



JORNADAS IBÉRICAS DE ICTIOLOGIA SIBIC

Conhecer para preservar

24 a 27 de junho de 2014 LISBOA
Museu Nacional de História Natural e da Ciência

WWW.SIBIC.ORG

**JORNADAS
IBÉRICAS
DE ICTIOLOGIA**

SIBIC

Conhecer para preservar

Patrocinadores
principais



Patrocinadores



Bolsas de Estudantes



Apoios



Oceanário de Lisboa
Sempre diferente.



Transportadora Oficial

Expositores



Instituições organizadoras



COMITÉ CIENTÍFICO

Paulo Alexandrino
Pedro Raposo de Almeida
Juan Francisco Asturiano
Henrique Cabral
Fernando Cobo
Maria João Collares-Pereira
Maria José Costa
Estibaliz Diaz
Isabel Domingos
Carlos Fernández-Delgado
Maria Teresa Ferreira
Maria Filomena Magalhães
Anabel Perdices
Ainhize Uriarte
Lluís Zamora Hernández

COMITÉ ORGANIZADOR

Maria Judite Alves
Pedro Raposo de Almeida
José Lino Costa
Ana Filipa Filipe
Christos Gkenas
Maria Filomena Magalhães
Carla Maia
Catarina Mateus
Natacha Mesquita
Bernardo Quintella
Filipe Ribeiro
José Maria Santos

GENERAL INFORMATION

VENUE

The V Iberian Congress of Ichthyology takes place at the National Museum of Natural History and Science (MUHNAC), situated in Rua da Escola Politécnica (56/58), near the Príncipe Real square in the hearth of Lisbon.

- Plenary and special sessions take place in *Amphiteatro Chimico* (Level 1)
- Presentations take place in two rooms simultaneously: *Auditório Valadares* (Level 1) and *Auditório Quintanilha* (Level 0)
- Poster sessions take place in *Corredor de Radioquímica* (Level 1)

TIMETABLE OF THE SECRETARIAT DURING THE CONGRESS

The Secretariat of the Congress locates at the main entrance of MUHNAC during the first two days. Afterwards, it will move up to the *Sala Zoologia* (Level 1). Open hours are the following: Tuesday, June 24, between 4.00 p.m. and 6.30 p.m.; remaining days between 8.30 a.m. and 4.30 p.m.. The Secretariat closes during main activities and technical visits.

REGISTRATIONS

The registration fee includes:

- Documentation and book of abstracts
- Access to all sessions and activities
- Technical and guided visits
- Welcome Drink on June 24th
- Lunches and coffee breaks between June 25th and 27th
- Congress dinner on June 25th
- Certificates of attendance and of presentation (oral communication/poster)
- Congress T-shirt

COMMUNICATIONS

Communications must follow the instructions below:

- **Oral communications:** You will have a **total of 12 minutes for presentation + 3 minutes** for questions; in every room a member from the local organization gives support to the attendees with the audio-visual media. **All presentations must be given to the organization at Secretariat on the day before their presentation.** We ask all presenters to check their presentations ahead of time. A dedicated room for the presenters to practice locates in Level 1 – Zoology.
- **Poster communications:** posters must be placed on *Corredor de Radioquímica* (Level 1), before the poster session (June 25) and should not be retrieved before June 27 (lunch time). During posters presentation, authors are asked to remain close to their posters in order to answer possible questions from the remaining attendees.

All presentations must be prepared according to the guidelines presented on the web page (http://www.sibic.org/jornadas/2014/comunicaciones_pt.html).

STUDENT PRESENTATION AWARDS

SIBIC awards the best oral and poster communication presented by students. If you are a student and intend to participate, please inform the Secretariat upon local registration. The awards consist in a diploma, a free annual registration as a SIBIC member, and scientific books. The local organizing committee is responsible for the jury selection and for the procedures related to the assignment of the awards. Best student presentation and poster will be announced on the closing ceremony.

INTERNET ACCESS

Free internet (Wi-Fi) is available during the Congress. Credentials will be given to attendees together with documentation.

There is a room for work meetings available on the ground level (Level 0, *Reserva Visitável*)

LUNCHES & COFFEE-BREAKS

Lunches take place at *Jardineta (Claustro)* in Level 0. We ask all participants to collaborate during the serving hours and help to maintain the area clean.

Coffee-breaks are at the *Sala Cyrillo Soares* (Level 1), close to *Auditório Valadares*.

CONGRESS DINNER – JUNE 25, Zambeze Restaurant (São Jorge Castle hillside)

Itinerary from the Baixa-Chiado metro station (located at Rua Garrett) to the restaurant Zambeze:

In the **Baixa-Chiado Metro** station (Blue line) located at Rua Garrett, step down through the moving stairway and exit at Rua do Crucifixo. **Go straight through Rua da Vitória** to Rua dos Fanqueiros (about 750m), where you will find the elevators inside the building (**Elevadores do Castelo**). Take the Elevator (open until 9 p.m.) and get off at last level Rua da Madalena, **go left** (around the corner) towards the Pingo Doce supermarket and Parking (Car Silo). Inside the building, **take the elevator** to the Restaurant Zambeze (level 7).



VISIT TO THE OCEANARIUM – JUNE 27 (5.30 p.m.)

The Oceanário de Lisboa opened in 1998 for the XXth Century's last World Fair, themed "The Oceans, a Heritage for the Future". With over one million visitors per year, the Oceanário has become a reference aquarium in Lisbon, in Portugal and across the world. As sponsor of the conference, the Oceanário offers an entrance to the participants on June 27, between 6 p.m. and 8 p.m., after the conference closing session.

The participants will be transported to the Oceanário by a bus from the municipality (transportation is carried out only towards Oceanário only). After the visit, the participants can enjoy this beautiful area by the Tagus River. It is served by several restaurants and bars. The best public transport to downtown is the Metro - Red Line (Oriente) – Vasco da Gama shopping mall.

Organizers: Catarina MATEUS (CO)

Please send an email to confirm your presence until June 10 to: sibic2014@museus.ul.pt



Oceanário de Lisboa

Sempre diferente.

VISIT TO THE EXPERIMENTAL FISH PASSAGE MODEL AT THE NATIONAL LABORATORY OF CIVIL ENGINEERING (L.N.E.C.) – FISHMOVE PROJECT – JUNE 28 (10 a.m.)

The FishMove project started in 2012 and involves 4 institutions: Instituto Superior de Agronomia (ISA, Coordinator), Instituto Superior Técnico (IST), Laboratório Nacional de Engenharia Civil (LNEC) and a Canadian consulting, Katopodis Ecohydraulics (KE). This project aims to assess the effects of small instream structures on the migratory movements of Iberian cyprinid species, particularly their ability to negotiate distinct physical and hydraulic obstacles to further develop mitigation measures for improving river connectivity in Portuguese rivers. In this journey, we will visit the experimental full-scale fish passage model at LNEC, where the laboratory component of the project takes place. At this time we should be running experiments to assess species jumping performance through a small simulated barrier.

How to get there: Walk down (350m) Rua da Escola Politécnica (Congress venue) to Metro station “Rato” (yellow Line). Take the metro (direction: Odivelas) and leave at station “Entrecampos”. Get off the station (Entrecampos / Av. E.U.A.) and catch Bus no. 744 (direction: Moscavide). Leave at station “Bombeiros Alvalade” and walk 250m to the destiny (huge building ahead at a crossing).

Meeting point will be at the outside main entrance of the building at 10 a.m. (GPS coordinates: N 38º 45.507; W 009º 08.458)

Organizers: Teresa VISEU (LNEC), José Maria SANTOS (ISA)

Visit conditioned to a maximum of 40 participants.

Please send an email before June 21 to confirm your presence to: jmsantos@isa.ulisboa.pt



GUIDED VISIT TO THE EX-SITU CONSERVATION FACILITIES AT THE VASCO DA GAMA'S AQUARIUM – JUNE 28 (10 a.m.)

The *ex-situ* conservation of endangered freshwater fish project started in 2008, aiming to preserve the genetic pool of populations in eminent risk of extinction until their habitats are restored and restocking with captive bred individuals may be accomplished. In this visit you will be able to visit one of the *ex-situ* conservation facilities of this project, in which *Iberochondrostoma lusitanicum*, *Iberochondrostoma almaiai* and *Achondrostoma occidentale* individuals are being kept. It will be possible to get in touch with the conditions in which juveniles are raised, the technical details implemented to achieve natural spawnings and the recent results from the restocking actions conducted so far.

How to get there: *By train*, get Cascais Line and leave at station “Algés”, catch Bus no. 76 to “Aquário” or walk around 10 min.. *By Bus*, catch Bus no.s 723, 729, 750 or 751, and leave at station “Algés” or Bus no. 1, 6 or 76 and leave at station “Dafundo”. *By Electric*, catch electric no. 15 in Praça da Figueira to “Algés”, and then catch Bus no. 76 to “Aquário Vasco da Gama”.

Organizers: Fátima GIL, Carla SOUSA-SANTOS.

Visit conditioned to a maximum of 15 participants.

Please send an email before June 21 to confirm your presence to: avg.aqua@marinha.pt; csousasantos@gmail.com.



OTHER AVAILABLE SERVICES AT MUHNAC

Established in 1926, the Museum functions under the University of Lisbon, and has numerous activities for the promotion of natural history and science awareness. Its rich collections, gathered along more than 250 years, span the areas of zoology, anthropology, geology and botany. The Exhibitions, Botanical Garden and Butterfly Garden are open for visits during the congress. Timetables are available at the main entrance of MUHNAC.

The Museum shop offers 10% discount on purchases for congress participants. There is an area with coffee machine and food, open from Tuesday to Friday, between 10 a.m. and 5 p.m..

TRANSPORTS AND PARKING

Lisbon is served by a network of metro and bus that can take you to almost all part of the city. The nearest metro stations to the Congress venue are RATO (Yellow Line) located 300m NW, and BAIXA-CHIADO (Blue Line) located 1300m SE. For details and maps of the entire network see <http://www.metrolisboa.pt/eng/>

Buses numbers 758 (approx every 9-11 min.) and 773 (approx every 14-15 min.) will take you very close to the Congress venue. Leave at station "R. da Escola Politécnica". Timetables and maps can be found at <http://www.carris.pt/en/home/>

Lisbon taxis are available 24h/day. To ask for a taxi, please call +351 219 362 113 (24h/day: Taxis de Lisboa) or +351 217 932 756 (Autocoope)

It is possible to park at MUHNAC. Please indicate until June 21, your name, number of car plate and arrival/departure day and hour.

