportation method used to travel up to 48 hours by truck with the Sphyrna lewini. During these transports a variety of water parameters were measured. This will show the toleration these sharks can handle during transportation.

All this information will lead to more insight about this sensitive, but beautiful shark species. This will result in more information being shared with other institutions who are keeping the Sphyrna lewini or are going to keep this species in the future.

Presentation type: Oral

Managing the genetics of a captive species (Episode 2): *Raja undulata*

Jean-Denis Hibbitt[1]

[1]Merlin Animal Welfare and Developments (SEA LIFE)

Over a number of years, UK aquaria have been collaborating in a managed breeding program for the endangered and commercially protected undulate ray, *Raja undulata*.

To further enhance this program, genetic research was undertaken for the first time on this species to establish the genetic primers and microsatellites needed to allow the development of a concise pedigree and family tree of the existing population.

At last year's EEA meeting the reasoning and method behind this research was explained. This year the result of this work will be presented revealing the relatedness and genetic diversity of the population and the discussions and conclusions that these results have generated.

Presentation type: Oral

Introduction to the 'Shark Lagoons' – a review of a unique elasmobranch and teleost exhibit emphasizing captive breeding successes over 17 years

Lewis N. Cocks[1], Alex P. Shepherd[1], Jonathan K.L. Mee[1]

[1]Issham Aquatics/AAA Aquarium Systems, Jeddah, Saudi Arabia

Issham Aquatics is the largest Aquarium Design, Construction and Operation company in the Middle East, and has been involved in many unique aquarium projects. Often these projects are for residential Clients who greatly value their privacy. With this proviso, we are pleased to be able to share specifics with this year's EEA of one of Issham's oldest and most successful exhibits: the 'Shark Lagoons'.

The Shark Lagoons is an artificial, outdoor, essentially-open system which focuses on Red Sea elasmobranch and teleost species. It is one of the largest private collections of tropical elasmobranchs in the world, all set within the privacy of the owner's tropical gardens.

Commissioned in 1998, the system volume is approximately 1.5 million litres and currently has 12 elasmobranch species as well as numerous teleosts, sea turtles, and significant invertebrate fauna. Two separate lagoon areas allow us to separate different size and temperament exhibit animals. Our husbandry strategy has been to closely monitor the activity and behaviour of the exhibit animals, and to minimize invasive handling and husbandry techniques. We believe that this is a primary reason for the ongoing reproductive success for select elasmobranch species.

The artificial lagoons are constructed of concrete and GFRC which was specifically designed to appear as natural and similar to the nearby Red Sea biotope as possible. In order to maintain a safe and stable water temperature in an outdoor environment where air temperatures regularly exceed 35C for months on end the system utilizes large volumes of natural seawater which goes through single pass sand filters. Over the years this combination has allowed a natural recruitment of Red Sea corals, other invertebrates, and even larval reef fish which have formed a unique living reef within the confines of artificial lagoons - that co-exists with our larger predators – making this exhibit a one of a kind in the Aquarium World.

Presentation type: Oral

Neuro-oxidative damage and aerobic potential loss of sharks under climate change

Rui Rosa[1], Marta Pimentel[1], José Ricardo Paula[1], Ana R. Lopes[1,2], Miguel Baptista[1], Vanessa M. Lopes[1], Katja Trübenbach[1], Derek Campos[2], Vera M.F. Almeida-Val[2], Mário Diniz[3], Ricardo Calado[4], Tiago Repolho[1]

[1]MARE – Marine and Environmental Sciences Centre, Laboratório Marítimo da Guia, Faculdade de Ciências da Universidade de Lisboa, Av. Nossa Senhora do Cabo, 939, 2750-374 Cascais, Portugal

[2]Laboratory for Ecophysiology and Molecular Evolution (LEEM), National Institute for Amazonian Research (INPA), Manaus, AM, Brazil

[3]REQUIMTE, Departamento de Química, Centro de Química Fina e Biotecnologia, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Quinta da Torre 2829-516, Caparica, Portugal.

[4]Departamento de Biologia & CESAM, Universidade de Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

Sharks occupy high trophic levels in marine habitats and play a key role in the structure and function of marine communities. Their populations have been declining worldwide by ≥90% and their adaptive potential to future ocean conditions is believed to be limiting. Here we investigated the combined effects of tropical ocean warming (+4 °C; 30 °C) and acidification (ΔpH=0.5) on the respiratory, neuronal and antioxidant enzymatic machinery of recently-hatched bamboo shark (Chiloscyllium punctatum). Thirty days post hatching, juvenile sharks revealed a significant decrease in brain aerobic potential (citrate synthase activity) under warm acidified conditions. While brain aerobic potential was highly positively correlated with shark survival, anaerobic capacity (lactate dehydrogenase) was negatively correlated. Also, an array of antioxidant enzymes (glutathione S-Transferase, superoxide dismutase activity and catalase) acted in concert to detoxify ROS, but this significant up-regulation was not enough to minimize the drastic increase in brain's peroxidative damage and cholinergic neurotransmission. We argue that the future conditions may elicit deleterious deficiencies in sharks' critical biological processes which, at the long-term, may have detrimental cascading effects at population and ecosystem levels.

Presentation type: Oral

Seasonal occurrence of basking sharks in the south of Portugal

Ana Couto[1]

[1]MARE /CIBIO

Several efforts in describing the seasonal occurrence and distribution of basking sharks have been made in northern Europe, particularly in UK waters. However, nothing is known regarding the occurrence of this species in the south of Portugal. Using twenty years observational data (1995 – 2015) collected within a tuna set-net (TUNIPEX, SA) located in south Portugal (Olhão), we demonstrated that the occurrence of basking sharks in the area is highly seasonal, with basking sharks occurring mainly in spring months, which coincides with the beginning of the upwelling season. Data suggests that their presence is related with lower values of chlorophyll a, sea surface temperature (SST) and three month lagged Atlantic Multidecadal Oscillation (AMO) and Artic Oscillation (AO) as well as with higher values of one month lagged upwelling index (UI). This suggests that basking sharks are highly associated with the formation of upwelling filaments that occur after upwelling events, which are characterised by low SST/primary productivity, but high zooplankton biomass. The influence of AMO and AO in the presence of individuals seems to be due to their effect on SST (negative AMO and AO – lower SST values) or/and in alterations in intensity of trade winds which are known to affect upwelling along the coast of Portugal. This study provides the first long-term investigation on the presence of basking sharks in southern Portugal, increasing our knowledge on this species' distribution and habitat use in relation with environmental variables.

Presentation type: Oral

Abundance and residency patterns of whale sharks (*Rhincodon typus*) at a provisioning site in Oslob, Philippines

Henriette Grimmel[1]

[1]Large Marine Vertebrates Project Philippines (LAMAVE)

Shark viewing tourism is a burgeoning global industry. Numerous operations provide sharks with food to increase sightings yet the effects of provisioning on shark behaviour are often poorly understood. At a globally unique provisioning site in Oslob, Philippines, we used photo-ID surveys to assess the daily abundance and site visitation patterns of juvenile whale sharks (*Rhincodon typus*), which have become the focus of a largely unregulated, community run tourism operation since 2011. Over three years, we identified 209 individuals at the site (a 0.065 km2 area located 50 -100 m from shore), with an average of 12.4 (SD = ± 4.8, max = 31) sharks sighted per day. Daily shark abundance increased over time and showed strong seasonal variation, with annual peaks occurring between May and November. We documented a spectrum of site visitation patterns ranging from single occurrence (21% of sharks identified) to year-round residency (5% of sharks identified). For frequently sighted sharks, principal coordinate analysis based on co-occurrence matrices revealed two primary residency groupings: highly resident sharks (*N* = 9), which were seen year-round with few prolonged absences, and seasonal sharks (*N* = 20), which were primarily present between May and November. The daily abundance of highly resident sharks varied non-linearly over time with no clear trend, while the daily abundance of seasonal sharks showed a clear increase during peak season in each year of the study. By comparing these residency patterns with data from non-provisioned locations in the Philippines and elsewhere, we provide insight into the impacts of provisioning on shark movements and inform the debate surrounding the future of this controversial activity.

Presentation type: Oral

Distribution patterns of blue shark in the Atlantic and Indian Oceans

Rui Coelho[1,2], Jaime Mejuto, Andrés Domingo, Kotaro Yokawa, Kwang-Ming Liu, Enric Cortés, Evgeny Romanov, Charlene da Silva, Fábio Hazin, Freddy Arocha, Aldrin Masawbi Mwilima, Pascal Bach, Blanca García-Cortés, Ana M. Ramos-Cartelle, Pedro G. Lino, Rodrigo Forselledo, Federico Mas, Seiji Ohshimo, Wen-Pei Tsai, Philippe Sabarros, Felipe Carvalho, Miguel N. Santos.

[1]Centre of Marine Sciences of the Algarve (CCMAR)
[2]Portuguese Institute for the Ocean and Atmosphere (IPMA)

The blue shark, *Prionace glauca*, is the most captured shark in pelagic longline fisheries targeting tunas and swordfish. As part of an ongoing cooperative program for fisheries and biological data collection, information collected by fishery observers, logbooks, scientific projects and surveys from several fishing nations in the Atlantic and Indian Oceans were compiled and analyzed, including Brazil, France, Japan, Namibia, Portugal, Spain, South Africa, Taiwan, Uruguay, USA, USSR and Venezuela. Datasets included information on geographic location, size and sex, in a total of 447,453 blue shark records (370,415 from the Atlantic and 77,038 from the Indian Ocean), recorded between 1966 and 2014. Sizes ranged from 36 to 394 cm FL (fork length) and considerable variability was observed in the size distribution by region and season. Larger blue sharks tended to occur in equatorial and tropical regions and smaller specimens in higher latitudes in more temperate waters, both in the Atlantic and Indian Oceans. Some fleets/surveys showed bimodal size distributions, likely related with those fleets/surveys operating in several locations throughout those Ocean. Differences in the sex ratios were also detected both spatially and seasonally. The distributional patterns presented in this study provide a better understanding of different aspects of blue shark distribution patterns in the Atlantic and Indian Oceans, and are currently being used on ongoing stock assessments of this species to help promote more informed management and conservation measures.

Presentation type: Oral

Occurrence of juvenile bull sharks (*Carcharhinus leucas*) in the Navua River in Fiji

Diego Cardeñosa[1], Juerg M. Brunnschweiler[2]

[1]School of Marine and Atmospheric Science & Institute for Ocean Conservation Science, Stony Brook University, Stony Brook, New York 11794, USA
[2]Independent Researcher, Gladbachstrasse 60, CH-8044 Zurich, Switzerland

Effective species conservation requires the protection of all stages of its life-cycle. The Shark Reef Marine Reserve on the southern coast of Viti Levu is a small entrepreneurial marine protected area where large numbers of adult bull sharks (*Carcharhinus leucas*) congregate due to food provisioning. At the end of a calendar year bull sharks leave the area for reproductive activity but nursery grounds are unknown. Between March 2014 and January 2015 we collected Local Ecological Knowledge and conducted a fishing survey in order to assess presence and abundance of juvenile bull sharks in the Navua River. Eighty-four percent of fishers interviewed along the Navua River reported to either see or catch sharks up to 8 km upriver from the river mouth. They described them as small sharks having a rounded snout and being grey-brown in colour with a white belly, morphological characteristics that match juvenile bull sharks. During the fishing survey a total of seven juvenile bull sharks were captured including two that were recaptured after 108 and 92 days at liberty (recapture rate = 28.6%). Our findings suggest a low abundance of juvenile bull sharks in the Navua Rivercaused by anthropogenic impacts such as habitat degradation and overfishing.

Presentation type: Oral

'Hotspot' of occurrence of smooth hammerhead (*Sphyrna zygaena*) in the temperate NE Atlantic

Rui Rosa[1], Ana Couto[1,2], James T. Ketchum[3], Miguel Guerreiro[1], Miguel Furtado[1], Nuno Queiroz[2], André A. Cid[4], Joana Castro[1,4]

[1]MARE – Marine and Environmental Sciences Centre, Laboratório Marítimo da Guia, Faculdade de Ciências da Universidade de Lisboa, Av. Nossa Senhora do Cabo, 939, 2750-374 Cascais, Portugal
[2]CIBIO/InBIO, Universidade do Porto, Campus Agrário de Vairão, Rua Padre Armando Quintas, 4485-661 Vairão, Portugal
[3]Biotelemetry laboratory, Department of Wildlife, Fish, and Conservation Biology, University of California, Davis, Ca, USA
[4]Associação para a Investigação do Meio Marinho, Rua Maestro Frederico de Freitas Nº15, 1º andar, 1500-399 Lisboa, Portugal

Despite having a worldwide distribution, and being listed as 'vulnerable', the knowledge on the biology and ecology of the smooth hammerhead *Sphyrna zygaena* in the NE Atlantic is very scarce. Here, we reveal inter- and intra-annual fluctuations in *S. zygaena* abundance in the Portuguese southwest coast, using data from a platform of opportunity for five consecutive years (2010-2014). Moreover, we also investigated how shark abundance related to local environmental conditions and large-scale wind climatology. Besides the description of the first 'hotspot' in the Atlantic region, we show a recurrent pattern of occurrence during the warmer summer and autumn months (from July to October) near Sagres, around Martinhal bay and islands. The intra-annual variations suggest shark movements were linked to seasonal changes in sea surface temperature and not with a central refuging strategy. In other words, hammerheads became more coastal in the study area during the warmer periods. Although we did not find any association between hammerhead occurrence and several climate indexes, the inter-annual variations were negatively and significantly associated with chlorophyll *a* and were marginally (positive) linked with one month lagged upwelling index. We argue that the inter-annual differences may be related with changes in the vertical thermal structure of the water column. Although it has been suggested, without any empirical data, that this 'hotspot' may constitute a nursery ground for *S. zygaena,* the present data does not allow us to accept or refute such claim. Future telemetry-based studies should be conducted to fully understand hammerhead inshore movements and habitat preferences and evaluate the criticalness of this 'hotspot' for these endangered top predators.

Presentation type: Oral

Azores seamounts as hotspots of *Mobula tarapacana* aggregations

Ana Filipa Sobral[1]

[1]MARE – Marine and Environmental Sciences Centre, University of the Azores, Dept. of Oceanography and Fisheries, 9901-862 Horta, Açores, Portugal

A lot of questions on the biology and ecology of the mobulid rays remain unanswered, delaying the identification and implementation of adequate conservation and management measures. Located in the middle of the Atlantic Ocean, the Azores is one of the few places in the world where large schools of M. tarapacana are known to aggregate. Obtaining daily data on abundance and behaviour of highly migratory pelagic species can be very challenging. Regarding these aggregations it is economically and logistically impossible for researchers to regularly conduct research due to the fact that these aggregations are usually located in remote places. However, it is possible to enroll divers to collect and report important data on the occurrence and abundance of these species. In particular, through the submission of photos which allow to obtain key information (e.g. behaviour, threats, IDs). Multi-year observational records are relatively easy to collect and can provide vital insights into patterns of occurrence and behaviour of these species. The aim of this work was to describe the spatial and temporal patterns of mobulid occurrence in the region, including their aggregation dynamics, and use these data to discuss the ecological significance of Azorean seamounts as habitats for mobulid rays.

Presentation type: Oral

Revised list of the sharks and rays from the Algerian basin

Hemida F.[1], Touati A.[1], Capapé C.[2]

[1]Ecole Supérieure des Sciences de la Mer et du Littoral (ENSSMAL)

[2] Laboratoire d'Ichtyologie Montpellier II, Sciences et Techniques du Languedoc

A systematic survey of elasmobranchs is still occurring along the Algerian basin, up-dating the list of sharks and rays observed during marine surveys and regular visits to fish markets. Records were compared to former lists (Hemida, 1998; Hemida and Labidi, 2001; Hemida et Labidi, 2007) and critically evaluated by examining and accurately identifying specimens.

Twenty species of sharks (from 12 families) and 15 species of rays (genus *Raja*, *Rostroraja* and *Dipturus*) have been recorded, using international identification keys (Bauchot and Pras, 1980; Compagno, 1984; Whitehead & al., 1986; Fisher et al., 1987) and new criteria. A drastic decrease of the number of shark species is noticed (30 to 20).Personal works on systematic showed that *Centrophorus* and *Mustelus*, in the studied area, are considered as complexes (Hemida & al., 2009; Hemida & al., 2011) and include only one species each. Requiem sharks may be considered less frequent inhabitants of at least the Algerian basin, in the last few years: only *Carcharhinus brachyurus* occurs but rarely. Meanwhile *Prionace glauca* is still frequent and abundant alongside the Algerian coast, as *Hexanchus griseus*, and *Alopias vulpinus*. These species are regularly present in the markets and are consumed like the other commercial fishes.

As regards rays, there is no significant change except for *Dipturus* Rafinesque, 1810. Two species of this genus occur in the Mediterranean (Fischer *et al.,* 1987): *D. oxyrhincus* (Linnaeus, 1758) and *D. batis* (Linnaeus, 1758). These rays share similar characters and determination remained uncertain for some specimens. A recent study (Hemida & al., 2015) showed a taxonomic uncertainty regarding the putative species of this genus. The results demonstrate clearly that *Dipturus nidarosiensis* (Storm, 1881) occurs in the Algerian basin. Conversely, *Dipturus batis* is no more valid in this area.

Presentation type: Oral

Searching for Sawfish in the UK: identifying rostra holdings

Cat Gordon[1]

[1]The Shark Trust

Sawfish are large shark-like rays, characterised by a distinct toothed rostrum (or saw). Sawfish inhabit shallow coastal waters in tropical and subtropical countries, where they are exposed to coastal fisheries. The rostra, which can be more than one quarter of the total body length, can easily become entangled in fishing gear (particularly trawls and gillnets) leading to incidental capture. Rostra are highly prized for medicinal and cultural purposes, as well as sold as curios in the tourist trade. Subsequently, all five species of Sawfish are now classified as Endangered or Critically Endangered on the IUCN Red List. Recent IUCN assessments recognised that sawfish are arguably the most threatened family of marine fishes.

As a member of the Sawfish Network, the Shark Trust will work in collaboration with Network colleagues, including the Sawfish Conservation Society (SCS), to deliver on a number of actions listed in the recent Global Sawfish Conservation Strategy. In particular; increasing awareness, compliance with CITES regulations and mobilising a coordinated community. The SCS is assisting researchers to establish the 'See a Saw' programme with pro-forma datasheets for citizen scientists and researchers feeding a central database. The Shark Trust will be securing information on the extent of rostra holdings in the UK, including details of species (using tooth count), social history and where possible, a sample for DNA analysis. The information collated will contribute to research efforts in international studies and made readily available for future research – findings will further our understanding of these fishes and thus conservation efforts.

With sawfish non-native to the UK, all rostra specimens are imported artefacts - while some may be contemporary, purchased since the listing of sawfish on CITES, many artefacts will likely predate CITES listing.

With a number of grey areas associated with the implications of ownership of pre-listed CITES artefacts, the Shark Trust is also liaising with relevant authorities to clarify the implications of ownership, particularly with regards companies/businesses which may be perceived to be indirectly profiting from the display of such artefacts.

Presentation type: Oral

Physiological and behavioural stress response in *Scyliorhinus canicula* following trawling

Simone Strandvad[1]

[1]Aarhus University

Small-spotted catshark (*Scyliorhinus canicula*) are a common bycatch in trawl net, but are discarded due to low commercial value. Earlier studies show that catshark have a high survival rate to discard, but little is known about how their behaviour and physiology is affected by being caught in trawl nets. A trawl simulator was constructed in the lab and adult and juvenile small-spotted catshark were trawled for 4hours. Routine activity and forage activity of both adult and juvenile catshark were monitored 24h before and after trawl. Behaviour were then expresses as percentage of activity during 24h observation and for half an hour of foraging. Blood samples were taken from adult catsharks by venal puncture before and after trawl. Blood samples were used for haematocrit and tested for levels of glucose and lactate. Oxygen consumption after a trawl were measured on adult catsharks by indirect respirometer. In February 2015 the research vessel Dana went on a bottom trawl survey in the North Sea and for all catsharks caught. Blood from those catsharks were used to compare with samples taken in the lab. Juvenile catsharks became significant less active after trawl, whereas there was no significant difference in activity in adult catsharks. Haematocrit levels increased significantly showing a regulation in oxygen transport to the muscles. Glucose levels increased after trawl indicating allocation of energy storage. Lactate increased after trawl showing a certain level of anaerobe metabolism during the trawl. The samples collected on the research vessel were comparable with those taken in the lab.

Presentation type: Oral

Trophic ecology and bioindicator potential of the North Atlantic tope shark

Paulo Torres[1]

[1]CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, InBIO Laboratório Associado, Pólo dos Açores

Sharks are marine top predators vital in maintaining ecosystem health and food web structure. In order to assess tope shark (*Galeorhinus galeus*) trophic ecology, stable isotope ratios and trace metal concentrations in muscle tissue were determined, according to size and gender, for 124 individuals caught within the Mid-Atlantic region. Data was complemented and analysed according to previous stomach content information and compared with studies performed in the North East Atlantic. Our results revealed that tope sharks fed at a low trophic level and within a more pelagic-based food web when compared with other North Atlantic regions. MixSIR application reflected its piscivorous diet and study area topography, oligotrophic waters and volcanic nature, suggesting the occurrence of a Mid-Atlantic tope shark population. Considering a non-anthropogenic volcanic source for observed metal contents, the results reflect bioaccumulation and suggest biomagnification processes for As and Hg. These metals exceeded legislated maximum limits for some countries with a maximum of 28.98 ± 1.26 and 0.57 ± 0.01 mg kg-1 wet weight, respectively, increasing significantly with size for both males and females. Conversely, Cr, Rb and Zn were relatively stable while Cd and Pb were not detected. Hg and Se were strongly correlated, suggesting a Se toxicity mitigation role. Given tope shark travel capacity and the results obtained, the species may be used as a Mid-Atlantic bioindicator of environmental quality.

Presentation type: Oral

New insights into the genetic structure of South African white sharks, *Carcharodon carcharias*

Sara Andreotti[1], Sophie Von der Heyden[1], Romina Henriques[1], Michael Rutzen[2], Michael Meÿer[3], Herman Oosthuizen[3], Conrad A. Matthee[1]

[1]Evolutionary Genomics Group, Department of Botany and Zoology, Private Bag X1, Stellenbosch University, Stellenbosch 7600, South Africa

[2]Shark Diving Unlimited, Kleinbaai, Gansbaai, 7220, South Africa

[3]Department of Environmental Affairs, Branch Oceans and Coasts, Private Bag X2, Roggebaai 8012, South Africa

The white shark (*Carcharodon carcharias* L.) is one of oldest shark lineages, with an evolutionary history dating back to ~about 14 Ma. This species has a nearly worldwide distribution, with individual sharks having the potential for dispersing large distances. The South African coastline represents one of the major aggregation areas for white sharks in the world and anecdotal evidence suggests that the species occurs along the entire coastline. However, previous genetic studies indicated that the heterogenic nature of South African coastline resulted in disjointed genetic patterns of several continuously distributed species, corresponding to the main biogeographic provinces. In the case of the white shark, both thermal fronts and female site philopatry have been identified as limiting dispersal in Australia. It is thus a possibility that the South African aggregation sites also correspond to different genetically identifiable sub-population units. This study provides new insights into white shark evolution by determining the genetic structure of the white shark population around the South African coastline. Mitochondrial (839bp) and microsatellite analyses (14 loci) were performed on 302 free ranging white sharks, sampled between 2010 and 2014, from five known aggregation sites along the coastline. Genetic diversity, local population sub-structuring analyses and local phylogeographic patterns evidenced a lack of geographic sub-structuring for both the mtDNA and nuclear DNA data. Although two divergent mtDNA haplogroups were detected, the data sets show a remarkably low level of intraspecific genetic diversity. The observed South African mtDNA biogeographic pattern, and low diversity levels, may be a consequence of a severe bottleneck or a recent colonization event from one or two sources.

Presentation type: Oral

Food preference and size hierarchy in captive sand tiger sharks

Elena Tamburin[1],Dino Scaravelli[2], Stefania Puce[3]

[1]Centro Interdisciplinario de Ciencias Marinas, IPN s/n Street, Col. Playa Palo de Santa Rita, 23096, La Paz, Baja California Sur, México.

[2]Department of Veterinary Medical Sciences, Bologna University, 50 Tolara di sopra street, Ozzano Emilia, Bologna, Italy.

[3]Stefania Puce PhD, Department of Life and Environmental Sciences, Polytechnic University of Marche, Brecce Bianche street, 60131 Ancona, Italy.

Sand tiger sharks (*Carchariastaurus*) is one of the most frequent species in aquarium exhibitions, however the IUCN classifyit as vulnerable. This specie is protected in Australia, Africa and South America and it is in the list of prohibited species by the National Marine Fisheries Service (NMFS), due to the strongly impact of sport fishery on it.

Observations in aquariums and in the field allow discovering that their diet is mainly based on teleostean fishes and cephalopods. Individual preferences exist and are probably related to the sharks' behavior and social interactions inside the group.

A research was carried out in the Cattolica Aquarium (Italy) during the period 2006-2012 to investigate the individual feeding preferences and the social interactions in five sand tiger sharks.

The animals, four females and one male, were identified by body marks. The diet data were collected during the feeding sessions by the aquarium staff and in 2012 were carried out behavioral observations by focal animal sampling method.

Each shark showed food preferences, also independent from environmental parameters such as temperature and photoperiod. Sex, age and geographic origin of the specimens resulted factors conditioning their food choices.

Based on 1350 minutes of behavioral observations, sharks showed a social hierarchy related to size:larger specimens act as dominant, medium sized try to emerge from the group and the smallest shark try to reduce interactions with the bigger ones.

Therefore, this investigation puts in evidence that sharks can express food preferences in relation to the regularity of food offered in captivity and the role of social relationships in the shark group.

Presentation type: Oral

An unexpected predation strategy: feeding mechanism on elasmobranch egg cases by the angular rough shark *Oxynotus centrina*

Pablo García-Salinas[1], Javier Guallart[1]

[1]University of Valencia

The angular rough shark *Oxynotus centrina* has been considered as a suction feeder predator of worm-like preys and small crustaceans. However, recent evidences obtained from specimens maintained in different exhibition aquaria have shown that they can survive and grow healthy over a long period by feeding exclusively on elasmobranchs eggs content.

The process followed by the shark, making a small hole and sucking its content, leaves specific predation marks on the egg case. We analyse here predation marks made by three specimens of *Oxynotus centrina* kept in two different aquaria on eggs cases belonging to four elasmobranch species: *Scyliorhinus canicula*, *S. stellaris*, *Raja undulata* and *R. microocellata*.

A total of 329 predation marks have been studied in order to analyse differences left by *Oxynotus centrina* on the egg cases. Each egg case was studied fresh or rehydrated, measuring four parameters in the main hole and the surrounding teeth marks.

The study of the marks suggests a unique mechanism of suction feeding predation: the upper jaw holds the egg, while the middle teeth in bottom jaw make an incision. Then a semi-circular hole is created while the animal sucks the egg content and tears the capsule.

According to our data, depending on weight, size, and roughness of the egg case, the marks are slightly different. Therefore, marks found in the egg cases of *Scyliorhinus* spp. tend to be longer and narrower; while marks over *Raja* spp. are shorter and wider.

Predation on elasmobranch eggs cases by other zoological groups has been previously documented, but present study constitutes the first time that a mechanism of these features is described and confirmed for several specimens of angular rough sharks. In addition, characterization of the marks on stranded and/or predated eggs, could serve as an indirect evidence of the presence of the shark in some regions.

Presentation type: Oral

Ontogenetic dietary of three species of pelagic sharks: Alopias pelagicus, Carcharhinus falciformis and Prionace glauca in the Marine Reserve Galápagos Island, Ecuador

Colombo Estupiñán-Montaño[1], Felipe Galván-Magaña[1], Diego Páez-Rosas[2], Fernando Elorriaga Verplancken[1], Alberto Sánchez González[1], Leonardo Abitia-Cárdenas[1]

[1]Centro Interdisciplinario de Ciencias Marinas, IPN s/n Street, Col. Playa Palo de Santa Rita, 23096, La Paz, Baja California Sur, México.

[2]Programa PROMETEO. Secretaria Nacional de Educación Superior, Ciencia, Tecnología e Innovación. Calle Whymper E7-37 y Alpallana. Quito, Ecuador

The sharks are top predators, which play an important role in the energy regulation within the trophic web. Therefore investigate the variability of sharks isotopic niche through time allow us to understand the dynamic of the ecosystem. Our target is to study the ontogenetic dietary of three species of sharks in the Marine Reserve Galápagos Island using stables isotopes ($\delta^{13}C$ and $\delta^{15}N$). A total of 685 collagen vertebral powder samples were collected for pelagic thresher shark *Alopias pelagicus* (*n*=353), silky shark *Carcharhinus falciformis* (*n*=200) and blue shark *Prionace glauca* (*n*=132). The mean isotopic signal for *A.* pelagicus was -14.2±0.7‰ $\delta^{13}C$ and 9.8±1.4‰ $\delta^{15}N$; in *C. falciformis* it was of -14.3±0.7‰ $\delta^{13}C$ and 11.9±0.9‰ $\delta^{15}N$, and in *P. glauca* was -14.9±0.6‰ $\delta^{13}C$ and 15.5±2.1‰ $\delta^{15}N$. The $\delta^{13}C$ in males (-14.3‰±0.5) and female (-14.1±0.8‰) of *A. pelagicus* were statically different (*p=0.001*), in spite of $\delta^{15}N$ that present similar values (male = 9.8±1.3‰; female = 9.7±1.5‰; *p = 0.32*). The *C. falciformis* presented equal values for $\delta^{13}C$ (-14.3±0.7‰, *p=0.69*) for both male and female, but presented different values in $\delta^{15}N$ (male = 11.8±0.9‰; female = 12.2±0.9; *p=0.003*). For *P. glauca* the $\delta^{13}C$ signals in male (-15.1±0.6‰) were different from female values (-14.8±0.6‰) (*p=0.01*) and about $\delta^{15}N$, both males (15.2±1.2‰) and females (15.8±2.0‰) showed similar values (*p=0.09*). Isotopic niche analysis defined *A. pelagicus* (σ^2=1.4) and *P. glauca* (σ^2 =2.6) as opportunistic predator and *C. falciformis* (σ^2=0.9) as specialist predators. The analysis of $\delta^{13}C$ and $\delta^{15}N$ enrichment relative showed ontogenetic change in the feeding habits in the three species, this suggest change in the habitat use and the trophic position through the growth.

Presentation type: Oral

Biodiversity of dogfishes (genus Squalus) in the eastern Atlantic and Mediterranean Sea – a molecular perspective

Ana Veríssimo[1], A. M. Griffiths, D. Zaera-Perez, R. Leslie, S. Iglésias, B. Séret, P. Grigoriou, C. Gubili, J. Navarro, C. Duffy

[1]CIBIO – University of Porto

The genus *Squalus*, or dogfishes, includes many coastal shark species commonly caught in commercial fisheries around the world. Despite their abundance, species diversity within *Squalus* is still poorly understood. In fact, recent studies on the Indo-Pacific region have described several new species, highlighting the need for revisionary taxonomic work clarifying and discriminating the different taxa. Less attention has been paid to the diversity of *Squalus* in the Atlantic Ocean *sensulato*, where only five species have been reported out of the 27 species currently accepted for the genus, namely *S. acanthias, S. blainville, S. megalops, S. mitsukurii*, and *S. cubensis*. Notwithstanding, species identification across the region appears to be very inconsistent and there is great taxonomic uncertainty among some of the Atlantic *Squalus*, particularly between *S. megalops* and *S. blainville*. This situation has contributed to the present confusion in species identification in the region, thus compromising the effectiveness and adequacy of any management and conservation efforts. In an initial effort to contribute to a comprehensive and clear alpha taxonomy of this highly diverse worldwide-distributed genus, we applied molecular genetic markers (mitochondrial cytochrome oxidase I and NADH-dehydrogenase 2) aiming to evaluate the number of discrete genetic lineages within *Squalus* in the eastern Atlantic and Mediterranean Sea. Furthermore, we compared this regional lineage diversity to that found worldwide, using publicly available data. Our results confirm the inconsistencies in species identification in the eastern Atlantic and Mediterranean. For instance, putative *S. blainville* and *S. megalops* sampled across the Mediterranean and along the eastern Atlantic from Portugal to South Africa clustered together in a single clade, sister to the clade of the Australian *S. megalops* (i.e. from the type location). Our data also indicate the presence of three highly divergent genetic lineages of *Squalus* in the Mediterranean Sea, comprising three distinct species.