INFORMATION ABOUT LISBON

Turismo de Lisboa (Tourism of Lisbon): <http://www.visitlisboa.com/>

Câmara Municipal (Town Hall): <http://www.cm-lisboa.pt/en>

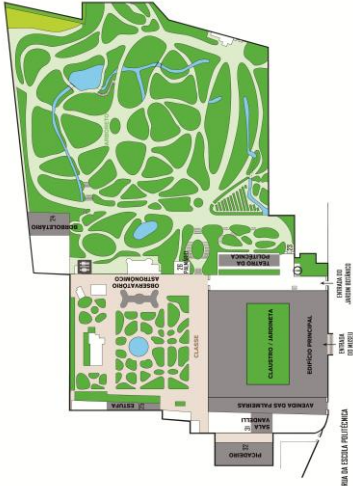
Weather Forecast: <http://www.ipma.pt/en/index.html>

CONTACTS

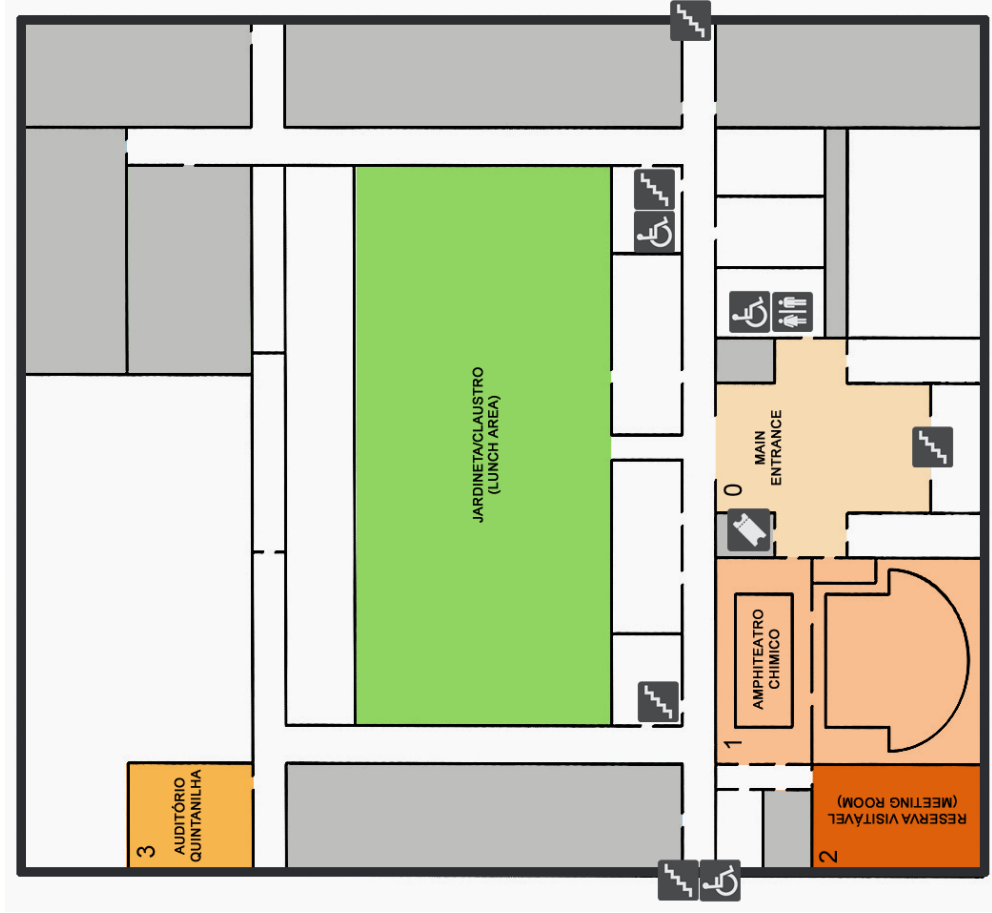
During the Congress, the following phone contacts will be available:

Secretariat (Filipe Ribeiro): 966201464

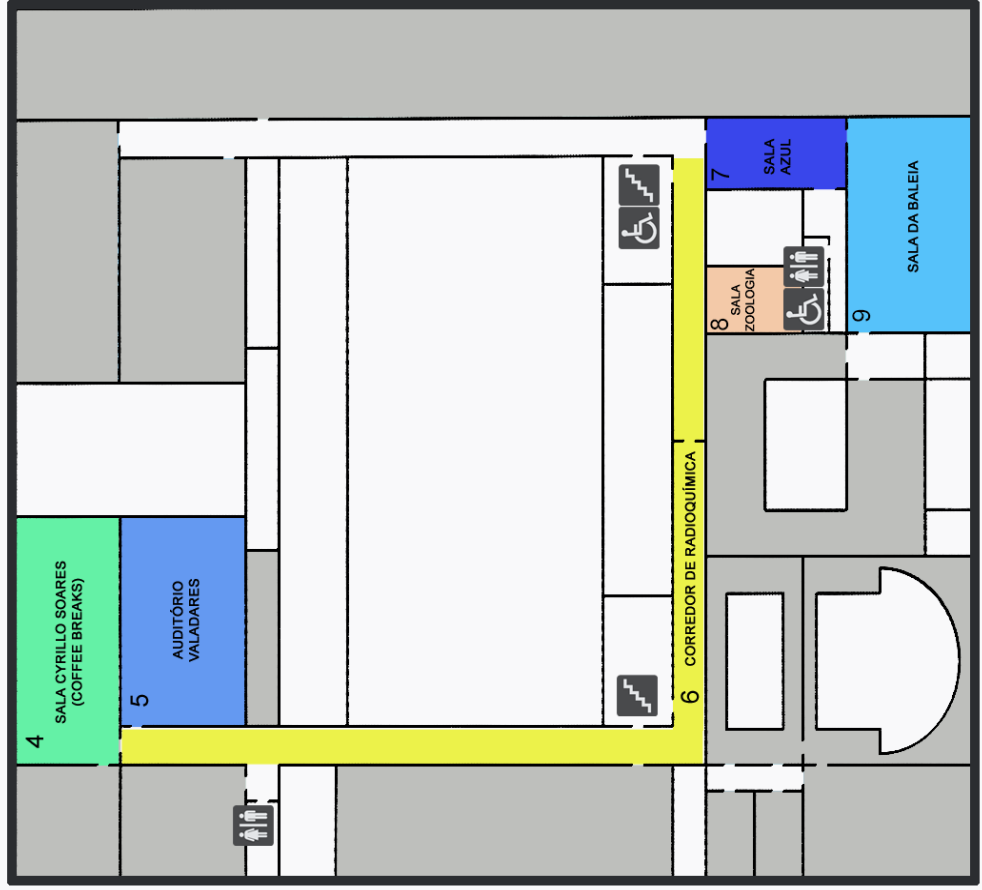
Secretariat (Carla Maia): 934514612



LEVEL 0



LEVEL 1



TIMETABLE

Tuesday, 24 June

- 17:00-21:00 Arrival & Registration at the Congress site
Congress Secretariat, Main entrance of the MUHNAC
- Welcome Drink – Fish tasting offered by Docapesca – Portos e Lotas, S.A.
Jardinetas MUHNAC
- Preview of the movie “Desert fish”, by Javier ESQUÍVIAS (2014)
- Opening Exhibition “Fish illustration”, Sala Azul

Wednesday, 25 June

- 8:30-9:00 Arrival & Registration at the Congress site
Congress Secretariat, Main entrance of the MUHNAC

Amphiteatro Chimico (Level 0)

- 9:00-10:00 Opening Ceremony
Carlos FERNÁNDEZ-DELGADO
- 10:00-11:00 PLENARY SESSION
Ecology and management of invasive fish: a perspective from the Iberian Peninsula.....(p. 21)
Emili GARCIA-BERTHOU

Sala Cyrillo Soares (Level 1)

- 11:00-11:30 Coffee-break

Auditório Valadares (Level 1)

ORAL SESSION. 0.1 NON-NATIVES FISHES: VECTORS AND IMPACTS

Chairman: Emili GARCIA-BERTHOU

- 11:30-11:45 **0.1:1 - Influence of Central European anglers on non-native fish introductions to Iberia**.....(p. 24)
Lukáš KALOUS, Filipe RIBEIRO & Miloslav PETRÝL
- 11:45-12:00 **0.1:2 - Fish stockings to newly formed man-made reservoirs in Turkey: ecological disasters or socioeconomic benefit?**.....(p. 24)
Ali Serhan TARKAN, Özcan GAYGUSUZ, Zeynep DORAK & Hamdi AYDIN
- 12:00-12:15 **0.1:3 - Some economic aspects of the introduced Atlantic salmon parasite *Gyrodactylus salaris* in Norway**.....(p. 25)
Jarle STEINKJER
- 12:15-12:30 **0.1:4 - Elevated water temperature and drastic changes in fish communities - a possible scenario for climate change in the lakes of northern latitudes**.....(p. 25)
Eva ZÁHORSKÁ, Mária BALÁŽOVÁ & Vladimír KOVÁČ
- 12:30-12:45 **0.1:5 - Aquarium Store Risk Assessment: evaluating fish invasion risk caused by ornamental trade**.....(p. 26)
Filipe RIBEIRO, Carlos MOURÃO, Inês RANGE & Maria Filomena MAGALHÃES

Auditório Quintanilha (Level 0)

ORAL SESSION. 0.2 MANAGEMENT OF REGULATED RIVERS AND RESERVOIRS

Chairman: Pedro Raposo de ALMEIDA

- 11:30-11:45 **0.2:1 - Can the placement of artificial boulders in pool-type fishways improve passage performance of benthic species?**(p. 27)
José M. SANTOS, Paulo BRANCO, Teresa VISEU, António N. PINHEIRO & Teresa FERREIRA
- 11:45-12:00 **0.2:2 - Ecohydraulics monitoring and improvement of fish passes in the Duero Basin: the case of river Tormes in Santibáñez de Béjar (Salamanca)**.....(p. 27)
Francisco Javier BRAVO-CÓRDOBA, Francisco Javier SANZ-RONDA, Jorge RUIZ-LEGAZPI, Juan Francisco FUENTES-PÉREZ & Víctor SALGADO-GONZÁLEZ
- 12:00-12:15 **0.2:3 - Benefits of hydroacoustics on fish research: Preliminary results of a TS study on Barbels**(p. 28)
Victoria RODRÍGUEZ SÁNCHEZ, Lourdes ENCINA & Amadora RODRÍGUEZ RUIZ
- 12:15-12:30 **0.2:4 - Pedrógão dam fish lift (Portugal, Beja) - goals and operation**.....(p. 28)
David CATITA, Rita AZEDO & Ana ILHÉU
- 12:30-12:45 **0.2:5 - Potentialities of fish behavioral barriers using acoustic stimuli: application in native species**.....(p. 29)
Joaquim de JESUS, Amílcar TEIXEIRA, Rui M.V. CORTES, Silvestre NATÁRIO, Clara AMORIM, Paulo FONSECA, João CARROLA, Simone VARANDAS & Luís T. PEREIRA

Jardineta (Claustro) (Level 0)

13:00 -14:30 Lunch

Auditório Valadares (Level 1)