Presentation type: Oral

Evaluation of a biopsy system to collect white shark (*Carcharodon carcharias*, Linnaeus 1758) muscle

Simone Rizzuto[1,4], Georgia French[2], Marlene Sturüp[2], Alison Towner[3], Letizia Marsili[4], William Hughes[2], Johannes H. van Wyk[1]

[1]Stellenbosch University, Department of Botany and Zoology, South Africa
[2]Sussex University, Brighton, UK
[3]University of Rhodes, Grahamstown, South Africa
[4]Università degli Studi di Siena, Italy

White sharks are protected in several countries under national legislation through the Convention of Migratory Species (CMS) and the Convention of the International Trade in Endangered Wild Flora and Fauna (CITES), considered as vulnerable by the International Union for Conservation of Nature (IUCN). The conservation status of this top predator calls for increased research effort to support effective management of white shark populations. For this purpose, it is necessary to develop minimally invasive methods, such as obtaining biopsies, as an alternative to sacrificing animals or relying on naturally deceased ones, to study physiological, genetic and toxicological endpoints. In 2015, dermis and muscle tissue biopsies were collected from 32 white sharks (from 2.5 to 4.6 m total length) in the licensed Gansbaai shark cage diving area (South Africa). We evaluated the success rate of "Finn Larsen Ceta Darts" sampling probes. Dermis success rate (DSR) and Muscle Success Rate (MSR) is defined as the percentage of biopsy samples containing the respective tissues. The results showed high DSR (84.61%) and MSR (79.49%), suggesting that probes (4 cm length and 0.9 cm diameter) are able to penetrate white shark dermal layer (0.99 ± 0.05 cm) collecting sufficient muscle tissue (1.64 ± 0.11 cm) for a variety of analyses. We also evaluated the behavioral responses of the sharks to biopsy in addition to the time period between the biopsy and the moment the shark was sighted again. The most observed behavior (N=18), was "no reaction", followed by an increase in speed and/or change of direction (N=14). Of the 32 sampled sharks, 29 were sighted again following the biopsy event in an average of 19 minutes, and the other 3 were seen again not more than a day later. This study supports the hypothesis that tissue biopsy is not only a useful method to collect high quality tissue samples (including dermis an muscle tissue), but also minimally affects the behavior of white sharks.

Presentation type: Oral

Species delimitation of carcharhinid sharks using next-generation sequencing and its implications for management

Alexis Simon[1,2], Charlie Huveneers[3,4], Bronwyn M. Gillanders[1,5],Geremy Cliff[6], Stephen C. Donnellan[7,8], Claudia Junge[1,5*]

[1]Southern Seas Ecology Laboratories, School of Biological Sciences, The University of Adelaide, SA 5005, Australia;
[2]École NormaleSupérieure, 45 rue d'Ulm, 75005, Paris, France;
[3]South Australian Research and Development Institute (SARDI), Australia;
[4]School of Biological Sciences, Flinders University, GPO Box 2100, Adelaide, Australia 5001
[5]The Environment Institute, The University of Adelaide, Adelaide, SA 5005, Australia
[6] KwaZulu-Natal Sharks Board, South Africa
[7]Australian Centre for Evolutionary Biology and Biodiversity, The University of Adelaide, Australia;
[8]South Australian Museum, North Terrace, Adelaide, SA 5000, Australia

Species delimitation of vertebrates is difficult when taxa are poorly divergent in morphology. A thorough statistical analysis based on morphology would require a global scale sampling effort. The development of next generation sequencing coupled with coalescent methods is a powerful approach to dissect species complexes in such cases. Many shark species of the genus *Carcharhinus* are economically important targets in fisheries around the globe. Their life-history traits make those species vulnerable to overfishing. Yet, due to their phenotypical similarities, theyare hard to distinguish and often taxonomically confused, making their management and conservation difficult. Previous morphological variation analyses of copper sharks *Carcharhinus brachyurus* did not detect divergent groups whereas mitochondrial DNA variation suggested potential divergence to sub-species level. This has however never been tested explicitly. Here, we use restriction-site associated DNA (RAD) sequencing resulting inthousands of single nucleotide polymorphisms (SNPs) across the genome to assess the genetic diversity in copper sharks. Our analyses of >3,000 SNPs as well as mitochondrial markers using i) principal component analysis, ii) coalescent method, and iii) neighbour network analysis showed a clear divergence between individuals from each side of the Indian ocean. Based on genetic, ecological and historical phylogeographic data, we propose the split of the South-African individuals into a new taxon. Management and conservation projects require accurate phylogenies and this work is a step forward towards a better understanding and delimitation of conservation units.

Presentation type: Oral

Comparative population genomics of two highly mobile whaler shark species caught in commercial and recreational fisheries

Claudia Junge[1,2], Stephen C. Donnellan[3,4], Charlie Huveneers[5,6], Corey Bradshaw[1,2], Alexis Simon[1,7], Bronwyn M. Gillanders[1,2]

[1]Southern Seas Ecology Laboratories, School of Biological Sciences, University of Adelaide, Australia;
[2]Environment Institute, University of Adelaide, Australia
[3]Australian Centre for Evolutionary Biology and Biodiversity, University of Adelaide, Australia;
[4]South Australian Museum, Australia;
[5]South Australian Research and Development Institute (SARDI), Australia;
[6]Flinders University, Adelaide, Australia
[7]École Normale Supérieure, Paris, France

Many shark species have a high innate risk of overexploitation from fisheries due to their economic value, slow maturity, and low recruitment compared to teleosts. Severe local population declines have worldwide motivated many National Plans of Action for the Conservation and Management of elasmobranchs. One way to optimise sustainable fisheries management is through the application of spatially explicit population models. However, the required baseline information is severely lacking for many shark species. Important parameters like population connectivity have been notoriously difficult and time-intensive to estimate. We here implemented a comprehensive genomic approach using thousands of single nucleotide polymorphisms (SNPs) to quantify the population structure of two commercially fished shark species: bronze whaler (Carcharinus brachyurus) and dusky shark (C. obscurus). Both species are distributed globally and have the ability to travel several thousand kilometres. In South and Western Australia both species are fished extensively yet their level of population connectivity remains unresolved throughout Australasia. We tested i) the accuracy of correct species identification, ii) several genetic connectivity scenarios and iii) the usefulness of neutral vs. putatively selected loci. We found evidence for panmixia within Australasia for both species, whereby both types of loci revealed the same lack of population sub-structure. Our study presents a straightforward and powerful approach to investigate population genetic connectivity in non-model, fisheries-targeted species. Furthermore, our results imply that these two carcharhinid sharks must be managed above regional scales, potentially even on a global scale, to ensure their future persistence. Ultimately, this data will, together with chemistry and life history data, be incorporated into spatially explicit population models for effective fisheries management.

Presentation type: Oral

Breeding and juvenile growth of the ribbontail stingray *Taeniura lymma* at Oceanário de Lisboa.

Ana Ferreira[1]

[1]Oceanário de Lisboa

Elasmobranchs are among the most threatened marine species at a global scale, mostly affected by over-fishing and habitat loss. It is now recognized the urgent need to adopt effective measures for *in situ* and *ex situ* conservation of these animals. The ribbontail stingray, *Taeniura lymma* (Forsskål, 1775) is a very attractive species for public aquariums. It is classified as "near threatened" by the IUCN and considered a strong candidate for a captive breeding program. In 2007, the European Studbook for *T. lymma* was implemented, to monitor the status and trend of the captive population, being coordinated by Oceanário de Lisboa. This study describes the establishment of a breeding group through monitoring, target feeding and animal training, for desensitization to clinical exams and biometric data collection. Environmental and water quality parameters were defined and controlled, to promote the welfare of breeding adults and juveniles. Successful breeding was achieved and pregnant females were monitored until the end of gestation. Fifteen rays were born with litters ranging from one to two pups. Gestation period ranged from 128 to 203 days. The neonates were subjected to a feeding and data collection protocol to assess their growth. No significant differences were found in the birth size and weight, between sexes or litter sizes. Growth in weight fitted a linear regression model and a growth of 3.25g.day^{-1} rate was estimated. The individuals weight increase after thirty, sixty and ninety days was also significantly different however, and it could not be associated with the juveniles' gender or litter size. This study intends to be a tool for replication of such programs in other institutions that keep this species. It will also increase the knowledge of this species biology and might contribute to the future establishment of effective conservation actions.

Presentation type: Oral

Assessment of blue shark (*Prionace glauca*) and Atlantic waters contamination through biochemical endpoints

Luís Miguel Fonseca Alves[1], Margarida Nunes[2], Philippe Marchand[2], Bruno Le Bizec[2], Susana Mendes[1], João Correia[1], Marco F.L. Lemos[1] & Sara C. Novais[1]

[1]MARE – Marine and Environmental Sciences Centre, ESTM, Instituto Politécnico de Leiria, 2520-641 Peniche, Portugal
[2]LUNAM Université, Oniris, Laboratoire d'Étude des Résidus et Contaminants dans les Aliments (LABERCA), F-44307 Nantes, France

Marine ecosystems are constantly being loaded with contaminants like persistent organic pollutants (POPs) and heavy metals. There is a need to link these measurements with biological endpoints, for example through the assessment of enzymatic activities. Big pelagic apex predators, like the blue shark *Prionace glauca*, are particularly affected by pollution. Their huge distributions, abundance and frequent capture by commercial fishing boats, make them potentially good species for biomonitoring studies.

This study aimed to assess the potential of *P. glauca* as a sentinel species for pollution monitoring surveys, using biochemical biomarkers. Twenty blue sharks were sampled of the coast of Portugal, aboard a commercial swordfishing boat. Concentrations of both POPs and trace elements, as well the levels of biochemical parameters related with detoxification, oxidative stress, energy metabolism and neuronal functions, were assessed. The characterization of the cholinesterases (ChE) present in muscle and brain tissues of *P. glauca* was made to evaluate their potential for further biomonitoring studies. The results suggest that the brain seems to contain atypical ChE, presenting mixed properties of two ChE types whereas the muscle seems to contain mostly acetylcholinesterase. The brain seems the most suitable for detection of exposure to low concentrations of anticholinergic compounds in the environment.

Contaminants were present in greater concentrations in liver, when compared to muscle. Positive and negative correlations were found between physiological parameters and contaminant accumulation levels and some suitable biomarker candidates were identified. ChE and Dna damage showed strong correlations with contaminants concentration levels, with the first proving to be a very sensitive and reliable biomarker of exposure to POPs.

This study highlights the usefulness of biochemical parameters, when combined with pollutant body burden determinations, to assess effects of contaminants and demonstrates the great potential of *P. glauca* to be used as a sentinel of marine pollution, through the use of suitable biomarkers.

Presentation type: Oral

Mercury in muscle and liver of silky shark *Carcharhinus falciformis* from the Gulf of Tehuantepec, México

Juanita Rodríguez-Gutiérrez.[1], Galván-Magaña F. and Arreola-Mendoza L.

[1]Centro Interdisciplinario de Ciencias Marinas.
Aav. Instituto Politécnico Nacional s/n col. Playa Palo de Santa Rita Apdo. Postal 592.
Código postal 23096. La Paz, Baja California Sur, México

High concentrations of mercury (Hg) in the environment is more alarming, because of its properties of bioaccumulation and biomagnification along the food chain. The food is the main route to absorption into the body (90%) and the central nervous and endocrine systems are targets affected by this xenobiotic. Mercury and their organic compounds in the marine environment represent a potential health hazard for the most vulnerable top predators like sharks and for humans through the seafood, due to accumulated higher concentrations associated frequently to sharks longevity. A continuing concern is the use of shark resources, considering that they are top predators and are constantly exploited as a source of food throughout the year. The presence of Hg in 122 silky sharks caught in the Gulf of Tehuantepec, Mexico was determined. In this area around of 3300 tons. are caught every year. We analized silky shark tissues (muscle and liver) to determine if the total Hg is permissible for human consumption (Less than 1 µg/g wet weight). We do not found correlation between concentration of mercury in both tissues and the total length of female, males, neonates and juveniles stages. However, there are significant differences between the mercury concentration in liver and muscle in both sexes (higher in hepatic tissue) and in both stages of maturity (neonates and juveniles). We found that Hg concentration in muscle remain (0.1526±0.038 µg/g wet weight) into the limits for human consumption from neonates and juveniles.

Presentation type: Oral

Composition and diversity of helminth fauna of the shortfin mako (*Isurus oxyrinchus*) and the blue shark (*Prionace glauca*) in the NE Atlantic

Penades-Suay, J.(1); Jarque-Rico, A. E. (1); Merchán, M. (2); Castro, A. (2); Tomás, J. (1); Aznar, F. J.
[1]Universidad de Valencia, Instituto Cavanilles de Biodiversidad y Biología Evolutiva (ICBiBE – Unidad de Zoología Marina)
[2] Asociación Chelonia

The present study describes the intestinal parasite community of 29 juvenile and adult specimens of shortfin mako (*Isurus oxyrinchus*) and 16 specimens of blue shark (*Prionace glauca*). The specimens were captured by longline fishery in the northeast Atlantic Ocean. Adult specimens of 4 species of cestodes were identified in makos: *Molicola* sp. (Trypanorhyncha) with prevalence 3.4%, *Crossobothrium* sp. with prevalence 17.2% and two species of *Rhodobothrium* (Tetraphyllidea) with prevalences 82.8% and 10.3%, respectively. Immature specimens of *Nybelinia* sp. (Trypanorhyncha, 17.2%) and *Dinobothrium* sp. (Tetraphyllidea; 3.4%) were also found. Mean species richness and mean total helminth abundance per host were 1.34 (± 0.84 SD) and 28.93 (± 56.01 SD), respectively. In the case of blue sharks, 9 cestode species were identified. Four were identified at species level: *Molicolahorridus, Anthobothrium laciniatum, Platybothrium auriculatum* and *Prosobothrium armigerum*; being their prevalences 18.8%, 62.3%, 62.5% and 68.8%, respectively. The other five were only identified at genus level. From the order Phyllobothriidea, *Paraorygmatobothrium sp.* (6.3%) and two of the same genus, *Phyllobothriinae*"a" (6.3%) and "b" (6.3%). Two other genus were identified: *Trypanorhyncha sp.* (Trypanorhyncha, 6.3%) and *Tetraphyllidea sp.* (Tetraphyllidea, 31.3%). Mean species richness was 2.7 (± 1.3 SD) and mean total helminth abundance per host was 31.9 (± 36.2 SD). In both cases, parasite species composition per host did not depart from the null hypothesis of independent colonization of each species. Host size and sex were not significant predictors of the abundance of any cestode species or species richness per host. The species-poor, randomly assembled helminth communities per host found in these large sharks differ from those found in coastal, benthic-pelagic elasmobranchs and resemble those described in other large oceanic predators such as cetaceans, marine turtles and marine birds. We suggest that the vagile behaviour and opportunistic diet of these predators, coupled with a "dilution" effect on infective stages in the pelagic realm, could generate poor and unpredictable helminth assemblages, generating a "Pelagic Predator Syndrome".

Presentation type: Oral

Colour change in the Small Spotted Catshark (*Scyliorhinus canicula*)

Dawn Watson[1]

[1]Bangor University

Colour adaption in the animal kingdom is a key part of evolutionary survival which is often overlooked despite its convergent evolution across many phyla. Colour change in elasmobranchs has been poorly studied, and it is largely forgotten about when examining the relationship between sharks and their environment. For benthic sharks, such as the small spotted catshark (*Scyliorhinus canicula*), being able to match the local surroundings would enable juveniles, in particular, to avoid detection increasing the likelihood of survival. The field of morphological colour change in elasmobranchs needs to be updated with the use of modern analysis techniques. For my Masters project I undertook an investigation to assess the effect of substrate and light conditions on morphological colour adaption in juvenile Small Spotted Cat sharks (*S. canicula*) using modern techniques. The juveniles (n=16) were placed individually into experimental tanks with a combination of substrate and lighting conditions. The sharks were photographed daily and these photographs were analysed through techniques developed to measure Skin Brightness, Skin Saturation, Spot Diameter and Spot Number. Statistical analysis found that substrate has a significant effect on Spot Diameter and Skin Brightness. Light levels appeared to have an effect, although not a uniformly significant one over all conditions. The skin saturation data showed a more complex relationship, as it appeared to interact with the other colour measures to produce differing degrees of variation within the saturation data. Spot number remained the same throughout the experiment. All results showed that the juvenile *S. canicula* were (reacting to the experimental environment) by changing their colouration and patterning in order to become more cryptic. This is the first study to quantify morphological colour change in juvenile *S. canicula*.