ORAL SESSION. 0.3 – NON-NATIVE FISHES: POPULATIONS` CONTROL

Chairman: Filipe RIBEIRO

- 14:30-14:45 **0.3:1 - Project Estany, a LIFE + project for the recovery and protection of the original biodiversity in Lake Banyoles: results of population control fish**.....(p. 30)
Quim POU-ROVIRA, Miquel CAMPOS LLACH, Carles FEO QUER, Ramon CASADEVALL & Arnau JUSCAFRESA
- 14:45-15:00 **0.3:2 - Decrease the pressure from exotic species on Saramugo (*Anaocypris hispanica*) populations**.....(p. 30)
Ana Cristina CARDOSO & Carlos CARRAPATO
- 15:00-15:15 **0.3:3 - Restoration of Aquatic Ecosystems. Protecting and maintaining Europe's Native Aquatic Ecosystems (Sponsor presentation)**(p. 31)
Gunnar PERSSON
- 15:15-15:30 **0.3:4 - Changes after eradication of a Carp population introduced in a lagoon of South of Spain**(p. 32)
Carlos FERNÁNDEZ-DELGADO
- 15:30-16:30 **MOVIE (40' / EN / subtitles EN)**
"Fear and Fishing in Lake Davis" by Univ. California, Davis (2005)(p. 23)
DEBATE: Options for control and eradication of invasive species

Auditório Quintanilha (Level 0)

ORAL SESSION. 0.4 FISH MOVEMENT AND SWIMMING PERFORMANCE

Chairman: Fernando COBO

- 14:30-14:45 **0.4:1 - Movements of native cyprinids in an upstream weir-fragmented stream**.....(p. 33)
Paulo BRANCO, Susana D. AMARAL, Teresa FERREIRA & José M. SANTOS
- 14:45-15:00 **0.4:2 - Seasonal movements, home range extension and micro-habitat use of the Iberian barbel under natural and regulated flow conditions**.....(p. 33)
Tiago Filipe NEVES, Carlos Manuel ALEXANDRE, José Lino COSTA, Pedro Raposo de ALMEIDA & Bernardo Ruivo QUINTELLA
- 15:00-15:15 **0.4:3 - Streamflow variability as a driver of the swimming performance and eco-morphology of a Mediterranean cyprinid species**.....(p. 34)
Carlos Manuel ALEXANDRE, Bernardo Ruivo QUINTELLA, Ana Filipa FERREIRA & Pedro Raposo de ALMEIDA
- 15:15-15:30 **0.4:4 - Volitionally swimming performance of Iberian fish: Determination and Applications**.....(p. 34)
Francisco-Javier SANZ-RONDA, Jorge RUÍZ-LEGAZPI, Francisco-Javier BRAVO-CÓRDOBA, Theodore CASTRO-SANTOS & Sergio MAKRAKIS
- 15:30-15:45 **0.4:5 - Study of Iberian nase, *Pseudochondrostoma polylepis* (Steindachner, 1864), movements, behaviour and fatigue in a vertical-slot fishway**.....(p. 35)
Felipe MORCILLO, Miriam CASTILLO, Diego GARCÍA DE JALÓN, Fernando TORRENT & Carlos ALONSO
- 15:45-16:00 **0.4:6 - Dorsal Fin Function in Centrarchids: biomechanics as a tool for management**.....(p. 35)
Anabela MAIA

Sala Cyrillo Soares (Level 1)

16:30-17:00 Coffee-break

Auditório Valadares (Level 1)

ORAL SESSION. 0.5 ASSESSMENT OF ECOLOGICAL WATER QUALITY

Chairman: Lluís BENEJAM

- 17:00-17:15 **0.5:1 - The Ecological Water Quality in Small Hydroelectric Projects. Importance of natural and anthropogenic dynamics of the river basin in the adequacy of monitoring programs**.....(p. 37)
Daniel OLIVEIRA, Nuno FORMIGO, Ana GUIMARÃES & Hugo FLÁVIO
- 17:15-17:30 **0.5:2 - Comparative analysis of two fish indices: application to the Sado river basin**.....(p. 38)
Francisco GODINHO, João OLIVEIRA & Paulo PINHEIRO
- 17:30-17:45 **0.5:3 - Definition and characterization of reference fish communities and fish-based quality index as an environmental impact assessment tool**.....(p. 38)
David DA FONTE & Nuno FORMIGO
- 17:45-18:00 **0.5:4 - Fish as indicators of ecological status in Mediterranean island streams: Insights from Cyprus**.....(p. 39)
Pedro SEGURADO, Stamatis ZOGARIS, Yorgos CHATZINIKOLAOU & Maria Teresa FERREIRA
- 18:00-18:15 **0.5:5 - Water Quality Monitoring of Rivers and Reservoirs with Light Autonomous Underwater Vehicles (LAUV)**.....(p. 39)
Daniel OLIVEIRA, Ana GUIMARÃES, Luís MADUREIRA, Alexandre SOUSA & Nuno FORMIGO

Auditório Quintanilha (Level 0)

ORAL SESSION. 0.6 CLIMATE CHANGE EFFECTS ON ESTUARINE AND COSTAL FISH COMMUNITIES

Chairman: Henrique CABRAL

- 17:00-17:15 **0.6:1 - Responses of estuarine fish assemblages to climate variations**.....(p. 41)
Filipe MARTINHO, Dániel NYITRAI, Marina DOLBETH, Joana BAPTISTA & Miguel A. PARDAL
- 17:15-17:30 **0.6:2 - Climate change effects on estuarine and coastal fish**.....(p. 41)
Catarina VINAGRE
- 17:30-17:45 **0.6:3 - Effects of Ocean acidification in coastal fishes**.....(p. 42)
Rui ROSA
- 18:00-18:30 **MOVIE (30' / ES / subtitles EN)**
"Desert fish" by Javier ESQUÍVIAS (2014).....(p. 23)

Corredor da Radioquímica (Level 1)

18:30-20:00 **POSTER SESSION**.....(pp. 90-147)

21:00 **CONGRESS DINNER at Zambeze Restaurant**

Thursday, 26 June

8:30-9:00 Arrival & Registration at the Congress site
Congress Secretariat, Sala Zoologia (Level 1)

Amphiteatro Chimico (Level 0)

9:00-10:00 **PLENARY SESSION**
Illustrating Fish.....(p. 21)
Pedro SALGADO & Claudia BAETA

Auditório Valadares (Level 1)

ORAL SESSION. 0-7 FRESHWATER FISH COMMUNITIES: STRUCTURE AND FUNCTIONING

Chairman: Felipe MORCILLO

- 10:00-10:15 **0.7:1 - Microhabitat preferences of Mediterranean barbel (*Barbus meridionalis*) in mediterranean streams, NE Spain**.....(p. 43)
Lluís ZAMORA, Jordi-René MORR, Anna COSTARROSA & Maria Misericordia BALANA
- 10:15-10:30 **0.7:2 - Distribution and composition of freshwater fish and mussel communities of Sabor and Tua rivers (Douro basin): Main threats and conservation measures**.....(p. 43)
Amílcar TEIXEIRA, Simone VARANDAS, Ronaldo SOUSA, Elsa FROUFE, Mariana HINZMANN & Manuel LOPES-LIMA
- 10:30-10:45 **0.7:3 - Monitoring reproduction activity and larvae distribution of *Petromyzon marinus* and *Lampetra planeri* in northern basins of Navarra**.....(p. 44)
Pedro M. LEUNDA & José ARDAIZ

- 10:45-11:00 **0.7:4 - Extended spawning in brown trout (*Salmo trutta*) populations from Southern Iberian Peninsula: the role of unpredictability and temperature**(p. 45)
 José Enrique LARIOS-LÓPEZ, José Manuel TIerno DE FIGUEROA, Miguel GALIANA-GARCÍA, Javier GORTÁZAR & Carlos ALONSO

Auditório Quintanilha (Level 0)

ORAL SESSION. 0.8 FRESHWATER FISH COMMUNITIES: EVALUATION TOOLS AND METHODS

Chairman: Miguel CLAVERO

- 10:00-10:15 **0.8:1 - Freshwater fishes - victims of their own success**(p. 46)
 Carlos GRANADO-LORENCIO, Patricia PELAYO-VILLAMIL, Castor GUISANDE, Richard VARI, Ana MANJARRÉS, Emilio GARCIA-ROSELLO, Jacinto GONZÁLEZ DACOSTA, Jürgen HEINE, Luis GONZÁLEZ-VILAS, Bernardo PATTI, Luz JIMENEZ, Pablo TEDESCO & Jorge LOBO
- 10:15-10:30 **0.8:2 - Conservation planning of freshwater biodiversity using coarse datasets: how much current protected areas in Iberian Peninsula protect freshwater biodiversity?**(p. 47)
 Ana Filipa FILIPE, Virgílio HERMOSO, Pedro SEGURADO & Pedro BEJA
- 10:30-10:45 **0.8:3 - Using graph theory to connect the dots in fragmented rivers**(p. 47)
 Paulo BRANCO, Pedro SEGURADO, José M. SANTOS & Teresa FERREIRA
- 10:45-11:00 **0.8:4 - Distribution modelling of freshwater fish using time to first detection**(p. 48)
 Mário FERREIRA, Ana Filipa FILIPE, Maria Filomena MAGALHÃES & Pedro BEJA

Sala Cyrillo Soares (Level 1)

11:00-11:30 Coffee-break

Auditório Valadares (Level 1)

ORAL SESSION. 0.9 MANAGEMENT AND CONSERVATION OF FRESHWATER FISH

Chairman: José Maria SANTOS

- 11:30-11:45 **0.9:1 - Best management practices mitigate the effects of certified eucalyptus plantations on Mediterranean streams**(p. 49)
 João OLIVEIRA, Fátima FERNANDES, Pedro SERAFIM & Teresa FERREIRA
- 11:45-12:00 **0.9:2 - River ecosystems and fish biodiversity of the Manu Biosphere Reserve, Perú: implications of knowledge in the conservation and management**(p. 49)
 Ibon TOBES, Rafael MIRANDA, Andrea PINO-DEL-CARPIO, Julio M. ARAUJO-FLORES & Hernan ORTEGA
- 12:00-12:15 **0.9:3 - Fishes of the Cusiana river, middle basin, department of Casanare: contribution to the identification of Savannas of High Conservation Value in the Orinoco basin in Colombia** ... (p. 50)
 Francisco A.VILLA-NAVARRO, Juan G. ALBORNOZ, Cristian C. CONDE SALDAÑA, Pamela T. ZUÑIGA-UPEGUI, Sofía RINCÓN, Cesar SUAREZ & José S. USMA OVIEDO
- 12:15-12:30 **0.9:4 - Recolonization process and fish assemblage dynamics in the Guadiana River (SW Spain) after the Aznalcóllar mine toxic spill**(p. 51)
 Ramón José DE MIGUEL RUBIO, Lucía GÁLVEZ BRAVO, Francisco José OLIVA PATERNA, Luis CAYUELA DELGADO & Carlos FERNÁNDEZ DELGADO
- 12:30-12:45 **0.9:5 - Effects of land use on size-related variables of freshwater fish in Uruguay**(p. 51)
 Lluís BENEJAM, Franco TEIXEIRA-DE MELLO, Mariana MEERHOFF & Sandra BRUCET

12:45-13:00	0.9:6 - The Vez river - Planning and Sustainable Management of the Fish Species (<i>Salmo trutta</i>)(p. 52) Sandra VIEIRA & António Moitinho RODRIGUES
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Auditório Quintanilha (Level 0)

ORAL SESSION. 0.10 FRESHWATER FISH COMMUNITIES: STRUCTURE AND FUNCTIONING

Chairman: Lluís ZAMORA

11:30-11:45	0.10:1 - Fishes in Moroccan desert rivers: the dry extreme of mediterraneity(p. 53) Miguel CLAVERO , Javier ESQUIVIAS, María RIESCO, Abdeljebbar QNINBA, Javier CALZADA, Filipe RIBEIRO & Miguel DELIBES
11:45-12:00	0.10:2 - Population structure and gene flow in desert environments: an application of molecular tools to isolated fish populations in West Africa(p. 53) Jolita DILYTÉ , Stephen SABATINO, Raquel GODINHO, José Carlos BRITO & Paulo ALEXANDRINO
12:00-12:15	0.10:3 - A metacommunity structure for stream fishes in the upper Paraná River basin(p. 54) Mauricio CETRA , Miguel Petrere JÚNIOR & Walter BARRELLA
12:15-12:30	0.10:4 - Interactive effects of habitat quality and connectivity on Mediterranean stream fish after the summer drought(p. 55) Daniel Filipe PIRES , Ana Filipa FILIPE, Pedro BEJA & Maria Filomena MAGALHÃES
12:30-12:45	0.10:5 - Evolution of fish assemblages in the downstream sector of the Tua river basin(p. 55) Paulo PINHEIRO , Francisco GODINHO, João PÁDUA, João OLIVEIRA & Liliana BENITES
12:45-13:00	0.10:6 - Headwater capture and phylogenetic structure of stream fish assemblages in central Brazil(p. 56) Pedro Podestà Uchôa AQUINO & Guarino Rinaldi COLLI
13:00-13:15	0.10:7 – Composition of the fish community of San Pedro river, Tabasco, México(p. 56) Alfonso CASTILLO-DOMÍNGUEZ , Carolina E Melgar VALDES, Everardo Barba MACÍAS, Rocío RODILES-HERNÁNDEZ, Alberto de Jesús NAVARRETE, Martha Perera GARCÍA, Carlos A Cuenca SORIA & Raúl E Hernández GÓMEZ

Jardineta (Claustro) (Level 0)

13:00-14:30	Lunch
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Amphiteatro Chimico (Level 0)

14.30-15:30	PLENARY SESSION Endangered sawfish and deep-sea sixgills: using modern telemetry to study very large elasmobranch fishes(p. 21) Dean GRUBBS
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Auditório Valadares (Level 1)

ORAL SESSION. 0-11 SHARKS AND RAYS IN THE NORTH-EASTERN ATLANTIC

Chairman: Dean GRUBBS

15:30-15:45	0.11:1 - Portuguese commercial elasmobranch landings (1986-2006)(p. 58) João CORREIA
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- 15:45-16:00 **0.11:2 - Deep-sea Chondrichthyes of the Macaronesian Islands (NE Atlantic Ocean)**.....(p. 58)
Mafalda FREITAS, Manuel BISCOITO, José I. SANTANA, José A. GONZÁLEZ, Raül TRIAY-PORTELLA,
 Eduardo ISIDRO, Ricardo SOUSA, João DELGADO, Albertino MARTINS & Consortium MARPROF-CV
- 16:00-16:15 **0.11:3 - Eating the neighbours: importance of small sharks in the diet of the rare deep-sea shark *Dalatias licha***.....(p. 59)
Joan NAVARRO, Marta COLL, Claudio BARRIA, Lourdes LÓPEZ & Raquel SÁEZ
- 16:15-16:30 **0.11:4 - Feeding ecology and ecological role of rare elasmobranch species in the western Mediterranean Sea**.....(p. 59)
Claudio BARRÍA, Marta COLL, Joan NAVARRO, Adrián CORRAL, Ana COLMENERO & Raquel SAEZ

Auditório Quintanilha (Level 0)

ORAL SESSION. 0-12 **NON-NATIVES FISHES: IMPACTS**

Chairman: Sehran TARKAN

- 15:30-15:45 **0.12:1 - Freshwater Blenny (*Salaria fluviatilis*) conservation in Lake Banyoles: actions to improve its habitat and predation impact of exotic fish**.....(p. 61)
Quim POU-ROVIRA, Miquel CAMPOS LLACH, Irene CAMÓS PLANA & Carles FEO QUER
- 15:45-16:00 **0.12:2 - Food resource use and overlap between non-native fishes in Mediterranean-type streams**.....(p. 61)
Christos GKENAS, Filipe RIBEIRO, Nazaret CAMPOS MARTÍN, Fatma KUBRA-ERBAY, Rafael ORJUELA, Julien CUCHEROUSET & Maria Filomena MAGALHÃES
- 16:00-16:15 **0.12:3 - What impact of invasive round goby *Neogobius melanostomus* and bighead goby *Neogobius kessleri* on native fishes and macroinvertebrates can be expected from their feeding ecology in the Middle Danube (and elsewhere)**.....(p. 62)
Barbora ŠTEVOVE & Vladimír KOVÁČ
- 16:15-16:30 **0.12:4 - Interactions between the invasive signal crayfish *Pacifastacus leniusculus* and the native fish populations in the north of the Iberian Peninsula**.....(p. 63)
Iván VEDIA, Rafael MIRANDA, Javier OSCOZ & Enrique BAQUERO

Sala Cyrillo Soares (Level 1)

16:30-17:00 Coffee-break

Auditório Valadares (Level 1)

ORAL SESSION. 0-13 **SHARKS BIODIVERSITY AND POPULATION DYNAMICS**

Chairman: Anabel PERDICES

- 17:00-17:15 **0.13:1 - Biodiversity of dogfishes (genus *Squalus*) in the eastern Atlantic and Mediterranean Sea – a molecular perspective**.....(p. 64)
Ana VERÍSSIMO, Andrew M. GRIFFITHS, Diana ZAERA-PEREZ, Rob LESLIE, Samuel IGLÉSIAS, Bernard SÉRET, Panagiotis GRIGORIOU, Chrysoula GUBILI & Joan NAVARRO
- 17:15-17:30 **0.13:2 - Population structure of the hammerhead shark, *Sphyrna zygaena* in the Atlantic and Indian Oceans, analyzed by mitochondrial DNA**.....(p. 65)
Bruno Alexandre DE FRANCO, Claudio OLIVEIRA, Fausto FORESTI, Miguel SANTOS, Rui COELHO & Fernando Fernandes MENDONÇA

- 17:30-17:45 **0.13:3 - Does Population Structure Match Variation in Life History Traits in a Model Shark Species, *Scyliorhinus canicula* (Linnaeus 1758)?**.....(p. 65)
Pedro CARDOSO, Andrew GRIFFITHS & Ana VERÍSSIMO

Auditório Quintanilha (Level 0)

ORAL SESSION. 0-14 **NON-NATIVE FISHES: LIFE-HISTORY VARIABILITY**

Chairman: Lukas KALOUS

- 17:00-17:15 **0.14:1 - Population traits of invasive bleak *Alburnus alburnus* between contrasting habitats in Iberian freshwaters**.....(p. 67)
Rodrigo MARTÍNEZ-SASTRE, Carlos RANGEL, Eduardo DA SILVA, David H. FLETCHER & David ALMEIDA
- 17:15-17:30 **0.14:2 - Relative Abundance and Growth Properties of Fishes Living in Büyükçekmece Reservoir (İstanbul, Turkey) in Existence of Exotic *Carassius gibelio* (Bloch, 1782)**(p. 67)
Gülşah SAÇ, Hacer OKGERMAN & Elif Ece SEREZLİ
- 17:30-17:45 **0.14:3 - Physiological potential for the invasive freshwater cichlid *Australoheros facetus* to inhabit brackish waters of the Guadiana river basin (Southern Iberian Peninsula)**.....(p. 68)
Flávia Baduy Vaz da SILVA, João Luís SARAIVA, Adelino V.M. CANÁRIO & Pedro Miguel GUERREIRO
- 17:45-18:00 **0.14:4 - Variations in reproductive parameters of an invasive population of topmouth gudgeon (*Pseudorasbora parva*) over time**.....(p. 69)
Kristína ŠVOLÍKOVÁ, Eva ZÁHORSKÁ & Vladimír KOVÁČ

Auditório Valadares (Level 1)

18:00-20:00 SIBIC General Assembly

Friday, 27 June

8:30-9:00 Arrival & Registration at the Congress site
Congress Secretariat, Sala Zoologia (Level 1)

Amphiteatro Chimico (Level 0)

9:00-10:00 PLENARY SESSION

Coastal fish assemblages: research challenges and societal needs.....(p. 22)
Henrique CABRAL

Auditório Valadares (Level 1)

ORAL SESSION. 0.15 **COASTAL FISH CONNECTIVITY AND STOCK IDENTIFICATION**

Chairman: Filipe MARTINHO

- 10:00-10:15 **0.15:1 - Discrimination of *Trachurus picturatus* stocks in the central and north-east Atlantic using otolith elemental and isotopic analyses**.....(p. 70)
Alberto Pereira CAEIRO, Alcides SIAL, Cláudia MOREIRA, Elsa FROUFE & Alberto Teodorico CORREIA

- 10:15-10:30 **0.15:2 - Habitat residency and movement patterns of *Centropomus parallelus* in a Brazilian subtropical estuarine complex determined by otolith microchemistry (Sr:Ca ratios) and microstructure (daily increments) analysis**.....(p. 70)
Felippe Alexandre DAROS, Henry Louis SPACH & **Alberto Teodorico CORREIA**
- 10:30-10:45 **0.15:3 - Using genetic markers to study marine fish connectivity in the Iberian Atlantic Coast**.....(p. 71)
Maria Ana ABOIM, Susanne TANNER, Patrick REIS-SANTOS & Henrique CABRAL
- 10:45-11:00 **0.15:4 - *Gaidropsarus* (Gadidae, Teleostei) of the North Atlantic: a brief phylogenetic review**.....(p. 71)
Sara M. FRANCISCO, Joana I. ROBALO, Sergio STEFANNI, **André LEVY** & Vítor C. ALMADA

Auditório Quintanilha (Level 0)