Presentation type: Oral

Habitat use of bigeye thresher and smooth hammerhead sharks in the eastern Atlantic Ocean based on satellite electronic tagging

Joana Fernandez-Carvalho[1,2], Rui Coelho[1,2] & Miguel N. Santos[1,2]

[1]Centre of Marine Sciences of the Algarve (CCMAR)
[2]Portuguese Institute for the Ocean and Atmosphere (IPMA)

Pelagic longliners targeting swordfish and tunas in oceanic waters regularly capture several elasmobranch species as bycatch, including currently protected species as the bigeye thresher (*Alopias superciliosus*) and the smooth hammerhead (*Sphyrna zygaena*). This paper presents results from 15 bigeye threshers (725 tracking days) and 5 smooth hammerheads (90 tracking days) tagged with pop-up archive satellite tags in 2012-2014 in the tropical NE Atlantic. State-space models using unscented Kalman filtering were used to process and analyze the daily geo-location estimates, and follow the sharks' daily movements. In terms of depth and temperature preferences, strong diel vertical movement patterns were observed for the bigeye threshers with the juveniles spending most of the daytime at depths of 360-390m and the nighttime at 30-60m, while the adults showed a shorter depth range spending most of daytime at 240-270m and the night at 90-120 m. For the smooth hammerheads no major differences were detected between day/nighttime periods, with the juveniles occupying mainly the 0-10m depth range and the adults slightly deeper waters of 30-40m. The operating pelagic longline gear was measured with Minilog Temperature and Depth Recorders (TDRs), and the overlaps with habitat utilization calculated. The overlaps are higher for the bigeye thresher juveniles and is taking place mainly during the night. The results shown are part of several ongoing Projects to study the habitat utilization of those species in the Atlantic. The results presented can now be used as inputs for Ecological Risk Assessments for sharks captured in oceanic tuna fisheries, and serve as a basis for efficient management and conservation of these pelagic sharks.

Presentation type: Oral

Conservation of scalloped hammerhead shark (*Sphyrna lewini*) and its critical habitat in Golfo Dulce, Costa Rica

Ilena Zanella[1]

[1]Asociación Conservacionista Misión Tiburón

The scalloped hammerhead shark, *Sphyrna lewini*, is an endangered and emblematic shark species in the Eastern Tropical Pacific Seascape (ETPS). It is characterized for being migratory. Females give birth to their young in coastal waters. Here, the young are afforded food and protection while they grow and reach sexual maturity. When sharks reach their adult stage, they begin large migrations. Aggregation sites for *S.lewini* have been identified on several oceanic islands in the ETPS, but little is known about their use of coastal areas. This study aims to describe *S. lewini* movements in aggregation sites of Golfo Dulce, South Pacific of Costa Rica. Fisheries-dependent biological data (size-TL, weight, sex, reproductive status) was gathered for *S. lewini* during artisanal fishing trips between May 2010 and May 2011 in Golfo Dulce. Catch per unit effort (CPUE) throughout the year was also estimated from catch data. We sampled a total of 315 sharks. Mean total length was estimated at 74.3±17.4cm. Both pups and juveniles were reported, which presented a male: female ratio of 1:1.2 ($p>0.05$). Total length and relative abundance of *S. lewini* had opposite tendencies, with the smallest TL (64cm) recorded during July-August, when CPUE was highest (0.0075). Temporary closures from June to August are therefore recommended at areas of highest reported catch. Based on the fisheries dependent data from on board observations, three aggregations sites were selected to deploy acoustic receivers and tag ten hammerhead sharks.Between June 2011 and July 2012, the receivers recorded almost 40.000 detections. All the sharks marked were reported by the receivers, showing daily movements between receivers. Sharks are present on the selected habitats between 09:00 and 22:00, during this period of time, 90% of the detections occur. Hammerhead sharks probably move to other places at night and during the early morning to feed.

Presentation type: Oral

Habitat use of bull shark (*Carcharhinus leucas*) in Islas Murcilelago, Golfo de Papagayo, Costa Rica

Andres Lopez[1]

[1]Asociación Conservacionista Misión Tiburón

The Guanacaste Conservation Area (GCA) is located in northwester Costa Rica, is an UNESCO World Heritage Site and has an important Marine Protected Area (MPA) (43,000 ha). In GCA are located the Islas Murcielagos or "Bat Islands", which are visited by tourist divers to see the natural congregations of bull sharks (*Carcharhinus leucas*). The bull shark has a worldwide distribution; it is migratory and live in coastal waters, in marine and freshwater ecosystems. In spite of the critical habitats presents at GCA, the ecology, the behavior and the habitat use of bull sharks are never study in this MPA. The aim of this project is promote the bull shark conservation toward the local communities and governmental sector, by the study of its population in GCA. We implement an acoustic tagging program: between June 2013 and November 2014, eleven bull sharks are tagged with acoustic transmitters. The information was recorded by on receiver located in San Pedrillo, Bat Island. The receiver has recorded almost 47,000 detections, mainly during daylight hours (06:00-18:00). The data showed a strong fidelity of females to the islands; however the number of detections during the dry season are significantly less than during the rainy season. Some females demonstrate high fidelity to the site, for example the 30322 transmitted more than 16,000 detections between June 2013 and February 2014. On the other hand, some females were detected only for a few weeks; the 30321 have transmitted 707 detections and stay at the site only one month period. The tendency to stay during daylight hours in the island (more that 75%), it probably related to reproductive aspects, since it is common to see females with post-copula marks. In turn, the absence of detections during the night suggests that bull sharks move to other surrounding areas to feed.

Presentation type: Oral

Measuring and mitigating extinction risk in European Chondrichthyans

Rachel Walls[1], Sarah Fowler[2] and Nicholas Dulvy[1]

[1]Simon Fraser University, 8888 University Drive, Burnaby, BC V5A 1S6, Canada
[2]1 Admiralty Cottages, Admiralty Road, Plymouth, Devon PL1 3RS, United Kingdom

The International Union for Conservation of Nature's (IUCN) Red List Assessments contribute to the motivation and foundation for global and regional biodiversity conservation and fisheries management efforts. Some of the earliest chondrichthyan fish Red List Assessments were undertaken in Europe, through workshops for the Mediterranean Sea (2003) and the Northeast Atlantic (2006). The following decade saw the introduction of several conservation and fisheries management measures for elasmobranchs in both sea areas. The IUCN Shark Specialist Group has recently reassessed the status of all chondrichthyans in European waters. This has allowed us to review changes in the Red List Index since these workshops, compare these with trends in the Red List Indices prepared for other taxonomic groups, and consider the extent to which conservation and management actions have mitigated the status of European elasmobranchs. Our comparison revealed striking differences in the overall status of elasmobranchs since the previous assessments and between regions, and compared with other taxa. The Red List Index for elasmobranchs is significantly lower (worse) than for any other major taxonomic group reviewed. Approximately 35% of Northeast Atlantic elasmobranchs are considered "safe", compared to only 10% of Mediterranean species. Similarly, 31% of Northeast Atlantic species are threatened with an elevated risk of extinction, compared to almost 50% in the Mediterranean; the latter has the highest proportion of threatened species in any region globally. Despite the downlisting of some Northeast Atlantic species since 2006, the overall Red List Index for chondrichthyans has deteriorated in both sea areas. We conclude by identifying the biodiversity and fisheries conservation and management measures that have been proposed; which ones have been adopted; which of the latter have been implemented effectively; and where improvements are most urgently needed.

Presentation type: Oral

Can public aquaria help change the World?

João Correia[1]

[1]Flying Sharks

Public aquaria and zoos have come a long way from early XXth Century facilities focused exclusively on displaying live animals to an audience thirsty for novel and interesting sights. As the end of the millennium approached, zoological institutions took on a role of leadership, steering the public towards a more enlightened view on the environment, conservation and education. This presentation reports on a myriad of such examples, ranging from the world famous 'Sea Food Watch' card promoted by the Monterey Bay Aquarium, or even 'The Great Egg Case' hunt promoted by Shark Trust and strongly supported, and disseminated, by Sea Life Centres worldwide. Likewise, the European Association of Zoos and Aquaria has lead nearly a dozen conservation campaigns, ranging from Apes, to Carnivores, to Bushmeat, amongst many other environmental issues crying for attention. These campaigns enjoy monumental support from the millions of visitors that zoos and aquaria welcome through their admission gates every year and these efforts have raised nearly 4 million euros thus far. These are but a few of multiple examples where the public aquaria, and zoo, community are spearheading the conservation of the natural world and education of society.

Presentation type: Oral

The Bristol Channel Skate Fishery (ICES Division VIIf): investigating sustainability and responsible consumption

John Richardson[1]

[1]The Shark Trust

The Bristol Channel (ICES Division VIIf) offers a salient example of a UK regional skate fishery in transition. As the conservative life-history characteristics of skate are now widely recognised, it is clear many species and populations are intrinsically vulnerable to elevated fishing mortality. In the move towards sustainable skate fisheries in EU waters, increasingly precautionary management measures have been introduced for the Celtic Sea Eco-region, including a reduction in the 'Skate and Ray' Total Allowable Catch (TAC). For the Bristol Channel fleet this has resulted in a significant decrease in TAC available to individual vessels, with direct ramifications for local fishing communities.

In response, the regional fishing industry has questioned the accuracy of stock assessments based on macro-scale management units (i.e. eco-regions), which they do not believe accurately reflects the situation in the Bristol Channel.

The Shark Trust is currently working with sectors of the fishing industry and supply chain. Using ICES Advice as a foundation, the Trust is evaluating a range of additional, complementary data to investigate the sustainability of the skate fishery, as well as potential support for the responsible consumption of appropriately managed species and stocks caught in the Bristol Channel. The Trust's primary focus is to secure a sustainable future for Bristol Channel skate populations and associated fisheries.

Presentation type: Oral

Combining forces: a multidisciplinary approach to unravel population structure in a heavily bycaught deepwater shark

Claudia Junge[1,2], Armelle Jung[3],Sienna Gray[4], Matt McMillan[1], Chris Izzo[1], Bronwyn Gillanders[1], Ole Thomas Albert[5], Steve Pedderson[6], Wolf Isbert[7], Timon Brueggemann[2], Giovanni Romagnoni[2], Diana Zaera[8], Farid Hemida[9], D. Jasper Maaholm[10], Michalis Mihalitsis[10], Fabrizia Serena[11], Einar Eg Nielsen[12]

[1]Southern Seas Ecology Laboratories, School of Biological Sciences, and Environment Institute, University of Adelaide, Australia;
[2]Centre for Ecological and Evolutionary Synthesis (CEES), University of Oslo, Norway;
[3]Les requins et des hommes, France;
[4]University of Edinburgh;
[5]Institute for Marine Research (IMR), Trømsø, Norway;
[6]Bioinformatics Hub, University of Adelaide, Australia;
[7]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Spain;
[8]Institute for Marine Research (IMR), Bergen, Norway;
[9]Ecole National e Superieure des Sciences de la Meret de l'Amenagement du Littoral (ENSSMAL), Algeria;
[10]University of Copenhagen, Denmark;
[11]Environmental Protection Agency – Marine Science, Italy;
[12]National Institute of Aquatic Resources, Technical University of Denmark, Denmark

The velvet belly lantern shark, *E. spinax*is a small-sized deepwater shark, which is often captured as by-catch in commercial deep-water fisheries and discarded due to its low commercial value. A decline has been observed in some areas attributed to excessive fishing pressure. Despite being a commonly found shark, there is a lack of knowledge about its population structure, ecology and response to environmental or anthropogenic changes. Due to its extensive latitudinal distribution, *E. spinax* could be a useful model species for understanding the level of connectivity and potential adaptive differences between deep-sea shark populations, especially with regard to anthropogenic impacts. This knowledge is crucial for the sustainable management of this species and possibly its habitat. In our multidisciplinary study, we aim to unravel what constitutes a population in a deepwater shark, using *Etmopterus spinax* as a model species, and how these populations differ from each other. We have population genetic data (mitochondrial DNA) as well as population genomic pilot data from thousands of SNPs across the genome (RAD Seq), and will discuss findings together with chemistry and pilot parasite data.

Presentation type: Oral

Discard survival of European skates: the need for species-specific data

Linda Planthof[1]

[1]Dutch Elasmobranch Society

The practice of discarding unwanted catch negatively affects the sustainable exploitation of resources and financial viability of fisheries. The reformed Common Fisheries Policy has introduced a landing obligation which will make compulsory the landing of all species that are subject to catch limits, including skates. As the intrinsic vulnerability of skate species vary, as well as the conditions under which they are fished upon, the discard survival rate of distinct species is highly variable. It is important to take these species-specific differences into account in policy decisions and management measures. This presentation will give an overview of the current knowledge on the discard survival rate of European skate species, and will discuss the necessary research to underpin future management decisions.

Presentation type: Oral

Spatial management of data-poor elasmobranchs using Boosted Regression Tree modelling

Simon Dedman[1]

[1]Galway-Mayo Institute of Technology

Skates and rays represent one of the most vulnerable components of the fish community in temperate demersal fisheries such as the Irish Sea. They also tend to be data poor in comparison to commercially exploited teleost fish. Spatial management has been suggested as an important tool in protecting these species, but this requires an understanding of the abundance distribution, and its relationship with the environment at both adult and juvenile life history stages. In this analysis, delta log-normal boosted regression tree models were used with bottom trawl survey data to derive rays' spatial abundance, and environmental links. The modelling approach allowed the development of detailed predictive maps of abundance of four common and rare skate and ray species implicated in the fishery: thornback, spotted, cuckoo and blonde rays. The distributions were driven by a general preference for sand and courser substrates, higher salinities, temperatures and currents speeds. The abundance distribution maps were examined together with maps of skate and ray commercial landings, suggesting that the main hotspots for the species were away from the main commercial fishing areas. The maps were also compared to potential MPAs proposed for wider ecosystem protection, and the main hotspots were well covered by the proposed MPAs. This combination of the main abundance hotspots in areas of low fishing, and wider potential ecosystem protection, suggests good potential for spatial management measures to protect these species in the Irish Sea. The methodology has been extended to encompass commercial fishing and predation by larger fish, as well as to automatically suggest optimal MPAs based on minimising fishery impact while still maintaining precautionary point biomass, B*pa*. This complex methodology is bundled into an R package that enables environmental scientists and fisheries managers to enjoy the benefits of these powerful statistical approaches without having to become an R expert.

Presentation type: Oral

Elasmobranchs & the E.U.: advocating for effective science-based management

Ali Hood[1]

[1]The Shark Trust

The vulnerability of elasmobranchs to fisheries pressure is well documented in scientific literature, yet the application of science-based fisheries management has often lagged behind that of more traditional commercial target species.

Historically Europe has played a central role in elasmobranch fisheries and despite the adoption in 2009 of the Community Plan of Action for Sharks[1] (CPOA-sharks); the revision[2] of the EU shark finning regulation[3] to requires fins-naturally-attached; and closure of fisheries for depleted species, the EU remains a global fishing power supporting a substantial export and consumer market, ranking highly in global 'shark' league tables for recorded landings, and failing to set catch limits on many of its substantial shark fisheries. However, concurrently the EU has emerged as an international leader with regards RFMO proposals demonstrating potential to act as a highly influential global fisheries manager.

In this context we discuss the pivotal role of the EU and the importance of effective implementation of the EU finning regulation. And, with shark meat now often surpassing fins as the primary driver for retention of sharks, there is also an increasing need to ensure advocacy efforts and public understanding reaches beyond shark finning and the fin trade. The *No Limits?* campaign will be referenced as a route to drawing both public and political attention to the pressing need for the adoption of science-based catch limits for those stocks currently devoid of European management.

Particular attention will be paid to the Blue Shark *Prionace glauca* in light of its dominance in global shark landings.

Presentation type: Oral

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[1] COM(2009) 40
[2] (EU) No.605/2013
[3] (EC) No.1185/2003

Environmental impact and management perspectives for shark and ray provisioning tourism

Pierpaolo Brena[1]

[1]CRIOBE (Centre de Recherches Insulaires et Observatoire de l'Environnement). USR 3278 CNRS-EPHE, BP 1013, 98729 Papetoai, Moorea, French Polynesia.