ORAL SESSION. 0.16 MANAGEMENT AND CONSERVATION: DATA BASES AND PROJECTS

Chairman: Carlos FERNANDEZ-DELGADO

- 10:00-10:15 **0.16:1 - Update of the National Inventory of ichthyological biodiversity and development and implementation of the Spanish Fish database: a collaborative project led by SIBIC**.....(p. 72)
Andrea PINO-DEL-CARPIO, Filipe RIBEIRO, Carla F. Q. MAIA, Francisco J. OLIVA-PATERNA, Carlos FERNÁNDEZ-DELGADO, Lluís ZAMORA, Frederic CASALS, Bernardo QUINTELLA, Pedro M. LEUNDA, Mar TORRALVA, Gustavo GONZÁLEZ & Rafael MIRANDA
- 10:15-10:30 **0.16:2 - LIFE Segura-Riverlink: an implementation of a green infrastructure approach to recover the longitudinal connectivity in a highly fragmented river basin**.....(p. 72)
Francisco J. OLIVA-PATERNA, Mar TORRALVA, David VERDIELL-CUBEDO, Ana RUIZ-NAVARRO, Fatima AMAT-TRIGO, Jorge SÁNCHEZ-BALIBREA, F. Javier SANZ-RONDA, Justo GARCÍA-RODRÍGUEZ, Rosa OLIVO, César AVILÉS & Eduardo LAFUENTE
- 10:30-10:45 **0.16:3 - Rehabilitation of River Mondego for the diadromous fish: An integrated management approach**.....(p. 73)
Pedro Raposo de ALMEIDA, Isabel DOMINGOS, José Lino COSTA, Catarina MATEUS, Carlos ALEXANDRE, Ana Filipa FERREIRA, Gabriela CARDOSO, Pedro FÉLIX, Esmeralda PEREIRA, Tiago NEVES, Ricardo BRANCA, Ana Filipa BELO, Felisbina QUADRADO, João FERREIRA, Ana TELHADO & Bernardo Ruivo QUINTELLA.
- 10:45-11:00 **0.16:4 - Citizen Science as a tool to obtain fish data records and public outreach: The Biodiversity4All project**.....(p. 74)
Patrícia TIAGO, **Filipe RIBEIRO**, Luis FERREIRA & Marcel DIX

Sala Cyrillo Soares (Level 1)

11:00-11:30 Coffee-break

Auditório Valadares (Level 1)

ORAL SESSION. 0.17 COASTAL FISH COMMUNITIES: STRUCTURE AND FUNCTIONING

Chairman: Maria José COSTA

- 11:30-11:45 **0.17:1 - Trophic dynamics of the pelagic ecosystem in the North-Western Mediterranean Sea using stable isotope analysis**.....(p. 75)
Marta ALBO-PUIGSERVER, Joan NAVARRO, Marta COLL, Craig A. LAYMAN & Isabel PALOMERA

11:45-12:00	0.17:2 - The Cape Verdean coastal ichthyofauna: a summary and remarks on endemism... (p. 75) Rui FREITAS
12:00-12:15	0.17:3 - The Lusitanian Toadfish as biomonitor of estuarine sediment metal burden: the influence of gender and reproductive metabolism..... (p. 76) Sílvia PEDRO , Bernardo DUARTE, Nuno CASTRO, Isabel CAÇADOR, Pedro Raposo de ALMEIDA & José Lino COSTA
12:15-12:30	0.17:4 - Increase of parasitism in the genus <i>Lophius</i> from the NW Mediterranean Sea and the effects in its morphology: searching for answers..... (p. 76) Ana COLMENERO , Claudio BARRÍA, Víctor TUSET & Pilar SÁNCHEZ
12:30-12:45	0.17:5 - AQUAGAMETE COST Action. Resume of the first grant period (March 2013 - May 2014)..... (p. 77) M.J. BAYARRI, Ákos HORVATH & Juan F. ASTURIANO

Auditório Quintanilha (Level 0)

ORAL SESSION. 0.18 THE POPULATION STATUS OF *ANGUILLA ANGUILLA* L.: MANAGEMENT AND CONSERVATION OPTIONS

Chairman: Isabel DOMINGOS

11:30-11:45	0.18:1 - Where the eel was: using historical data to describe the original range of a collapsing species..... (p. 78) Miguel CLAVERO & Virgilio HERMOSO
11:45-12:00	0.18:2 - Prevalence and intensity of <i>Anguillicoloides crassus</i> and its effect on European eel condition in Mediterranean rivers (NE Spain)..... (p. 78) Lluís ZAMORA & Anna COSTARROSA
12:00-12:15	0.18:3 - Movements of yellow eels (<i>Anguilla anguilla</i> L.) migrating through a fish lift..... (p. 79) José M. SANTOS , João M. OLIVEIRA, Rui RIVAES, Raul ARENAS, Teresa FERREIRA, Ulisses CABRAL & João PÁDUA
12:15-12:30	0.18:4 - Silver eel migration by telemetry, mortality and corrective measures adoption in a hydroelectric power station in Urola river..... (p. 80) Iker AZPIROZ , Mikel LIZASO & Darío YÉCORA
12:30-12:45	0.18:5 - How could we reinforce the eel population in the Oria (Basque Country)? (p. 80) Estibaliz DÍAZ , Aizkorri ARANBURU & Iker AZPIROZ
12:45-13:00	0.18:6 - Glass eel recruitment dynamics in a southern Europe estuary (Oria, Spain), 2003-2012..... (p. 81) Aizkorri ARANBURU, Estibaliz DÍAZ & Cédric BRIAND

Jardineta (Claustro) (Level 0)

13:00-14:30 Lunch

Auditório Valadares (Level 1)

ORAL SESSION. 0.19 SISTEMATICS, ZOOGEOGRAPHY AND POPULATION GENETICS

Chairman: Maria João COLLARES-PEREIRA

14:30-14:45	0.19:1 - Spatial distribution of molecular lineages of the Iberian cobitids..... (p. 82) Anabel PERDICES , Ignacio DOADRIO, Ana Rita AMARAL & Manuela COELHO
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14:45-15:00	0.19:2 - Divergence-dependent reproductive isolation and semi-permeable species boundaries in Iberian <i>Barbus</i> and <i>Luciobarbus</i> (Teleostei, Cyprinidae)(p. 82) Hugo F. GANTE, Ignacio DOADRIO, Maria Judite ALVES & Thomas E. DOWLING
15:00-15:15	0.19:3 - Using morphological characters, genetic markers and heart fatty acid signature profiles to investigate the population structure of sea lamprey (<i>Petromyzon marinus</i>, L.) in western Iberian Peninsula(p. 83) Catarina Sofia MATEUS, Maria João LANÇA, Maria MACHADO, Maria Judite ALVES, Natacha MESQUITA, Bernardo Ruivo QUINTELLA & Pedro Raposo de ALMEIDA
15:15-15:30	0.19:4 - Tackling hybridization in fish populations: the significance of multidisciplinary approaches(p. 83) Carla S. A. PEREIRA, Maria Ana ABOIM, Petr RAB & Maria João COLLARES-PEREIRA
15:30-15:45	0.19:5 - Genome-wide estimates of inbreeding and population structure in wild populations of Atlantic salmon in Spain(p. 84) Lara COVELO-SOTO, Paloma MORÁN & María SAURA
15:45-16:00	0.19:6 - Chromosome study in localities of <i>P. mexicana</i> and <i>P. sulphuraria</i> in Tabasco and Chiapas, Mexico(p. 85) Alain Lois D'ARTOLA-BARCELÓ, Lenin ARIAS-RODRIGUEZ & Salomon PARAMO-DELGADILLO
16:00-16:15	0.19:7 - Evolutionary history and population genetics of a cyprinid fish (<i>Iberochondrostoma olisiponensis</i>) endangered by introgression from a more abundant relative(p. 86) Carla SOUSA-SANTOS, Hugo F. GANTE, Joana ROBALO, Pedro PROENÇA CUNHA, António MARTINS, Marco ARRUDA, Maria Judite ALVES & Vítor ALMADA

Auditório Quintanilha (Level 0)

ORAL SESSION. 0.20 THE POPULATION STATUS OF *ANGUILLA ANGUILLA* L.: MANAGEMENT AND CONSERVATION OPTIONS

Chairman: Estibali DIAZ

14:30-14:45	0.20:1 - Cryopreserving European eel (<i>A. anguilla</i>) sperm: comparison of two methods for standardization(p. 87) María C. VÍLCHEZ, Marina MORINI, David S. PEÑARANDA, Luz PÉREZ, Alexandra DEPINCE, Eszter KÁSA, Catherine LABBÉ, Ákos HORVATH & Juan F. ASTURIANO
14:45-15:00	0.20:2 - River Minho vs. other Portuguese streams - When the darkness supports eel conservation(p. 88) Carlos ANTUNES, Catarina BRAGA & Mário Jorge ARAÚJO
15:00-15:15	0.20:3 - Can coastal lagoons contribute to the recovery of the European eel stock? The case of Santo André Lagoon (SW Portugal)(p. 88) Isabel DOMINGOS, Vera LOPES & José Lino COSTA
15:15-15:30	0.20:4 - The eel fishery in Santo André Lagoon: can science mediate the conflict between exploitation and conservation?(p. 89) José Lino COSTA, Vera LOPES & Isabel DOMINGOS
15:30-16:30	DEBATE: Eel management plans - difficulties and challenges

Amphiteatro Chimico (Level 0)

16:30-17:30 CONGRESS CLOSING CEREMONY
STUDENT AWARDS

17:30-20:00 **V.1**
VISIT TO THE OCEANARIUM

Organizers: Catarina Mateus (CO)

Please send an email to confirm your presence to: sibic2014@museus.ul.pt

Saturday, 28 June

10:00 **V.2**
VISIT TO THE EXPERIMENTAL FISH PASSAGE MODEL AT THE NATIONAL LABORATORY OF CIVIL ENGINEERING (L.N.E.C.) – FISHMOVE PROJECT

Organizadores: Teresa VISEU (LNEC), José Maria SANTOS (ISA)

Visit conditioned to a maximum of 40 participants

Please send an email to confirm your presence to: jmsantos@isa.ulisboa.pt

10:00 **V.3**
GUIDED VISIT TO THE EX-SITU CONSERVATION FACILITIES AT THE VASCO DA GAMA'S AQUARIUM

Organizadores: Fátima GIL (AVG), Carla SOUSA-SANTOS (ISPA)

Visit conditioned to a maximum of 15 participants

Please send an email to confirm your presence to: avg.aqua@marinha.pt,
csousasantos@gmail.com

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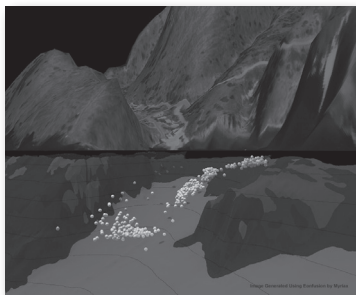
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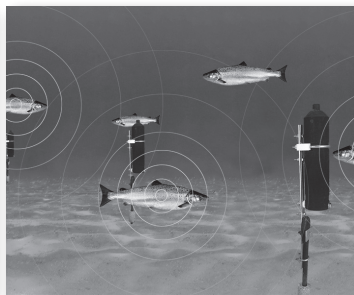


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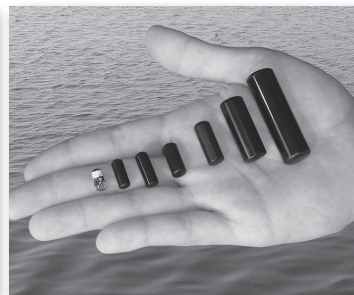
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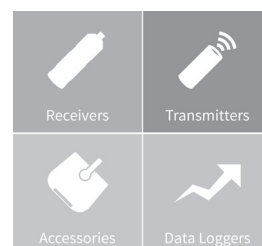
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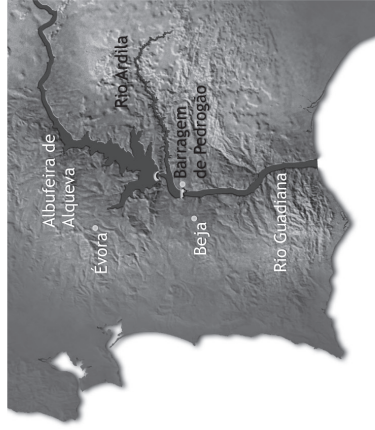
DPP

Dispositivo de Passagem de Peixes

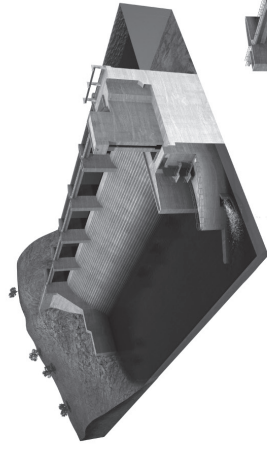
Barragem de Pedrogão



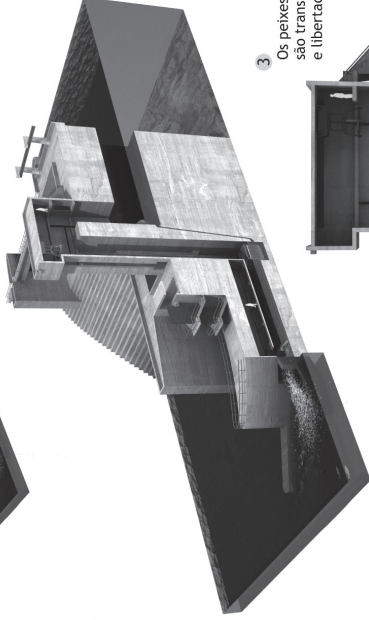
A importância do dispositivo de passagem de peixes da Barragem de Pedrogão (DPP) está relacionada com a localização desta barragem, uma vez que se trata da primeira estrutura de jussante para montante e a única estrutura entre o rio Guadiana natural e o rio Ardila.



Empresa de desenvolvimento
e Infra-estruturas do Alqueva, S.A.



O dispositivo da passagem de peixes da barragem de Pedrogão (DPP) tem como objetivo garantir a continuidade fluvial entre o rio Guadiana, a jusante desta barragem, e o rio Ardila, a montante, garantindo a variabilidade genética e sustentabilidade das populações piscícolas.



3

Os peixes que se encontram na caixa são transportados sobre a barragem e libertados na albufera.



2

No final do canal de atração encontra-se submergida a caixa elevatória que sobe ciclicamente.

1

O caudal libertado pela entrada do DPP atrai os peixes que seguem o estímulo da corrente.



Sequência e funcionamento do DPP

Peixes migradores

Espécies Alvo



Barbo-do-sul
Luciobarbus sclateri



Barbo-de-cabeça-pequena
Luciobarbus microcephalus



Cumba ou Barbo-trombeteiro
Luciobarbus comizo



Boga-do-Guadiana
Pseudochondrostoma wilkottii

As espécies piscícolas autóctones potamódromas realizam migrações ao longo dos rios para efetuarem a desova nas zonas de cabeceira.



ABSTRACTS

P. 1

ECOLOGY AND MANAGEMENT OF INVASIVE FISH: A PERSPECTIVE FROM THE IBERIAN PENINSULA

Emili GARCIA-BERTHOU

Institute of Aquatic Ecology, University of Girona, E-17071 Girona, Spain (emili.garcia@udg.edu) <http://invasiber.org/EGarcia/>

Freshwater fish are severely threatened by multiple stressors, particularly in Mediterranean ecosystems. One of these threats are invasive species, which are both a unique research opportunity and an urgent management issue. I will provide an overview of the ecology and management of invasive species, building on our research on invasive fish in the Iberian Peninsula. The ecological understanding of invasive fishes has advanced much in the last decades. We have learned for instance that invasive fishes are more diverse in life history traits than native species, that there are clear introduction routes and vectors in the Iberian Peninsula and that this has led to biotic homogenization. However, we still have large knowledge gaps, particularly regarding their ecological effects and mechanisms of impacts. In my opinion, these gaps emerge from the inadequate scarcity of field experiments, long-term monitoring and time series of fish assemblages. Despite being a hot topic, the management of this environmental issue has advanced less, probably due to low funds devoted to it but also to the focus of scientists on conceptual issues and basic biology instead of applied research and public outreach. I will provide an overview of these topics using the research in my lab as examples.

P.2

ILLUSTRATING FISH

Pedro SALGADO¹ & Cláudia BAETA²

¹E-mail: pedro.r.salgado@gmail.com; ²E-mail: mail@claudiabaeta.com

Scientific illustration is the visual component of science communication. Fish, ichthyologic illustration, is one of its most demanding subject matters. When communicating scientific knowledge, scientific illustration plays a unique role. By communicating subtleties, highlighting important characteristics and suppressing ambiguities, scientific illustration reveals itself as an important element in accurate communication. Conveying information in a clear way has been the main purpose of scientific illustration. In addition, illustrations can provide an easier and more appealing way to reach a wider audience, ranging from a specialized scientific community to the general public.

In this presentation, numerous examples of fish illustration will be shown, from an historical context to contemporary approaches for different purposes, audiences and layouts. Several case studies will be presented, describing the whole process from the first sketches to the final art rendering. To achieve best results it is crucial a good communication relationship between the illustrator and the scientist. Basic steps, handling, use of references and photographs, representation standards, methods, materials and printing requirements will be discussed.

P.3

ENDANGERED SAWFISH AND DEEP-SEA SIGILLS: USING MODERN TELEMETRY TO STUDY VERY LARGE ELASMOBRANCH FISHES

R. Dean GRUBBS

Florida State University, Coastal and Marine Laboratory, 3618 Coastal Highway 98, St. Teresa, FL 32358-2702, USA. (dgrubbs@bio.fsu.edu)

Unraveling the ecology of large marine predators is challenging due to their naturally low abundances, a concealing environment and the logistical constraints associated with capture and handling. These difficulties are

compounded for imperiled and deep sea taxa. However, modern telemetry, particularly archival satellite telemetry, offers powerful tools for studying such species. I will present research using these techniques study the ecology of smalltooth sawfish and bluntnose sixgill sharks, two species that are top-level predators, but inhabit very different marine environments.

The smalltooth sawfish (*Pristis pectinata*) is listed as *Critically Endangered* in the IUCN Redlist of Threatened species and is the only native marine fish listed as *Endangered* under the United States' Endangered Species Act. Sawfish declined due to overfishing and fishery bycatch remains the largest source of direct mortality, though habitat loss from urban development, agriculture, and freshwater diversion hinders recovery. We are using varied forms of archival satellite telemetry on adult smalltooth sawfish to 1) examine regional fidelity, migration and exchange between population segments, 2) determine if aggregation sites related to feeding, mating or parturition exist and 3) assess mortality risk due to interaction with commercial and recreational fisheries. Tagging data from 40 sawfish suggest little movement between adjacent populations and confirm that adults aggregate in shallow, productive estuaries but also reveal they inhabit deeper waters (45-55 meters) along the edge of the continental shelf where they overlap with numerous fisheries.

The bluntnose sixgill shark (*Hexanchus griseus*) is a large, poorly-studied deep-water species with a patchy worldwide distribution, typically inhabiting 200-1000 m depths associated with insular and continental slopes and submarine canyons. We are using satellite telemetry 1) to assess whether these deep-water sharks survive being brought to the surface, then to 2) examine diel to seasonal patterns of vertical movement and migration, and 3) compare movements between four oceanic regions (Central Pacific Ocean, Northwest Atlantic Ocean, Gulf of Mexico, Bahamas). We have captured 60 bluntnose sixgills between 51 and 500 cm (total length) at depths of 265-1,153 m and tagged 20 with archiving satellite transmitters. Post-release survival is high (83%) but recovery requires 48-60 hours. Bluntnose sixgills displayed distinct diel vertical migrations in all regions, occurring shallower during night than during day. Migration depths reflected regional differences in thermoclines, ranging from 175-300 m (NW Atlantic) to 450-900 m (Bahamas). Water temperatures were near 17°C during day and 5°C during night across all regions.

P.4

COASTAL FISH ASSEMBLAGES: RESEARCH CHALLENGES AND SOCIETAL NEEDS

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Coastal fish assemblages comprise a wide diversity of typologies that are considerably different according to the habitat, namely estuarine systems, intertidal areas, rocky reefs, sandy areas, among others. During decades a large volume of literature has been published on coastal fish communities' composition and structure. Most of these studies addressed also spatial and temporal patterns which highlighted several relationships with abiotic (mainly) and biotic factors. Although these classical approaches are still adopted, in more recent years several research challenges have been directing studies towards other features, namely the study of the relationships between biodiversity and ecosystem functioning, interrelationships with other biological groups, effects of human pressures and modelling of different levels of biological organization. The cutting-edge research topics not always correspond to what is important for human society, being often evident a mismatch between current research challenges and societal needs. In particular, the applied research needed for maintaining goods and services related to fish communities are related to food production and fisheries management, fish hazards, ecosystem health, recreation and cultural heritage.

MOVIE

M.1

FEAR AND FISHING IN LAKE DAVIS - 40', English

Jarrett BYRNES, Liz CHAMBERLIN, Sarah ELMENDORF, Ryan FISCHER, Suzanne OLYARNIK, Amber WRIGHT

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Fear and Fishing in Lake Davis is a tale about people, and government, and the fish that came between them. In the 1994, California Department of Fish and Game (CDFG) officials discovered that anglers had illegally introduced northern pike (*Esox lucius*), a popular Midwestern sport fish, into Lake Davis (Portola, California), a Sierra Nevada reservoir located in rural California. CDFG officials were concerned that pike would make their way downstream from Lake Davis into California's besieged Bay-Delta system, where a new predator could harm both commercially important and endangered native fish species. Pike also posed a threat in Lake Davis. The local economy depends on a healthy trout fishery, which is imperiled by the presence of the predatory pike. To get rid of the invasive pike, the California Department of Fish and Game decided to poison the lake and kill the pike. Residents in the nearby town of Portola, which gets its drinking water from Lake Davis, were outraged.