The use of olfactory stimuli and the provision of food are a common practice to prompt artificial aggregations of elasmobranch species, and ensure their visibility to tourists. By promoting the non-extractive value of elasmobranchs and enhancing positive attitudes towards this threatened taxon, shark and ray provisioning activities are promoted as a conservation tool. However, concerns arise about the ecological consequences of shark provisioning and its long-term sustainability. By using a functional framework, we conduct an exhaustive review of the ecological, behavioral and physiological effects of shark and ray provisioning around the world. Focusing on the underlying processes that rule the response of targeted elasmobranch species, we report effects acting at the individual, group, and community-scale. We suggest that the most commonly described alterations of individual movement patterns have cascading effects through the group and community-scale, ultimately resulting in altered health condition and behavior toward humans. We conclude by stressing the potential for provisioning activities to support the investigation of complex ecological processes in elasmobranchs, and the promising insights provided by social sciences to fill the gap between sustainable tourism, science and conservation.

Presentation type: Oral

Turning the tide – can reintroduction help elasmobranch populations recover?

Paddy Walker[1]

[1]Dutch Elasmobranch Society

The steady decline of many species of elasmobranchs in the past decennia has been well documented. Progress made in international protective legislation, the implementation of the EU Community Plan of Action for Sharks and national management plans has not yet proved effective for restoring shark and ray populations in European waters. Although realistically any improvement will take many years to come to light due to the long generation time typical to elasmobranchs.

Conservation organisations and managers alike are increasingly inclined to take matters into their own hands and species which are locally extinct such as the Atlantic sturgeon and salmon have been, or are being, reintroduced.

As an answer to this increase in “conservation through intervention” IUCN has developed guidelines to ensure that there is an adequate appreciation of the risks and enough (scientific) evidence to assess the feasibility of reintroduction of species.

This paper will present an analysis of the IUCN Guidelines for reintroductions and other conservation translocations and how they could be applied to the reintroduction of elasmobranch species in the North Sea. The feasibility of reintroduction and the important role that aquaria might play in a reintroduction scenario will be explored. Intervention as a conservation option will be discussed.

Presentation type: Oral

Introducing Save our Sharks – a campaign for shark & ray management in the Dutch Caribbean

Irene Kingma[1]

[1]Dutch Elasmobranch Society

The waters round the islands Aruba, Bonaire, Curacao, Saba, Statia and St. Maarten are home to approximately 30 species of sharks and rays. Among these are charismatic species like whale shark, tiger shark and greater hammerhead shark. Up to now there has not been effective management or conservation in these countries.

The Dutch Caribbean Nature Alliance hopes to change this. Together with the Dutch Elasmobranch Society and research institute Imares they have launched a 3 year campaign which goal is to stop the decline of in the Dutch Caribbean and encourage islanders to benefit from their presence as a valuable tourism asset.

In the project we will focus on:

- Educating both local people and Dutch citizens on the importance role sharks play in the marine ecosystem
- Working with local fishermen to find solutions workable solutions to stop shark (by)catches
- Work with government to have effective management and control of shark populations
- Enhance the scientific knowledge needed for conservation and management

Presentation type: Oral

Can Deep Sea Sharks respond to short term protection? Looking into the deep

Jorge Fontes[1]

[1]MARE/IMAR - DOP Cais de Sta Cruz 9900-Horta

As global fishing effort increasingly expands into deeper water, concerns exist over the ability of deep-sea cartilaginous fishes to sustain fisheries such pressure, due to intrinsically low rates of population recovery, the lowest levels observed to date. Once a stock has been depleted it will take decades, and potentially centuries, before it will recover.

Here, we present the preliminary results from a monitoring study on a seamount marine reserve, from the Azores (Condor seamount), to investigate the potential short term (four years) effect of protection on the community structure, with focus on dep sea elasmobranchs and other top predators. We used multidisciplinary approach, and a combination of data from classic scientific fishing experiments, remote video surveys and acoustic telemetry.

Presentation type: Oral

Reproduction of Velez ray (*Raja velezi, Chirichigno 1973)* in the Mexican Pacific

Katherin Soto López[1]

[1]Centro Interdisciplinario de Ciencias Marinas- IPN

Raja velezi (Chirichigno 1973) is an oviparous ray from the Rajidae family, caught by the artisanal fishery in the western coast of Baja California Sur, Mexico. The biology of this species is poorly known, being recorded only in the Mexican Pacific coast. The present study provides information on the reproductive biology of *R. velezi* to recommend possible measurements to help with its fishery management. A total of 105 rays were analyzed, 56 males and 49 females, caught from March to July. The sizes ranged from 53 to 96 cm of disc width (AD). Three stages of sexual development were identified: immature, maturing and mature. Females attained larger sizes than males; such differences were presented only in mature organisms but not in immature and maturing organisms. The sex ratio was 0.87H:1M. Both ovaries were functional, with a visible asynchronously oocyte development. The ovary was classified as an outer type. The oviducal gland (GO) show a linear relationship between AD increments. The histological description of the GO allowed identifying four zones: "club", "papillary", "baffle" and "terminal". The "club" and “baffle” zones showed the development of secretions; whereas sperm storage was located in the "terminal" zone. The uterus showed structural segmentation when maturity is reached. In males both testis were functional as well, but the right testicle presented larger development. Although significant differences were found between testis sizes, the development area of testicular lobes was similar in both, without relationship between testis size and AD.. First maturity of females is reached at 68.7 cm of AD and 65.1 cm of AD for males. Gravid females were registered during April and May, presenting two ovigerous capsules, one in each uterus, thus being classified as simple oviparity.

Presentation type: Oral

Reproductive biology aspects of the bathypelagic shark *Etmopterus spinax* (Elasmobranchii, Etmopteridae) in the Balearic Sea

Alba Martín-Lázaro[1], Bas-Silvestre M.[1], Serrano-Rodríguez N.[1], Guallart J.[1], Romana C.[1]

[1]Marine Biology Laboratory, Zoology Department. Universitat de València

The Velvet Belly Lanternshark *Etmopterus spinax* (Linnaeus, 1758) is a deep-sea squaloid species that can be found in the Central and Northeastern Atlantic and in the Mediterranean Sea. It has been classified as "Least Concern" in the IUCN Red List.

Aspects of the reproductive biology of this shark in the Balearic Sea have been studied from incidental catches in a bottom trawl fishery targeting red shrimp (*Aristeus antennatus*) at the Ibiza Channel. Specimens (n = 322) were obtained from June 2013 to May 2014 in a depth range of 380 to 730 m. Mother-embryo nutritional relationship has also been studied through the analysis of changes during development in total wet weight, water content and, organic and inorganic matter from oocytes to full-term embryos.

Sizes distribution of catches covers all the range, from newborns to large adults. Maximum size was higher in females (449 mm TL) than in males (399 mm TL). Sexual maturity was reached in the range 292 – 331 mm TL for males (M50 = 310,0 mm TL) and 326 – 416 mm TL (M50 = 339,8 mm TL) in females. The mean (± s.d.) ovarian fecundity was 14,15 ± 4,73 oocytes and the uterine fecundity was 8,20 ± 3,27 embryos. No seasonal reproductive pattern was found.

One hermaphrodite specimen (with developed claspers together with ovaries and uterus) was found, which represents 1,62% of adult specimens studied.

During embryonic development, changes in composition from ova to full-term embryo were estimated as: wet weight +42,1%, water content +102,4%, organic matter -32,2% and inorganic matter +159,7%. These results suggest that *Etmopterus spinax* is a lecithotropic species (or with possible incipient histotrophy), in which females do not provide to the embryos organic matter during their development; instead, they provide water and mineral salts.

Presentation type: Oral

Age and growth of the butterfly ray *Gymnura marmorata* (Cooper, 1864) in the southern occidental coast of Baja California Sur, México

Jesús Bernardo Sánchez Cota[1]

[1]Centro Interdisciplinario de Ciencias Marinas #5992 Instituto Politecnico Nacional STREET, colonia: Palo de santarita, P.C. 23096, La p Paz, Baja California Sur, México.

G. *marmorata* is the fifth specie most captured in the Mexican artisanal fishery of rays and the biological information is lacking, so is very difficult to propose management measures. The aim of this research project is to generate baseline information for this batoid. The age and growth of G. *marmorata*, in Baja California Sur (BCS), México, was investigated comparing the adjustment of five growth curves. These models are the Von Bertalanffy growth model of 2 parameters (VBGM-2), the Von Bertalanffy growth model of 3 parameters (VBGM-3), the Gompertz growth model of 2 parameters (GGM-2), the Gompertz growth model of 3 parameters (GGM-3) and finally the two phases growth model (TPGM-5).These curves are the most used to describe the age and growth of batoids. During this research project 167 vertebrae samples of *G. marmorata* (55 Male; 112 Female) were collected from artisanal fishery, through the years 2013 and 2014The organisms collected presented width measures which ranged from 340 mm to 1410 mm (340-798 mm Male; 370-1410 mm Female).For each ray a longitudinal section of the vertebral centra (0.4mm of thickness) was developed to evidence the vertebrae bands pattern. The reading of growth bands was made using digital enhanced images, analysing precision and agebias among readings and among readers. The deposition time of growth marks was assumed to be about one year, using indirect methods. The GGM-3 model (AD_{∞}=138.3, k=0.171, t0=1.14) presented the better fitting among curves used, according to the Akaike's information criterion (AIC). Due to this the GGM-3 model offered the best description of *G. marmorata* growth trendin this study. The results obtained during this research project accorded to others age and growth researches developed in different ray species and represented one of the first baseline information for *G. marmorata* biology.

Presentation type: Oral

Age and growth of the smooth hammerhead shark, *Sphyrna zygaena*, in the Atlantic Ocean

Daniela Rosa[1], Rui Coelho[1], Joana Fernandez-Carvalho[1]; Miguel N. Santos[1]

[1]Portuguese Institute for the Ocean and Atmosphere (IPMA)

The smooth hammerhead shark (*Sphyrna zygaena*) is regularly caught as by-catch in pelagic longline fisheries, but is one of the least studied of all pelagic sharks. Age and growth of this hammerhead was studied along a wide Atlantic region covering both hemispheres. Data from 304 specimens, ranging in size from 126 to 253 cm fork length (FL) were analysed. Growth models were fitted using the von Bertalanffy growth equation re-parameterised to calculate L_0, using the sampled and several back-calculated datasets. The von Bertalanffy growth equation fitted to a modified Fraser-Lee back-calculated dataset seems to be the most adequate to describe the growth in this species, with resulting growth parameters of L_{inf} = 248cm FL, k = 0.10 year^{-1} for males and L_{inf} = 273 cm FL, k = 0.09 year^{-1} for females. Although further work is still needed, this study adds to the knowledge of vital life-history parameters of the smooth hammerhead shark in the Atlantic Ocean, which can now be used for population dynamics and stock assessment models to aid in the management and conservation of this species.

Presentation type: Oral

Seasonal variability in the distribution of giant manta rays *Manta cf. birostris* in the Mexican Caribbean Sea and evaluation of habitat suitability

Ana Hacohen-Domené[1]

[1]Centro Interdisciplinario de Ciencias Marinas (CICIMAR)

Manta rays are filter feeder elasmobranchs that usually aggregate in tropical and subtropical waters around the world. These aggregations are often related to biological and environmental variables, such as abundance of their prey (zooplankton), preferred sea surface temperature, and bathymetric features (sea depth and distance to the coast). The goal of the present study is to describe the spatial distribution of manta rays in the northern Caribbean Sea and evaluate if there is a seasonal variability of the habitat preference related to the environment. To do so, we analyzed surface sightings made during scientific boat surveys, conducted from 2006-2011, through MaxEnt model. Manta ray distribution patterns during the study period, showed manta rays are distributed in the north of Isla Holbox and the northwest of Isla Contoy, and are more abundant during July – August. Also, effects of environmental variables on manta rays suggest that manta ray abundance is closely related to food availability (areas with high primary productivity), in shallow areas close to shore. Moreover, model responses suggest that suitable habitat from May – August is dependent on a mix of chlorophyll-*a*, primary productivity and distance to the coast. Our results also show heterogeneity of habitat use, in the form of seasonal variability in habitat suitability between May and September. This data presented in this study regarding the seasonal distribution of manta rays and the suitability of their habitat may be used to develop management strategies as design of marine protected area for this species in the Mexican Caribbean Sea.

Presentation type: Oral

Preliminary results on the genetic variability of long-nosed skate [*Dipturus oxyrinchus* (L. 1758)] populations from the Mediterranean Sea and adjacent Atlantic Ocean

Riccardo Melis, Laura Vacca, Maria Cristina Follesa, Alessandro Cau, Angelo Cau, Rita Cannas

University of Cagliari – Department of Life and Environmental Sciences

The present work aimed at analysing samples of the near-threatened long-nosed skate *Dipturus oxyrinchus* (L. 1758), in order to provide information on the genetic structure within the Mediterranean Sea and on connectivity between the Mediterranean and the Atlantic Ocean.

A total of 196 specimens, caught in 8 sampling sites of the western Mediterranean Sea (Sardinia and Algeria) and Eastern Atlantic Ocean (France). The great majority of samples were collected along the coasts of the island of Sardinia, where among the greatest Mediterranean survey catches are recorded, in order to contribute to the formulation of an effective management plan for the species in this area.

A partial region (666 bp) of the mitochondrial control region was sequenced and the genetic variability was studied: a total of 22 haplotypes were identified; the four main haplotypes were shared by all Sardinian populations.

Contrary to the results of previous studies based on a very limited number of specimens, the present analyses pointed out the sharing of haplotypes between the Atlantic and the Western Mediterranean, challenging the validity of the hypothesis of genetic isolation of the Mediterranean stocks.

Moreover, the analyses revealed a high variability within the Mediterranean, with high haplotype diversity (Hd = 0.805) and low nucleotide diversity (= 0.003). The AMOVA analysis underlined the presence of a genetic structure (overall st = 0.074, P-value = 0.00). The SAMOVA software indicated the occurrence of significant distinct genetic clusters (ct = 0.09, P-value = 0.02). As concern the demographic history of Mediterranean populations, the results of the mismatch analyses and Fu's FS tests of neutrality showed signatures of population (demographic and/or spatial) expansions.

Presentation type: Oral

Analysis of the population structure of small-spotted catshark (Scyliorhinus canicula) populations within the Mediterranean Sea based on nuclear microsatellite data.

Laura Vacca, Riccardo Melis, Maria Cristina Follesa, Alessandro Cau, Alessia Cariani, Fausto Tinti, Angelo Cau, Rita Cannas

University of Cagliari – Department of Life and Environmental Sciences

Twelve polymorphic nuclear microsatellite markers have been used to investigate the genetic population structure of the demersal small-spotted catshark Scyliorhinus canicula within the Mediterranean Sea and the adjacent Atlantic Ocean. A total of 215 individuals were genotyped from seven locations (Mediterranean Sea -Western Basin: Sardinia, Algeria, Morocco; Central Basin: Sicily and Ionian Sea; Eastern Basin: Cyprus; Atlantic Ocean - North Sea).

Pairwise comparisons between loci revealed no linkage disequilibrium, whereas departure from Hardy-Weinberg equilibrium (heterozygote deficiency) were observed in all populations (except Sicily). Genetic diversity was similar among populations (overall uHe=0.64).

AMOVA analyses indicated a significant genetic differentiation among all locations (overall FST = 0.06134;P-value=0.00). Pairwise Fst values (range from 0.159 to 0.009) confirmed significant differentiation among all samples, with the only exception of Sicily and Algeria.

A weak but significant among group differentiation was found when placing samples in a five different groups (North Sea/ Morocco+ Algeria/ Sardinia/ Sicily+ Ionian Sea /Cyprus; FCT= 0.0396; P-value = 0.00293+-0.00164).

In particular, the four samples collected in Sardinia (off the north, northwestern, south, south-eastern coasts) were all significant differentiated, suggesting the occurrence of potential limitation to gene flow. Present results, still preliminary, if confirmed by the analysis of a broader number of specimens, could represent very useful information for the prompt sustainable management of this important commercial resource especially in this area. In fact, although the species, listed as Least Concern in the IUCN Red List, is considered overexploited in the some areas (e.g. in the central Mediterranean Sea), it is still reported to be stable or showing even increasing trends of abundance in Sardinia.

Presentation type: Oral

RAIMEST: Study of skates stock in the Eastern English Channel (VIId)

Charlotte Fabjanczyk[1], Hélène Gadenne[2], Nicolas Leblanc, Alain Tétard, Théo Filippi, Richard Brouzes

[1]OPBN (Organisation de producteur Basse Normandie)
[2]IFREMER (French Research Institute For Exploitation of the Sea)

In the Eastern English Channel (ICES VIId division), skates are economically important for fishermen and the lack of fishery data precludes the definition of stocks units and the creation of management measures for a sustainable fishery.

In this framework, the RAIMEST project is conducted by the French fisheries producer organization and the French regional committees to enhance the data collection. The main objective is to improve the existing knowledge about skate stocks in the Channel (especially in ICES VIId division). Data are provided by two complementary sources: empirical fishermen knowledge (interviews with fishermen) and scientific data ("OBSMER" French observation at sea program). The objectives of this study are (i) to improve the knowledge of the functional areas and the spatial distribution of 6 skate species using fishermen observation, (ii) to improve the stocks assessment method, and (iii) to evaluate error rates in skates identification by the fishermen.

This report shows that skates are widely distributed over the Eastern English Channel, and the dominant species is the tornback ray (raja clavata). The juveniles are mainly concentrated in the coastal areas. The fishermen identification of tornback is correct most of the time but they misname the others skate species in this area, despite they are able to correctly recognize the species. This last point is very encouraging for future enhancement of this fishery management.

Presentation type: Poster

AGE and GROWTH of three different rajids from the central Mediterranean sea

Bellodi A.[1], Mulas A.[1], Cau Al.[1], Cuccu D.[1], Vacca L.[1], Vittori S.[1], Follesa M.C. [1]

[1]Department of Life Science and Environment – University of Cagliari

Elasmobranchs age and growth estimation is generally considered more challenging than in teleosts due to the intrinsic difficulties linked to the absence of otoliths and the consequent employment of other calcified structures. Moreover, recently, several authors stated that not always the more known von Bertalanffy Growth Function (VBGF) represents the more precise way to describe elasmobranchs growth, especially for batoids. In this study four of the most used staining techniques (unstained, Alizarin, silver-nitrate and EDTA decalcification)were tested on vertebral centra of three Rajids caught in Sardinian sea: *Raja brachyura* (77 females, 92 males), *Dipturus oxyrinchus* (76 females, 54 males) and the Mediterranean endemic *R. polystigma* (97 females, 87 males). Furthermore, four different growth models were applied: the VBGF, the Exponential, the Gompertz and finally the Logistic, with the aim of stating which of them provided the best fitting result to age at length data of the studied Rajids. According to the Index of Average Percent Error (IAPE) and CV%, the observation of unstained vertebral centra achieved the best results in terms of readings precision and reproducibility for *R. brachyura*and *D. oxyrinchus*, while the same outcome was provided by Alizarin red stained centra for *R. polystigma*. For what concerns the modelling of growth curves, according to the Akaike's Information Criterion, the VBGF showed the best fitting to the observed data for *R. brachyura*. Instead, the *S*-shaped functions, the Gompertz and the Logistic model displayed the best growth curves for *D. oxyrinchus* and *R. polystigma* respectively. Given the importance of age and growth data in the definition of effective management plans, our results highlighted the importance and necessity for rajids to test different staining techniques and growth models in order to reach the finest results.

Presentation type: Poster

Persistent organic pollutants (POPs) in juvenile blue shark (*Prionace glauca*) from Portuguese coastal waters

Luís Miguel Fonseca Alves[1*], Margarida Nunes[2*], Philippe Marchand[2], Bruno Le Bizec[2], Marco F.L. Lemos[1] & Sara C. Novais[1]

[1]MARE – Marine and Environmental Sciences Centre, ESTM, Instituto Politécnico de Leiria, 2520-641 Peniche, Portugal
[2]LUNAM Université, Oniris, Laboratoire d'Étude des Résidus et Contaminants dans les Aliments (LABERCA), F-44307 Nantes, France
*Luís Alves and Margarida Nunes contributed equally for this work.

Human activities constantly release harmful contaminants into the environment, many of which end up reaching marine ecosystems. Persistent organic pollutants (POPs) are known to adversely affect marine biota due to their toxicity. Since these contaminants tend to accumulate in animal tissues, predators like sharks are particularly vulnerable to POP exposure. The blue shark (*Prionace glauca,* L.1758) is one of the most consumed sharks in the world, being the most commonly caught shark species globally, mainly due to bycatch, and recent studies have demonstrated its potential to be used as a sentinel for marine contamination.

Twenty juvenile blue sharks were sampled off the coast of Portugal (NE Atlantic Ocean), aboard a commercial swordfishing boat. The concentration of dioxin-like polychlorinated biphenyls (DL-PCBs), polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), perfluorinated compounds (PFCs) and brominated flame retardants (BFRs) was determined in liver and muscle tissues. Contaminants were found in higher levels in liver when compared to muscle, and these tissues showed different contamination profiles for PCDDs, PCDFs, PFCs (perfluoroalkyl sulphonates and perfluoroalkyl carboxylates) and BFRs (polybrominated diphenyl ethers and polybrominated biphenyls). DL-PCB profile was dominated by congener #118 in both liver and muscle. To our knowledge, this is the first study addressing the presence of PFCs in blue sharks and its presence, as a risk to human health, is also addressed.

Presentation type: Poster

Reproductive biology of the brown ray *Raja miraletus* (Chondrichthyes: Rajidae) from Sardinian waters (Central Western Mediterranean)

Marongiu M.F.[1], Porcu C.[1], Cannas R.[1], Pesci P.[1], Soldovilla G.[1], Vacca L.[1], Follesa M.C.[1]

[1]Department of Life Science and Environment – University of Cagliari

The brown ray *Raja miraletus* Linnaeus, 1758 is a medium-sized skate living in the over soft bottoms of the shelf and the uppermost slope. In the Mediterranean Sea, it is commonly caught by trawl and gill nets as by-catch. In Sardinian waters, this species is a regular component of discarded fishes, but sometimes the largest individuals are commercialized. Considering the rajids vulnerability to overfishing, the aim of this work is to give information on the reproductive biology of this speciesin order to increase its life history data. A total of 1131 specimens (584 females and 547 males) were sampled during experimental and commercial hauls (depths 28-176 meters)around Sardinian seas from 2005 to 2014 years. The total length (TL, in centimeters), the total weight and the gonad weight(both in grams) were taken. Specimens were sexed and the maturity stages were determined following the scale of oviparous Elasmobranchs proposed in the Medits handbook 2013 (Medits, 2013). Females (11.5-49.2 cm TL) and males (9.4-48.9 cm TL) covered generally similar length ranges. Size at maturity (L_{50}) was similar in both genders (males 41.2 cm TL) (females 42.2 cm TL). The seasonal evolution of maturity stages highlighted a predominance of female and male immature specimens throughout the year. Mature females were sampled mostly from spring to summer, with a high frequency of females with egg cases during the summer months. Furthermore, male mature specimens were found all over the year, as confirmed by the Gonado-somatic Index. Ovarian fecundity reached a maximum of 15yolked follicles. In conclusion, this work made a valuable contribution to the implementation of basic management measures useful to ensure the sustainability of rajids catches.

Presentation type: Poster

Seasonal Comparison of Chondrichtyan by-catch of trawl fishery around Imbros (Gokceada, N.E. Aegean Sea)

Emre Yemişken[1], Cem Dalyan[1], Suna Tüzün[1], Persefoni Megalofonou[2], Lütfiye Eryilmaz[1]

[1]Department of Biology, Section of Hydrobiology, Faculty of Science, Istanbul University, Turkey
[2]Department of Biology, Section of Zoology Marine Biology, University of Athens, Greece

The aim of this study is to compare Chondrichthyan species by-catch of trawl fisheries of Imbros among four seasons within the fishing closure period (between 15 April and 15 September) and fishing period (between 15 September and 15 April). Chondrichthyan species composition, abundance (individuals/km^2) and biomass (kg/km^2) were investigated from June 2014 to April 2015, using seasonal commercial trawl surveys. Data were collected by 52 hauls from three depth contours (0-100 m, 100-200 m and 200-400 m). Fifteen Chondricthyan species comprising 221 individuals were caught, including 2 *Dipturusbatis*, which is a critically endangered species, as well as 16 *Galeus melastomus,* 137 *Scyliorhinuscanicula,* 1 *Squalus blainville*, 2 *Etmopterusspinax,* 1 *Leucaraja naevus* and 7 *Raja miraletus* that are of least concern status in IUCN red list in the Mediterranean Sea. Totally, 11.75 % of the total biomass consisted of Chondrichthyan species and their abundance represented 5.96 % of the total number of fish caught. Mean biomass of Chondrichtyan species was 3.4 kg/ km^2 and their abundance 47.26 individuals / km^2. Statistical analysis were shown that there wasn't a relation between depth and abundance of Chondrichthyans (ANOSIM, R= 0.02). However, there wasn't significant differences between catch period and abundance (ANOSIM, R=0.156) as well as between the fishing closure period and fishing period (t-test = 0.0347, p>0.05). *Scyliorhinus canicula* was the main Chondrichthyan species in all three depths contours (mean 1.31 kg/km^2). Its abundance showed a decline trend from September, beginning of the fishing period, to April, the end of fishing period (22.78 individuals/km^{2}in September 2014, 3.87 individuals/km^{2}in January 2015 and 0.74 individuals/km^{2}in April 2015).

Presentation type: Poster

By-catch distribution and survival rate estimate of Common skate, *Dipturus cf flossada,* by French fishing trawlers in the Celtic Sea.

Thomas Barreau[1]

[1]French National Museum of Natural History

During 7 surveys on board of French fishing trawlers, data have been collected on 329 fishing operations. For each of them common skate bycatch were exhaustively counted ending up to a total of 1385 specimens. On this amount 1215 were measured. Total lengths range between 192 and 1420 mm. Population size distribution is showing numerous individual between 200 and 800 mm then fewer from 800 to 1100 mm and a peak on larger animals around 1200. Fishing boats were volunteers to accept an observer and didn't change their fishing habits for the occasion. Boarding was organised when areas exploited by fisherman had high chances of common skate by-catch. Maps of distribution and density per km² in the visited area were produced showing by-catch distribution. Average densities were calculated on mesh of 0.25x0.25 degrees. Spatial analyses show a high average density of 25 individual par km² for small skates (< 400 mm) in the south west of the Scilly Islands. This results correlate with bathymetry (shallower) and seafloor (roller and gravel) could indicate the presence a common skate nursery in this specific area. Condition of the 1215 measured individual were estimate following a scale based on physical criteria such as spiracle's movement (0: Dead; 1: Poor; 2: Good; 3: Excellent). Considering that skates categorised as 0 and 1 didn't survive, survival rate is 46.4%. Size influences the survival rates and smaller individual less than 400 mm long have a survival rate of 33.4%.

Presentation type: Poster

Using Baited Remote Underwater Video To Assess The Biodiversity And Relative Abundance Of Elasmobranch Species at Tubbataha Reefs Natural Park

Henriette Grimmel[1]

[1]The Large Marine Vertebrate Project Philippines

Elasmobranchs are amongst the most threatened group of marine species. Over-fishing, coupled with life history characteristics of shark and ray species has resulted in sharp decrease in population numbers worldwide. The use of non-invasive and non-extractive survey techniques are becoming more widespread in elasmobranch ecology literature. Baited remote underwater video surveys (BRUV) are a relatively new and cost effective means of survey for numerous marine and aquatic species including sharks and rays. A total of 87 BRUV surveys was were conducted between the months of March – June in 2015 across 3 habitat zones within the waters of Tubbataha Reefs Natural Park, located in the middle of the Sulu Sea. A total of 287 encounters were recorded throughout the study. 11 species of elasmobranch were documented during BRUV surveys, in order of decreasing frequency :Grey reef shark *Carcharhinus amblyrnchus ,* whitetip reef shark *Triaenodon obesus ,* tiger shark *Galeocerdo cuvier ,* pelagic thresher *alopias pelagicus ,* scalloped hammerhead *Sphyrna lewini*. grey nurse shark *nebrius ferrugineus,* blacktip reef shark *Carcharhinus melonopterus*, silky shark *Carcharhinus falciformis*, spotted eagle ray *Aetobatus narinari,* , marble ray *Taeniura meyeni* whaleshark *Rhincodon typus.* Relative abundance of elasmobranch encounters did not differ with respect to depth. Species richness increased with an increase in survey length and an increase in depth of sampling.

Presentation type: Poster

New insights on the biology and the abundance of the uncommon deep-sea Little sleeper shark *Somniosus rostratus* (Somniosidae) from the Balearic Sea (Western Mediterranean): do mesopelagic habits partially explain rarity of its catches?

Javier Guallart[1], Pablo García-Salinas[1]

[1]University of Valencia

The Little sleeper shark is considered avery uncommon species inhabiting NE Atlantic and Mediterranean deep-sea waters. Its current IUCN status is “Data Deficient”.

Data obtained from bottom trawling fishery targeting red shrimps (*Aristeus antennatus*) at the Ibiza Channel (Western Mediterranean) (500-800 m depth) showed that it is not as uncommon as thought. During 18 months of surveillance (March 2013 - August 2014) results showed a catches frequency of 5.12 * 10^{-2}specimens * fishing-journey^{-1} or a density of about 6.14 * 10^{-2} specimens*km^{-2}: on average it represents the catch of about one specimen per month and fishing vessel trawling on these bottoms.

Although literature describes the species as demersal, several evidences presented here suggest mesopelagic habits.

Among specimens studied (n = 20), 40.0% had the stomach empty and 60.0% showed cephalopod remains in its contents. The majority of these remains belonged to species of *Histioteuthis*. Both species of the genus inhabiting the Mediterranean Sea (*H. bonelli* and *H. reversa*) have mesopelagic habits, carrying out vertical migrations along the water column.

In addition, a specimen carrying a hook in its mouth was found. This type of hook is used in a local fishery on midwater (typically, about 500 m depth over 1.000 m bottoms) targeting for swordfish (*Xiphias gladius*).

Some authors have related the rarity of catches of *S.rostratus* with a preference of the species for habitats deeper than 1.000 m. However, most of records presented in literature correspond to catches made at shallower depths, supporting the information presented here.

Therefore, we hypothesize that *Somniousus rostratus* has mainly mesopelagic habits, inhabiting the water column over the slope or the deep-sea floor. Deep midwater habitats are almost unexploited by commercial fisheries and are poorly studied by scientific surveys. That could explain the supposed rarity of this species throughout its geographic range.

Presentation type: Poster

First record of young of the year scalloped hammerhead shark, *Sphyrna lewini* (Carcharhiniformes: Sphyrnidae) from Isla del Coco National Park, Costa Rica

Geiner Golfin Duarte[1]

[1]Isla del Coco National Park of Costa Rica

The scalloped hammerhead shark, *Sphyrna lewini* is a coastal and pelagic circumglobal species that resides within coastal warm temperate and tropical seas. *Sphyrna lewini* exhibits strong intraspecific segregation: neonates and young-of-the-year spend the first part of life in coastal inshore waters (nursery grounds), while adults migrate offshore, yet return to protected nursery habitats for mating and pupping. On December 3, 2014, at approximately 19:00, four young of the year *S. lewini* were caught with hand line and a modified size 5 circular hook, in Wafer Bay, Isla del Coco, Costa Rica (5.5451ºN 87.0626ºW). A total of 3 males (total length 73, 73, 76 cm) and 1 female (total length 75 cm) were recorded. The presence of these individuals at Isla del Coco suggests that a pregnant female gave birth at Wafer Bay, which may be used as a nursery ground by *S. lewini*. We recommend further study to evaluate the presence and movements of young-of-the-year and juvenile *S. lewini* in Wafer Bay to determine if this was an isolated incident or if the bay is a nursery ground for *S. lewini*.