Fear and Fishing in Lake Davis captures the story of this ongoing environmental conflict on film. Through interviews with local residents, elected officials, and state agency personnel directly involved in the dispute, the film vividly portrays the clash between community and state government over controlling the invasive northern pike.

M.2

DESERT FISH - 30', Spanish With English Subtitles

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¿Es el río una corriente de agua que llega al mar?... no siempre. Al Sur de Marruecos, donde el Alto Atlas deja paso al desierto del Sáhara, existen una serie de cuencas fluviales que nacen en las altas y nevadas cumbres, y mueren en las ardientes arenas. Pese a su aislamiento, son el habitat de numerosos organismos acuáticos, entre ellos más de una decena de especies de peces y las nutrias que se alimentan de ellas. Al recorrer ecosistemas tan poco productivos, los ecosistemas fluviales se convierten en focos de vida, que se concentra en ellos para explotar sus recursos. La población humana también está unida a sus orillas para vivir, cultivar, beber y encontrarse, desarrollando una cultura de subsistencia con mínimos recursos totalmente asociada a los ecosistemas fluviales. El documental se quiere acercar a la biodiversidad de estos ríos, desde su nacimiento hasta su desaparición en el desierto, mostrando al mismo tiempo el desarrollo de un proyecto de investigación científica. El eje conductor será el estudio de los peces y la nutria, para conocer el funcionamiento y estado de conservación de estos ecosistemas.

É um rio um curso de água que chega ao mar ? ... nem sempre. No sul de Marrocos, onde as montanhas do Atlas dão lugar ao deserto do Saara, uma série de bacias hidrográficas, com origem nos altos picos nevados, morrem nas areias escaldantes do deserto. Apesar do seu isolamento, são o habitat de muitos organismos aquáticos, incluindo mais de uma dezena de espécies de peixes e a lontra, que se alimenta deles. Ao percorrer ecossistemas tão pouco produtivos, os ecossistemas fluviais convertem-se em focos de vida, onde as espécies de concentram para explorar os seus recursos. A população humana também faz parte destes ecossistemas, vivendo, crescendo, bebendo, e desenvolvendo uma cultura de subsistência, com o mínimo de recursos, totalmente associados aos ecossistemas ribeirinhos. O documentário pretende mostrar a biodiversidade destes rios, desde a sua nascente até ao seu desaparecimento no deserto, divulgando simultaneamente o desenvolvimento de um projeto de investigação científica. O eixo condutor do documentário será o estudo dos peixes e da lontra, e a sua influência no funcionamento e no estado de conservação destes ecossistemas.

O.1:1

INFLUENCE OF CENTRAL EUROPEAN ANGLERS ON NON-NATIVE FISH INTRODUCTIONS TO IBERIA

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To examine the recent and future role of Central Europeans in the non-native fish introductions in Iberia, we analyze the angler's community in the Czech Republic and anglers *in situ* along the Ebro River in Spain. Additionally, we searched available literature, fishing forums and interviewed experts in Spain and other Central European countries to obtain additional information. The arrival of Central European non-native fishes, such as *Silurus glanis*, *Sander lucioperca*, *Esox lucius* and *Cyprinus carpio* to Iberian Peninsula attracted Central European anglers to this region as a vacation destination for recreational fisheries. This happened when the individuals of these non-native fishes in the Ebro River attain large sizes such as *Silurus glanis*. Here we focus on the transport of non-native fish used as live bait (e.g. *Carassius gibelio*) done by anglers from Central Europe to Iberian Peninsula. The further implication for conservation and management, as well as the potential role of societal issues such as recreational activities and cultural and habitual practices, are discussed.

O.1:2

FISH STOCKINGS TO NEWLY FORMED MAN-MADE RESERVOIRS IN TURKEY: ECOLOGICAL DISASTERS OR SOCIOECONOMIC BENEFIT?

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The stocking of freshwater fishes is a common worldwide practice mainly for aquaculture and angling-related purposes. In Turkey, this is mainly carried out in newly established water reservoirs to enhance fish production and sportive fishing however several non-native fish species have been introduced mostly through unintentional or unauthorized stocking associated with intentional stocking of common carp, *Cyprinus carpio*. The aim of the present study is to understand whether these fish stockings to newly established reservoirs provide an increase in production of native and desirable fish fauna of these environments or it triggers non-native fishes' distribution and further spread by decreasing efficiency of the stockings due to increase unwanted and unexploited pest species. For this purpose, a representative region in north-western of Anatolia, Turkey (Kocaeli Peninsula) was studied between 2009 and 2011. A total of 20 fish species including 6 non-native species was collected from 13 reservoirs. Non-native gibel carp, *Carassius gibelio* was the most abundant and frequently encountered species followed by endemic species Pursak chub, *Squalius pursakensis*. Non-native fish species richness was found to distribute disproportionally among the reservoirs but their relative abundances increased while native species abundance decreased over three-year study period. Non-native fish species showed a poor environmental relevancy compared to native species but they tend to have wider environmental tolerance ranges and higher optimum environmental values than native species.

O.1:3

SOME ECONOMIC ASPECTS OF THE INTRODUCED ATLANTIC SALMON PARASITE *GYRODACTYLUS SALARIS* IN NORWAY

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The invasive salmon parasite *Gyrodactylus salaris* is among the worst threats to Atlantic salmon (*Salmo salar*) today. *G. salaris* is a small (0.5 mm) ectoparasitic monogenean which is found on fins and skin of Atlantic salmon in its freshwater phase. In Norway, *G. salaris* has caused epidemics that have devastated stocks of Atlantic salmon in 49 rivers. The density of salmon parr in infected rivers has been reduced on an average of 86 % and the catch of salmon are reduced on an average of 87 %.

The occurrence of *G. salaris* in Norwegian salmon rivers causes a yearly economic loss in the range of 34-40 million €. This loss is primarily due to the lost salmon fishing in infected rivers and loss of sea fishing in the adjacent sea areas. The most visible factor is the loss of local economic ripple effects of salmon fishing in the rivers. It is worth noting that the economic loss mainly affects communities around the infected watercourses. In addition, the Norwegian Government spent yearly about 9 million € for measures to limit the damage caused by the parasite. The most important measures are surveillance, preventing the spread of the parasite, eradication of the parasite from infected rivers, and conservation and restoration of fish populations that are directly affected by the parasite or indirectly as a result of the actions implemented for the parasite eradication. During the 35 years history of *G. salaris* in Norway, the expenditure has reached 90 million €. If we include the loss of income on salmon fishing and loss of local economic ripple effects in the same period, a rough estimate suggests that Norway has a total economic loss of 430-538 million € as a consequence of the introduction of *G. salaris* in 1975.

O.1:4

ELEVATED WATER TEMPERATURE AND DRASTIC CHANGES IN FISH COMMUNITIES – A POSSIBLE SCENARIO FOR CLIMATE CHANGE IN THE LAKES OF NORTHERN LATITUDES

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Climate is the average pattern of weather over the long term. There's no doubt that the climate is growing warmer currently. Increased temperature will probably cause warmer water temperatures in northern-latitude lakes and this may cause seasonally stressful conditions for coldwater-adapted fish species, but may provide suitable thermal conditions to allow non-native warmer fish species to thrive in these lakes. The Lake Licheńskie is a part of a complex of five lakes interconnected by a canal network that serves as the cooling system for the Konin and Pątnów power plants. Consequently, the water temperature increased in the average temperatures of 5 to 7°C. Indeed, temperature regime has considerable influence on the life-histories of organisms and this phenomenon is also relevant for invasive species.

Topmouth gudgeon (*Pseudorasbora parva*) is one of the most invasive organisms of recent times and it was introduced into the Lake Licheńskie in 2003. It was collected from 2004 to 2011, and thereafter examined for morphology and life-history traits. Looking at the morphology of topmouth gudgeon there are differences in the body shape of mature males and females resulting from different developmental patterns. Development was characterised by negative allometry in most characters. This rises a relevant question, why the isometric growth did not predominate, when the water temperature was stable. A possible answer is due to high reproduction effort of this population.

During the studied period of time, the population changed its reproductive strategy and started to produce much more oocytes (mean 5391 oocytes within six spawning periods in 2006–2011) than populations from normal

habitats, e.g. in Slovakia (mean 3 000 oocytes). This resulted in a rapid increase in relative abundance (up to 60%), and topmouth gudgeon became a dominant fish species in a very short time. Nevertheless, predictions of how the climate change will affect native and non-native species globally are impeded by uncertainties about how multiple environmental factors will interact to influence the distribution and abundance of aquatic organisms. It will probably change the aquatic ecosystems and the most flexible and the most plastic species will be the most successful. Topmouth gudgeon demonstrates high phenotypic plasticity in all parameters, from reproduction to morphology. Thus, this species is expected to be successful even if the climate changes radically. This study was funded by the Slovak Scientific Grant Agency (Project No. 1/0392/12).

O.1:5

AQUARIUM STORE RISK ASSESSMENT: EVALUATING FISH INVASION RISK CAUSED BY ORNAMENTAL TRADE

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The aquarium trade is one of the main vectors of non-native species introduction in natural aquatic systems worldwide. In the Iberian Peninsula 30-50% of the introduced freshwater fish were due to the aquarium trade, and it is the second introduction vector in Portugal. However, there is limited knowledge about which species are traded and about which stores have the widest range of species and individuals and pose the highest invasion risk. In this study, we evaluate the risk of different aquarium fish stores by incorporating data species composition in stores and species risk assessed by Fish Invasiveness Screening Kit (FISK). Firstly, we conducted a species inventory in 37 stores in Lisbon area. Secondly, we determined invasiveness risk, using FISK, for the 40 freshwater ornamental fishes most commonly sold. Store risk index was determined as the total species risk of evaluated species present in each store. We recorded a total of 18 105 freshwater fishes and 259 species. The most diverse fish families Cichlidae (82 species) and Cyprinidae (38 species) and the most abundant species were *Carassius auratus* (1916 specimens) and *Poecilia reticulata* (1548 specimens). From the top 40 ornamental fishes, five species were considered to have a high risk of invasiveness in Iberian Peninsula (FISK score >20), namely *C. auratus*, *Cyprinus carpio*, *P. reticulata*, *Xiphophorus helleri* and *Hypostomus plecostomus*, while *Astronotus ocellatus* and *Poecilia sphenops* had scores close to high risk threshold (FISK ranging from 18 to 19). Store risk index was calculated for each store and identified which stores had the highest potential to sell high invasion risk ornamental fishes, based on FISK assessment. Store risk was moderately variable, though showed a tendency to increase in chain stores and stores conducting more frequent importations. This approach needs to be validated in order to be used as management tool in invasion risk assessments. A store risk index could allow us to identify high risk aquarium stores, enabling a better implementation of preventive measures, such enforcement and targeted public awareness initiatives.