Presentation type: Poster

First record of the blacktip reef shark *Carcharhinus melanopterus* (Carcharhiniformes: Carcharhinidae) from the Tropical Eastern Pacific

Maikel Perez Montero[1]

[1]Cocos Island National Park of Costa Rica

The blacktip reef shark *Carcharhinus melanopterus*, is one of the most common IndoPacific reef sharks. On April 29, 2012 at 20:00 hrs., a blacktip reef shark, was caught during a tagging expedition studying population dynamics of the whitetip reef shark *Triaenodon obesus*, in Chatham Bay, Isla del Coco National Park. Chatham Bay is located on the north side of Isla del Coco between coordinates 5º33'25.28"N, 87°02'53.11"W and 5º33'04.71"N, 87°02'13.76"W. Positive identification of the species was attained by analysis of the following distinctive characters (Compagno 1998, Compagno 2005):

1. Short rounded snout with large anterior nasal flaps.
2. Black tips on all fins, including the edge of the caudal fin's upper lobe
3. Light band that borders the black mark on the first dorsal fin.
4. Distinctive body color: yellow-brown dorsal surface and white underside, with conspicuous dark bands on the flanks that extend back towards the pelvic fins.

The shark's size (89cm TL) together with the low calcification of its claspers, suggests the individual was a juvenile. This is the first record of a blacktip reef shark from Isla del Coco National Park and from the Tropical Eastern Pacific (Allen & Robertson 1998, Robertson & Allen 2008). Garrison (2005) identified over 270 fish species (including 7 sharks and 4 rays) at Isla del Coco: 30 species have a circumtropical or circumglobal distribution and over 40 species are reported from scattered Indo-Pacific locations or throughout the Indo-Pacific Ocean (most of these are bony fish, e.g. the genus Thalassoma, that probably travelled 5000km with floating debris to arrive in the Eastern Pacific Ocean (EPT). Several Indo-Pacific elasmobranchs are present at Isla del Coco, including the silvertip (*Carcharhinus albimarginatus*) and the white-tip shark (T. besus). Their distribution extends into the continental waters of Central America. Other example is the marble ray (*Taeniura meyeni*); is only present at Isla del Coco and Galapagos Islands in the Tropical Eastern Pacific, and absent from the central American mainland (Grove & Lavenberg 1997). The presence of a juvenile blacktip reef shark at Isla del Coco suggests that a pregnant female traveled at least 5000km and arrived at Isla del Coco to give birth at Chatham Bay. *C. melanopterus* possibly represents a new arrival for Isla del Coco National Park.

Presentation type: Poster

Skate eggcases collected ashore as indicators of the seasonality of the egg laying

Martin M.C.[1], Rohr A., Stéphan E., Gadenne H.

[1]Association Pour l'Etude et la Conservation des Sélaciens (APECS)

Several skate species have been recorded in French coastal waters and most of them are still little known. With the CapOeRa program (based on the Shark Trust Great Eggcase Hunt), the NGO APECS look at the interest of the eggcases as signs of presence to improve the understanding of the breeding ecology and to locate oviposition sites. This Citizen Science program started in 2008 invites the public to collect eggcases washed ashore along the French shore. In parallel, APECS started in 2011 a second protocol called "Sentinelles" which has a stricter collection protocol (e.g., same location being sampled over time, regular sampling intervals). We will present the results of comparisons between both protocols. Preliminary analyses suggest interesting seasonal patterns. In addition, we will discuss our findings that opportunistic public data collection might not be always efficient at detecting seasonality signals. Thus, both protocols demonstrate complementarities for investigating skate ecology.

Presentation type: Poster

Can opportunistic sampling provide information for conservation of sharks and rays? Chondrichthyans Population genetics and breeding ecology in Turkish seas

Elizabeth Grace Tunka Eronat[1]

[1]Ege University, Faculty of Fisheries

Chondrichthyans are one of the top predators in marine ecosystems. This study will build important data to help us understand the abundance of chondrichthyans throughout the Turkish coast. In Turkish seas, there are 66 cartilaginous species (32 selachii, 33 batoid, and 1 chimaera) which represents 75% of the total chondrichthyan species found in the Mediterranean and 12% of the total marine fish fauna of Turkey. Almost half of these species are listed by IUCN as Near Threatened, Critically Endangered, or Vulnerable and of the remaining species a further 15 are data deficient. Fisheries activities are intensively done throughout Turkey and while chondrichthyans are not specifically targeted they are caught frequently as by-catch. On this regard to provide information and sufficient data to understand chondrichthyans biology and ecology for conservation measures in these waters a project was proposed and is funded by The Rufford Foundation.

The aim of the project, is to use participatory methods and opportunistic sampling of by-caught chondrichthyans to provide and generate data on the species for future conservation measures. First, a network was set between fishermen/fisherwomen from various parts of Turkey. Samples are being collected since May 2015. With the beginning of the project, 10 g of tissue samples are collected from every species for DNA barcoding and to identify phylogenetic relations between species and populations. Where fresh whole individuals were received, to obtain more data on their reproduction systems, gonads were dissected for histological studies. Also on individuals dissections were conducted and stomach contents were identified and recorded. By collecting all the info and data we can, we hope to generate a wide range of information for future chondrichthyan conservation studies or actions in Eastern Mediterranean.

Presentation type: Poster

Parasite fauna in the mesopelagic shark *Etmopterus spinax* (Squaliformes, Etmopteridae) from the Ibiza Channel (Western Mediterranean)

Bas-Silvestre M.[1], Martín-Lázaro A.[1], Serrano-Rodríguez N.[1], Guallart J.[1], Montero F.E.[1]

[1]Instituto Cavanilles de Biodiversidad y Biología Evolutiva

Despite the key role of sharks in the marine ecosystems, many biological and ecological aspects of sharks remain unknown. This scarce knowledge is particularly substantial in the case of deep sea sharks, as the Velvet Belly Lanternshark *Etmopterus spinax.* Parasites and other pathogens of these sharks are also unknown. Parasites provide information not only on the health of these sharks, but also are very informative as indicators of several aspects of the biology of their hosts and their surrounding ecosystems. For example, heteroxenous parasites can provide information on other animals acting as intermediate or definitive hosts, while monoxenous parasites inform about the demography and populations of the same shark species.

This study is based on the analysis of the parasite fauna of 48 specimens of the mesopelagic shark *Etmopterus spinax* (428-144 mm TL size range) captured as by-catching a bottom trawl fishery (380-730 depth range) targeting red shrimp (*Aristeus antennatus*) at the Ibiza Channel (Western Mediterranean).

The most prevalent (47,92%) and abundant (898±87,77) parasite species were Tetraphyllidea fam. gen. sp. (Platyhelmintha, Cestoda) (commonly known as the species complex, "*Scolex pleuronectis*"), found in the digestive. The rest of the parasites collected (Trypanorhyncha fam. gen. sp. and *Anisakis* sp. larva 3, type 2) appeared to be accidental. All these parasite species are larval, what implies that *Etmopterus spinax* is mostly a prey of other predators (e.g. larger shark species), required to complete the life cycles. A morphological study of the plerocercoid of Tetraphyllidea fam. gen. sp. has been also developed in order to find morphological traits to differ the morphotype found in *E. spinax*.

Although this shark is classified as "least concern" by the IUCN Red List, these kind of studies are needed not only to improve the management and conservation of this species but their delicate ecosystems.

Presentation type: Poster

Trophic ecology of the velvet belly lanternshark, *Etmopterus spinax* (Chondrichtyes: Etmopteridae) in the Western Mediterranean (Valencia's Gulf)

Serrano-Rodríguez N.[1], Vicent-Rubert J.J.[1], Bas-Silvestre M.[1], Martin-Lazaro A.[1], Guallart J.[1]

[1]University of Valencia

Etmopterus spinax is a bathypelagic shark that inhabits the upper slope and the external part of the continental shelf, is a common species captured by fishing vessels in deep-water fisheries. Feeding habits of *E. spinax* in Valencia's Gulf and Alicante (Western Mediterranean) have been investigated through the analysis of the stomach contents of 200 specimens. In this work it has been described his diet composition and its variation with size, sexual maturity, sex, bathymetry and seasonality. The analysis of the diet of *E. spinax* suggest that he is a macropredator of mesopelagic species as cephalopods, crustaceans and teleost; benthic species are excluded from his diet. This species exhibits a group hunting behavior in smaller sharks and an opportunistic and scavenger feeding habits in larger sharks.

Presentation type: Poster

First Record of Tortonese's Stingray, *Dasyatis tortonesei* (Myliobatiformes: Dasyatidae) from Sea of Marmara (North-East Mediterranean Sea)

Taner Yildiz[1], Emre Yemişken[2], Cem Dalyan[2], Uğur Uzer[1], F. Saadet Karakulak[1]

[1]Istanbul University, Faculty of Fisheries, Department of Fisheries Technology, Istanbul, Turkey
[2]Department of Biology, Section of Hydrobiology, Faculty of Science, Istanbul University, Turkey

The Tortonese's stingray, *Dasyatis tortonesei*, Capape 1975 was firstly reported in Sea of Marmara. The Tortenese Stingray, *Dasyatis tortonesei*, Capape 1975 is one of the endemic chondrichtyan species in Mediterranean Sea. Sixteen batoid fishes were reported from Sea of Marmara which is a deep inland connecting from North Aegean Sea to Black Sea East in Mediterranean Sea. However, there was just recorded, *Dasyatis pastinaca* belong to family Dasyatidae, from Sea of Marmara. Although, *D. pastinaca* is well documented of distribution and biology in Mediterranean Sea, the limited information have been obtained about *D. tortonesei* because of the point of valid species discussion. On 6-7 May2015, Twenty-four specimens of Tortonese's stingrays were captured from three hauls as 34, 61 and 63 m depths (40° 56'016 N 29° 06' 101 E - 40° 39'520 N - 28° 26' 591 E) on a muddy bottom by using bottom trawl net in North of Sea of Marmara. The species morphological measurements were noted with length-weight relationship (a= 0.0018 and b= 3.3491).

In this study, we present a preliminary information about Tortonese Stingray*, D. tortonesei* from Sea of Marmara.The record of *D. tortenesei* is become more of an issue about knowledge of endemic species distribution not only evaluation of biogeographical situations but also discussion of the ecosystem problems in Mediterranean Sea.

Presentation type: Poster

The study of the relationship between squamation pattern and lifestyle as a potential tool for ecological inferences in deep water sharks

Humberto G. Ferrón[1], Carlos Martinez-Pérez, Alba Martín-Lázaro and Héctor Botella

[1]Geology Department. Universitat de València

More than one third of all described species of chondrichthyans inhabit deep water environments. The ecology and behaviour of most of these species is poorly known because many of them have never been studied *in situ* and only some biological aspects have been inferred from indirect observations on the morphology, anatomy and stomach contents of captured individuals. Interestingly, the close relationship between morphology and function in shark scales is well known, being involved in at least four functions (protection against abrasion, defense against ectoparasites, reduction of the skin friction drag and accommodation of photophores in bioluminescent sharks). Here we propose a new methodology, based on the study of the relationship between the squamation pattern and the ecology in well-studied sharks, that could be useful for ecological inferences in less known species such as those living in deep water environments.

With this aim, we have characterized the scale morphologies associated to each function by classic morphometrics and discriminant analysis. Subsequently, we have studied the squamation patterns of 43 species of sharks, whose ecology is well known, taking into account both the arrangement and the percentages of body area occupied by each scale morphology and scale functional type. Then the species were classified into ecological groups and the relationship between the lifestyle and the squamation pattern was established by two different ways. Firstly, we described the typical squamation pattern of each ecological group taking into account the distribution of the functional types on the body and, secondly, we performed a discriminant analysis taking into account the percentages of coverage of each functional type. In both cases we found a good correlation between the lifestyle and the squamation in all studied sharks. In this way, it is established a robust comparative framework where poorly known species, such as deep water sharks, can be included for ecological inferences in future works.

Presentation type: Poster

The occurence of *Squatina squatina* Linnaeus, 1758 from Gokceada (North-Eastern Aegean Sea)

Emre Yemişken[1], Persefoni Megalofonou[2], Cem Dalyan[1],

[1]Istanbul University, Faculty of Fisheries, Department of Fisheries Technology, Istanbul, Turkey
[2]Department of Biology, Section of Zoology Marine Biology, University of Athens, Greece

In this study, provided to update knowledge of occurrence of *Squatina squatina* Linnaeus, 1758 from North Aegean Sea and gave an information about deposition of calcified on vertebrae to age determination of the specie. Two female individuals of *Squatina squatina* were caught by longline in offshore of Gokceada (Imbros-North Eastern Aegean Sea) from 109 m depths. The band pairs of vertebrae was investigated by using colorization and non-colorization method. Some vertebrae measurements were counted. And the translucent and opaque bands on the vertebrae observed in detail. The discriminative band pair numbers showed variety between colorization methods such as 22 – 24 (Total Length: 596 mm), 24-28 (Total Length: 1177 mm). There is no differences view of band on vertebrae between Silver nitrate colorization method and without colorization method. However, the red alzarine method didn't demostrate a good results to clarify the bands.

Presentation type: Poster

Diet of an endangered Rajid species in the Celtic Sea: the common skate, *Dipturus* cf. *flossada*

Sarah Brown-Vuillemin[1]

[1]French National Museum of Natural History and Université du littoral Côte d'Opale (ULCO)

Stomach contents from 313 *Dipturus* cf. *flossada* captured during trawl surveys in Celtic sea (2012-2015) were analyzed to examine their diet composition. Fifty prey species were identified and have been regrouped into 6 categories of prey for the analyses. *D.* cf. *flossada* feed mainly on shrimps, crabs and fishes. No differences between sexes are observed, but analysis showed significant ontogenetic changes in diet. Specimen's total lengths range between 197 and 1412 millimeters. The Levin's index indicates that *D.* cf. *flossada* is a specialist predator (Bi<0.6) for all stages of life. The value of the Prey-Specific Index of Relative Importance (%PSIRI) showed that shrimps (%PSIRI=98) largely dominated the diets of smaller individuals (<455 mm), then their proportion decreases during growth to be replaced by crabs and fishes. Longer individual (>1229 mm) show a specialization for fishes (%PSIRI=81). This specialization is confirmed by a high trophic level (TL>4) corresponding to a tertiary consumer in the food chain. The low dietary overlaps between juveniles, sub-adults and adults suggest the possibility of sharing resources. Similarly, in the same size classes, differences in diets according to the stage of maturity are observed with a large dominance of fishes, (%PSIRI=80) for mature individuals in comparison with immature (%PSIRI=40). Results implicate that an accurate diet characterization requires taking into account the life cycle.

Presentation type: Poster

Systemic gas embolism in sharks! Evidence of decompression like lesions in by-caught little sleeper sharks *Somniosus rostratus* from deep sea trawls

Daniel García[1], José Luis Crespo[1], Javier Guallart[1], Pablo García-Salinas[1], Maria Ángeles Jiménez[1], Micah Brodsky[1]

[1]University of Valencia

Gas embolism associated with decompression has been described in air breathing marine vertebrates, including cetaceans, pinnipeds, and sea turtles, and in teleost fish possessing a swim bladder. In air breathing marine vertebrates, gas embolism has been associated with anthropogenic factors, such as exposure to sonar and by-catch in commercial fishing gear. In mammals and turtles gas bubbles have been observed in several tissues and are considered to reflect nitrogen supersaturation caused by changes in diving behaviour or physiology.

This is the first report describing decompression like gas bubbles emboli in cartilaginous fish, such as elasmobranchs, that lack internal gas filled spaces. Results from post mortem CT scans, necropsy, and histopathology of three specimens of deep-sea shark *Somniosus rostratus* caught at 600-800 m depth in commercial bottom trawls in the Ibiza Channel (Western Mediterranean) are consistent with signs of gas emboli.

Gas bubbles were observed on CT images in several tissues including the eyes, brain case, and urogenital system. Macroscopic gas bubbles and lesions were observed during necropsies. Histopathology revealed tissue damage consistent with gas bubble trauma underneath serosal membranes of the intestine, liver and spleen. In addition, vascular ectasia consistent with gas filling of blood capillaries and lymphatic vessels was observed in multiple tissues, including kidney, liver, spleen and meninges. We theorize that these bubbles could most probably originate from either oxygen or CO_2 supersaturation. We plan to discuss and contrast our findings with other zoological groups and present plans for future research to characterize this phenomenon and mechanisms of decompression associated with gas embolic disease in cartilaginous fishes.

Presentation type: Poster

Climate change is affecting elasmobranch biodiversity in the marine waters of the Madeira Archipelago (NE Atlantic)

Mafalda Freitas[1,2], João Canning-Clode[2,3]

[1]Estação de Biologia Marinha do Funchal, Cais do Carvão, Promenade da Orla Marítima do Funchal, 9000-107 Funchal, Madeira, Portugal.
[2]MARE – Marine and Environmental Sciences Centre, Estação de Biologia Marinha do Funchal, Cais do Carvão 9000-107 Funchal, Madeira, Portugal.
[3]Smithsonian Environmental Research Center, 647 Contees Wharf Road, Edgewater, MD 21037, USA

The global warming of the oceans and the ability of many successful non-native marine species to tolerate a broader thermal range than similar native species is changing species distributions across seas and oceans. As a response to this recent warming, a poleward movement in latitude of numerous species has been observed in many biogeographic regions.
The Madeira Archipelago is located southwest of continental Europe and 700 km off the Moroccan coast in the Atlantic Ocean. In recent years several new records of marine invertebrates and fish have been registered in Madeiran waters due to biological invasions but also due to climate change.
For the past 20 years, several species of marine fishes from tropical and subtropical seas have been showing up in Madeira and as a result, these new records have been expanding their distribution range, particularly its north limit. In this context, we present in this account four new elasmobranch species we consider are range expansions for the Madeira island system.

Presentation type: Poster

Deep-sea Chondrichthyes caught in an experimental fishing survey off the Canary Islands (NE Atlantic Ocean)

Mafalda Freitas[1,2]; Ana Luísa Costa[1,2],João Delgado[3]; S. Jiménez[4]; J. A. González[5]; Viriato Timóteo[3]

[1] Estação de Biologia Marinha do Funchal, Cais do Carvão, Gorgulho, 9000-107, Funchal, Madeira, Portugal.
[2]MARE – Marine and Environmental Sciences Centre, Estação de Biologia Marinha do Funchal, Cais do Carvão 9000-107 Funchal, Madeira, Portugal.
[3] Direcção de Serviços de Investigação das Pescas, Estrada da Pontinha, 9004-562 Funchal, Madeira, Portugal.
[4] Museo de Ciencias Naturales de Tenerife, 38001 Santa Cruz de Tenerife, Spain.
[5] Grupo de Ecología Marina Aplicada y Pesquerías, Universidad de Las Palmas de Gran Canaria, Departamento de Biología, Campus de Tafira, Las Palmas de Gran Canaria, 35017 Las Palmas, Spain

There is a long tradition in the deep-sea fishery of the bathypelagic black scabbard-fish, *Aphanopus carbo* and *A. intermedius*, in Portugal mainland and in the Archipelago of Madeira. In Madeira, this fishery is performed with drifting longlines, set between 800 and 1200 m of depth, on the slopes of the islands of the archipelago and nearby seamounts. This is one of the oldest known fisheries in the world targeting a deepwater resource.

In March 2009 an experimental survey to obtain indications about the abundance of black scabbard-fish and to access the by-catch of this type of fishery was carried out inside the Canary Island ZEE, in the framework of a fisheries agreement between Macaronesian archipelagos (Madeira, Azores and the Canaries).

Eleven species of Chondrichthyes were identified, belonging to 5 families: Pseudotriakidae, Centrophoridae, Etmopteridae, Somniosidae and Chimaeridae.For some of the species caught and due to its rarity, data regarding depth of occurrence, sexual matury and morphometry are given.

Several voucher specimens from all species caught were deposited as reference collections in the Natural History Museum of Funchal (MMF).

Presentation type: Poster

First record of a gravid blue shark, *Prionace glauca* in Corinthian Gulf, Hellas, eastern Mediterranean Sea

Persefoni Megalofonou[1]

[1]Department of Biology, Section of Zoology-Marine Biology, University of Athens, Panepistimiopolis, 157 84 Athens, Greece

The blue shark is the most abundant shark species of the pelagic ecosystem in the Mediterranean Sea having a broad geographic distribution from the Strait of Gibraltar to the Lebanon coasts and from the African to European continental shelf. On 11th February 2015, a large specimen with a total weight of 320 kg was captured in Corinthian Gulf, a semi-enclosed gulf between the Peloponnesus to the south and Central Hellas to the north with a maximum depth of 935 m. This is the first record of the species in this area and the largest gravid female ever reported in the Mediterranean Sea. A detailed description of the specimen by measurements of morphometric characters is given. Fifteen of its embryos were recovered and measured.

Presentation type: Poster

On the occurrence of pelagic sharks in Calabria (Southern Italy, central Mediterranean)

Gianni Giglio[1], Silvio Cimbalo, Stefania Giglio, Elena Madeo, Francesco Pellegrino, Francesca Riviello, Giuseppe Rjillo, Sandro Tripepi, Emilio Sperone

[1]University of Calabria, Department of Biology, Ecology and Earth Sciences

This contribution presents the results of a survey study on the spatiotemporal patterns of distribution of large predatory sharks in Calabria between the years 2000-2015. The Tyrrhenian side of the study area lies in the western Mediterranean, while the Ionian side lies in the eastern Mediterranean. Calabria is divided from Sicily by the Messina Strait The Ionian continental shelf is not particularly wide, and the depth along the Sicilian coast drops suddenly and reaches -2000 m within few miles from the coast. The Messina Strait is very important from a geological and an oceanographic point of view, because together with the Sicily-Tunisian Ridge it is one of the two conjunction points between the western and eastern basins of the Mediterranean Sea. A total of 14 species were recorded: *Alopias superciliosus, Alopias vulpinus, Carcharhinus brevipinna, Carcharhinus obscurus, Carcharhinus plumbeus, Carcharodon carcharias, Cetorhinus maximus, Hexanchus griseus, Isurus oxyrhinchus, Lamna nasus, Odontaspis ferox, Prionace glauca, Sphyrna lewini* and *Sphyrna zygaena*. Among these species, the blue shark *Prionace glauca* and the bluntnose sixgill shark *Hexanchus griseus* were the most common ones. Also of interest was the frequency of species such as *Carcharodon carcharias*, *Sphyrna zygaena, Isurus oxyrhinchus* and *Cetorhinus maximus*. 46% of all reported records derived from the Tyrrhenian side of the region and 54% on the Ionian side. The presence of species such as *Alopias superciliosus, Carcharhinus obscurus* and *Sphyrna lewini* is of interest from a biogeographical point of view. The reproduction of the species *Carcharhinus obscurus, Carcharhinus plumbeus, Hexanchus griseus, Isurus oxyrhinchus, Prionace galuca* and *Sphyrna lewini* was documented along the Calabrian coast, particularly on the Ionian side of the region. The recovering of Ionian *Sphyrna zygaena*, *Hexanchus griseus* and *Prionace glauca* populations and the declining of *Lamna nasus* and *Odontaspis ferox* populations were also noted.

Presentation type: Poster

Deficit in digestive capabilities of shark early stages under climate change

Rui Rosa[1], Marta Pimentel[1], Juan G. Galan[1], Miguel Baptista[1], Vanessa M. Lopes[1], Catarina Santos[1], Ricardo Calado[2], Tiago Repolho[1]

[1]MARE – Marine and Environmental Sciences Centre, Laboratório Marítimo da Guia, Faculdade de Ciências da Universidade de Lisboa, Av. Nossa Senhora do Cabo, 939, 2750-374 Cascais, Portugal
[2]Departamento de Biologia & CESAM, Universidade de Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

Few empirical information is currently available on the potential effects of acidification and/or warming in sharks, but none exist about digestive capabilities under such future conditions. Here we investigated the impact of both acidification (ΔpH=0.5) and warming (+4 °C; 30 °C) on the digestive enzyme levels of recently-hatched tropical bamboo shark (*Chiloscyllium punctatum*). Thirty days post hatching, juvenile sharks revealed a significant increase in pancreatic trypsin levels under warming, but also a significant decrease under acidification, namely a 42 % drop under present-day temperature and 44% drop under the warming condition. A similar trend was recorded for the alkaline phosphatase activity in shark's intestine, i.e., the impact of environmental hypercapnia was also quite notorious - a 50 % drop under present-day temperature and 49% drop under the warming condition. We argue that these trends might be the result of reduced protein synthesis due to energetic limitations to fuel essential processes, which led to a decrease in metabolic rates and general body fitness.

Presentation type: Poster

Ecto and endo-parasites of elasmobranchs stranded along Calabrian coast (southern Italy, central Mediterranean)

Elena Madeo[1], Stefania Giglio, Emilio Sperone, Gianni Giglio, Sandro Tripepi, Concetta Milazzo

[1]University of Calabria, Department of Biology, Ecology and Earth Sciences

The purpose of this paper was to provide preliminary data on parasites of elasmobranchs stranded along the Calabrian coast: in particular, we examined two specimens of *Dalatias licha*, one of *Isurus oxyrinchus* and five of *Prionace glauca*. Specimens were all of different sizes and came from the Ionian coast of the Calabria region. The isolation of parasites from the organs was performed according to the common parasitological techniques. Parasites were isolated, cleaned in saline, fixed in ethanol 70°, cleared in Amman lactophenol and classified according to literature.

In all examined species, nematodes larvae were found in the stomach and the spiral valve. Due to the bad condition of the samples, it was not possible to obtain an identification at genus or species level just from the morphology of these larval stages. In addition, the parasitological examination revealed the presence of the cestodes of the Order Trypanorhyncha (Diesing, 1863) in *Isurus oxyrinchus* (stomach, spiral valve), larvae of cestodes Tetraphyllidea (Carus, 1863) in a specimen of *D. licha* (spiral valve) and cestodes belonging to the family Phyllobothriidae (Braun, 1900) in *P. glauca* (spiral valve). During the investigation we observed the presence of ectoparasites too. In particular, the skin of *I. oxyrinchus* was infested by the copepod *Euryphorus brachypterus (*Gerstaecker, 1853) and by larval stages belonging to the family Caligidae; on the gills of the same specimen we found females of *Nemesis Lamna* (Risso 1826). The skin of *P. glauca* was infested by the copepod *Echthrogaleus coleoptratus* (Guérin-Méneville, 1837) and the gills by a female specimen of *Kroyeria lineata* (Van Beneden, 1853). The results obtained are in agreement with literature; some particular cases require further investigations.

Presentation type: Poster

ICP-MS as a useful tool to determine heavy metals content in elasmobranchs

Sandro Tripepi[1], Raffaella Santoro, Stefania Giglio, Elena Madeo, Concetta Milazzo, Gianni Giglio, Emilio Sperone, Donatella Barca

[1]University of Calabria, Department of Biology, Ecology and Earth Sciences

Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry which is capable of detecting metals and several non- metals at concentrations as low as one part in 10^{15} (part per quadrillion, ppq) on non-interfered low-background isotopes. This is achieved by ionizing the sample with inductively coupled plasma and then using a mass spectrometer to separate and quantify those ions. Compared to other techniques, ICP-MS has greater speed, precision, and sensitivity. The surveys are performed to a level of precision and high sensitivity, with measurement limits in the ppm (mg / kg) and ppb (micrograms / kg).

This research represents the first attempt to use this technique to determine the content of heavy metals in elasmobranchs stranded along the coast of Calabria. In particular, we analyzed tissues of *Hexanchus griseus* (1 specimen), *Galeorhinus galeus* (1 specimen), *Scyliorhinus canicula* (3 specimens), *Torpedo torpedo* (1 specimen) and *Galeus melastomus* (5 specimens). For each specimen were analyzed samples of brain, fat, muscle and skin. The heavy metals evaluated were: Fe, As, Sr, Cr, Mn, Ni, Cu, Zn, Se, Cd, Sn, Mo, Pb. The data showed a different capacity to accumulation of heavy metals in relation to the tissues considered, and in relation to the ecological preferences of the species. Also the size and, consequently, the age, of the specimen could have an influence on the rate of accumulation. The low number of samples does not allow further speculation, but the data obtained have verified the effectiveness of ICP-MS as accurate method for determining the content of heavy metals in tissues of elasmobranchs.

Presentation type: Poster

Maximizing smartphone technology in marine recording projects

Cat Gordon[1], John Richardson[1]

[1]The Shark Trust

Growing acknowledgement of the value and role of citizen science is allowing members of the public to play a far greater and more effective role in elasmobranch research, and potentially feed into conservation and management policy. Recognising this, the Shark Trust has developed smartphone apps aimed at increasing the flow and quality of records for two key Shark Trust citizen science projects: the Great Eggcase Hunt (GEH) and the Angler Recording Project (ARP).

Each app was developed with a different objective in mind. The GEH receives a high volume of records (over 80,000 to date) however unverified records have produced some spurious entries in the dataset. As such, it is important to increase the number of records submitted with photographs of the eggcase, allowing the records to be verified. The smartphone app should increase both the flow and quality of records submitted to the project, thereby improving knowledge of egglaying species and those marine areas important to their static life history stage.

In contrast, the ARP receives fewer records (approx. 8000 to date), due primarily to a general reticence on the part of sea-anglers to engage in recording projects. The smartphone app will make catch recording and reporting as simple and straight-forward as possible, with the objective of increasing the volume, accuracy, and geographic and demographic spread, of records submitted. Ultimately, as the project grows, trends in the abundance and distribution of species throughout UK waters may become visible, which can contribute to more effective fisheries management and conservation.

Presentation type: Poster

Scyliorhinus stellaris eggcase tagging project

Cat Gordon[1]

[1]The Shark Trust

The Nursehound (*Scyliorhinusstellaris*) is one of the most abundant shark species encountered in British waters, although they are listed as Near Threatened on the IUCN Red List. Despite this widespread distribution, the eggcases are most commonly washed up and recorded to the Shark Trust's Great Eggcase Hunt from around the south and west coast of England and Wales. Egglaying has been documented as occurring during spring and summer months in shallower waters, with an incubation period of 9 – 11 months, depending on water temperatures.

In Devon, a local site has been discovered where numerous *S. stellaris* eggcases have been deposited in a sheltered channel. The area can be easily snorkelled on a low spring tide, with the depth usually ranging from 0.5 – 1.5m. There is an abundance of Rainbow Wrack (*Cystoseira tamariscifolia*) in this channel, and all eggcases recorded to date have been found attached to this. Since April 2014, the eggcases have been photographed and tagged, and the water temperature, tide height and time, and significant weather events have been recorded for each survey.

During the preliminary study all eggcases encountered were tagged, however the main aim is to record newly deposited eggs (distinguished by their transparency and lack of bio-fouling) in order to monitor the average development period while in-situ and whether the eggs are deposited outside of the known egglaying period. Other factors such as the success of hatching for each egg and the level of bio-fouling with age are also being monitored.

Presentation type: Poster

The role of sharks in a coastal ecosystem of the southern Brazil

Hugo Bornatowski H.1; Angelini, R.2; Amorim, A.F.1

[1] - Instituto de Pesca. Avenida Bartolomeu de Gusmão, 192. Santos, SP, CEP 11030-906, Brazil

[2] - Departamento de Engenharia Sanitária e Ambiental, Universidade Federal do Rio Grande do Norte, UFRN, BR-101, Campus Universitário, Natal, RN CEP59078-970, Brazil

Understanding the ecological role of a species within an ecosystem depends largely on knowledge of its trophic relations. Comprehending these trophic interactions and the position of species within a foodweb is a crucial step in clarifying the dynamics of marine communities and the impacts individual components (i.e. species) have on trophic network compartments. Failure to recognize the importance of direct and indirect effects can lead to serious gaps in our understanding of the causes and consequences of disturbances in foodwebs. We used Ecopath with Ecosim models to evaluate the role of coastal sharks [i.e. *Galeocerdo cuvier*, *Sphyrna* spp. (*S. zygaena* and *S. lewini*), *Carcharhinus obscurus* and *Rhizoprionodon lalandii*], and their influence on marine structure in a subtropical ecosystem in southern Brazil. The results showed that tiger *G. cuvier* and hammerhead *Sphyrna* spp. sharks are ecologically important predators of the southern Brazilian coast, and their ecological importance in the food web is high, being classified as keystone species in this ecosystem. A mixed-trophic impact matrix was generated and tiger shark exerted a strong positive impact on Tetraodontidae fishes, and negative impacts on sea birds and Gerreidae fishes. Hammerhead sharks negatively impacted batoids (*Rajidae* and *Dasyatidae*), *R. lalandii* and *Carangidae* fishes. Analysis of the Brazilian southern coast reveals that sharks are keystone predators, and are highly impacted by fishing. Increases in fisheries can have strong effects on the food web.

Presentation type: Poster