O.2:1

CAN THE PLACEMENT OF ARTIFICIAL BOULDERS IN POOL-TYPE FISHWAYS IMPROVE PASSAGE PERFORMANCE OF BENTHIC SPECIES?

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The placement of boulder substrate at the bottom of pool-type fishways with the goal of aiding fish passage is an issue of increasing awareness in fishway science. The goal of this study was to assess the performance of two boulder density designs combined with two fishway discharges, in assisting upstream passage of a potamodromous cyprinid species, the Iberian barbel (*Luciobarbus bocagei*), in an experimental full-scale pool-type fishway. Although there were no significant differences in fish passage success between configurations with different boulder densities (high density: 35%; low density: 40%), the higher fishway discharge induced a higher proportion ($P < 0.05$) of mean successful negotiations (50%), relative to the lower fishway discharge (25%). Furthermore, under higher flow discharge, fish took significantly less time ($P < 0.05$) to ascend the fishway (5.3 ± 4.2 min) in opposition to the lower boulder density (12.1 ± 6.5 min). Results showed that although fish passage success was independent of boulder density, a tighter configuration combined with a higher discharge can be beneficial, as it was found to reduce passage time.

O.2:2

ECOHYDRAULICS MONITORING AND IMPROVEMENT OF FISH PASSES IN THE DUERO BASIN: THE CASE OF RIVER TORMES IN SANTIBÁÑEZ DE BÉJAR (SALAMANCA)

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In recent years there have been many renovation and improvements in facilities on migration of the Iberian ichthyofauna. To ensure the proper functioning of these, it is fundamental to carry out an evaluation and subsequent follow-up, both hydraulic and biological aspects. Also propose and implement improvements if they will be necessary. In this study we analyze the biological behaviour in a "submerged orifice and non-sumerged notch" fishway (movement pattern, approach, entry, passage) of the main native migratory species of the Duero Basin: Trout (*Salmo trutta*), Barbel (*Luciobarbus bocagei*) and nase (*Pseudochondrostoma Duriense*), as well as the most relevant hydraulic parameters (flow, velocity, depth, power). It has been conducted in the Tormes River near Santibanez de Béjar (Salamanca). Biological monitoring was performed using trapping, tagging with microchips (PIT tags) and video monitoring. According to these data, we have proposed a number of improvements in the fishway, which they are being implemented in two phases. These works consist of increasing attraction, decreasing the slope, change weirs (submerged notch) and adjust the flow rate. Thus a midterm evaluation will be conducted, and it may determine whether the advancement of the works is adequate or whether further adjustments to the design and final implementation are needed.

O.2:3

BENEFITS OF HYDROACOUSTICS ON FISH RESEARCH: PRELIMINARY RESULTS OF A TS STUDY ON BARBELS

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Hydroacoustic is a widespread technique used to estimate the size of fish stocks and their related biological parameters, as well as to map their spatial distribution or their behavioural and trophic relationships. In relation to other methods, the possibility to investigate a large volume of water in a short time is one of the most important advantages of scientific echosounders, in addition to providing absolute estimates of fish abundance and biomass. Moreover, the fact that it is a non-invasive method that allows for exploration of large areas with high spatial and temporal resolution needs to be emphasised. Acoustic methods are an essential part of fisheries science and a great advance in the understanding of fish and fisheries.

In terms of a sustainable fisheries management focused on improvement of water quality, the quantitative assessment of fish stocks is a crucial component. In order to calculate fish biomass and density, it is necessary to know the relationship between biological parameters such as the length or weight of the studied specimens and the associated target strength (TS) or sound backscattered from fish. This study presents the results of an *ex situ* experiment performed on free-swimming Barbels using a SIMRAD EK60 split beam echosounder at 200 kHz. TS-length and TS-weight relationships were derived at different orientations for the studied population, thus orientation is considered as a major influence on fish target strength (TS). Moreover, the influence of track beam position on mean TS was studied. The results showed that beam position does not have a significant influence on fish TS within the first 5 dB of the beam pattern. Additionally, the effect of pulse duration on the estimated TS was studied. Results showed no differences between mean TS obtained by using 0.128 ms or 0.256 ms. In comparison with other published relationships, results have shown that those equations tended to underestimate real Barbel sizes. It is therefore recommended to use specific equations in order to accurately estimate density and biomass in aquatic systems where Barbel is an important component of fish community.

O.2:4

PEDRÓGÃO DAM FISH LIFT (PORTUGAL, BEJA) – GOALS AND OPERATION

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Dam construction has serious impacts on ictiofauna by transforming lentic habitats in lotic ones, promoting exotic species, fish populations' fragmentation and connectivity loss between reproduction and feeding areas. Fish passages are mainly used to minimize dams barrier effect, that break or limit fluvial longitudinal continuity, allowing obstacle transposition and consequent migratory or dispersive movements, namely by diadromous or potamodromous species.

In this context, EDIA S.A. included a fish passage (lift type) in Pedrógão dam project, as a minimization and compensation measure for Alqueva and Pedrógão dams construction over Guadiana river fish species, allowing migratory reproductive movements of some potamodromous species between Guadiana and Ardila rivers. This infrastructure is functioning since 2006, and to disclose Pedrógão dam Fish lift, a digital platform was developed that allow to identify some autochthonous fish species, to know the fish lift infrastructure and alert to some important environmental issues on dam construction context. The digital application allows to visualize and consult the bio-ecology of *Luciobarbus steindachneri*, *L. comizo* e *L. microcephalus*, *Pseudochondrostoma willkommii*. It also enables to visualize a 3D model of the fish lift from different perspectives and a film that illustrates its operation and goal.

POTENTIALITIES OF FISH BEHAVIORAL BARRIERS USING ACOUSTIC STIMULI: APPLICATION IN NATIVE SPECIES

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It is known that some acoustic or light stimuli have a repulsive effect in fish behaviour. The use of this effect in the development of behavioural barriers can help to protect fish, namely the potamodromous species, reducing the mortality caused by the hydraulic structures of dams. The effects of two acoustic stimuli (140 Hz and *Sweep-up*: 0-2000 Hz) were tested under laboratory conditions in three native freshwater species: *Salmo trutta*, *Pseudochondrostoma duriense* and *Luciobarbus bocagei*. These species avoided both sound stimuli, and the endemic cyprinids, *Pseudochondrostoma duriense* and *Luciobarbus bocagei*, presented the most significant repulsive response to the *Sweep-up* (0-2000 Hz). These results demonstrate the great potential of acoustic behavioural and its application can be used, isolated or combined with other stimuli (light, sound), in order to contribute for the conservation of Portuguese native freshwater species.

O.3:1

PROJECTE ESTANY, A LIFE + PROJECT FOR THE RECOVERY AND PROTECTION OF THE ORIGINAL BIODIVERSITY IN LAKE BANYOLES: RESULTS OF POPULATION CONTROL FISH

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Currently, invasive alien species constitute the main challenge for the management of Lake Banyoles, especially fish such as Largemouth Bass (*Micropterus salmoides*), Pumpkinseed (*Lepomis gibbosus*), Perch (*Perca fluviatilis*), Pikeperch (*Sander lucioperca*) and Carp (*Cyprinus carpio*). The proliferation of exotic fish species has led to the extinction or rarefaction of native fish: *Gasterosteus aculeatus*, *Barbus meridionalis*, *Squalius laietanus* and *Salaria fluviatilis*; it has also caused negative effects on other aquatic fauna of interest, as several naiads or herpetofauna species.

Between 2010 and 2014 was executed the project entitled "Improvement of habitats and species in the Natura 2000 network Banyoles: a demonstration project" (LIFE08 NAT/E/000078). This project's main objective was to design and implement a global action to combat slow down and reverse the decline of species and habitats of Community interest that are causing invasive species in this natural area, through control of invasive species and population reinforcements of some native species. The results obtained with the control of exotic fish fauna are presented.

Control of exotic fish populations was based on population culling, through intensive fishing combining various capture techniques: electric fishing with boat, nets, large traps and longlines. Near 120.000 fish of alien species were captured. For Largemouth Bass, has achieved a reduction of more than 90% of the population fraction with size above 40cm. In the case of Carp, a greater than 80% reduction of the total starting population has been achieved. In contrast, the density of Pumpkinseed and Perch has maintained stable, or even has increased slightly for some age groups.

Beyond the short-to medium term, one of the main challenges of this pilot project focused on implementing techniques and procedures, and with a reasonable cost, to maintain a sufficient pressure on populations of exotic species to ensure the conservation of native species. In this sense, we also present the results of the comparative analysis of the efficiency of fishing depending on the fishing technique, the time of year and other key environmental factors. All this information will be used to reorganize the control strategy of exotic fish in the lake. During the next 4 years this strategy will be implemented under the LIFE Potamo Fauna (LIFE12 NAT/ES/001091), a new project started in January 2014.

O.3:2

DECREASE THE PRESSURE FROM EXOTIC SPECIES ON SARAMUGO (*ANAECYPRIS HISPANICA*) POPULATIONS

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The Guadiana basin has currently seventeen allochthonous or exotic fish species, a greater number than the eleven autochthonous freshwater species. The presence of exotic species in the Guadiana basin is clearly a problem for the survival of autochthonous species.

The question of how to act in order to minimize in some way the pressure from exotic species in the distribution areas of the Saramugo (*Anaocypris hispanica*) was considered at the Action Plan for Conservation of Saramugo, and it is a challenge that must be handled within a very short time.

It is therefore urgent to inform the population about the consequences arising from the dissemination of exotic species. The foreseen awareness campaign should regard not only the population but also the institutions with responsibilities in the management of water resources.

On the other hand, and not less important, the preparation and implementation of control plans for exotic species would be the short term measure allowing to ensure the survival of some of the existing the Saramugo populations.

Such plan should include not only the removal of exotic species, but also other ways of control, such as: the implementation of devices in the dams that would prevent downstream leaks; in specific cases the creation of fishing reserves in the areas with Saramugo populations that would allow fishing exotic species; the removal of thin sediments from the stream beds, all together with would enable a greater control of their populations.

O.3:3

RESTORATION OF AQUATIC ECOSYSTEMS. PROTECTING AND MAINTAINING EUROPE'S NATIVE AQUATIC ECOSYSTEMS

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The problem: Native biodiversity in European waters is under attack from Non-Native, Invasive Fish Species and from parasites. Many of these alien species like *Cyprinus carpio*, *Pseudorasbora parva* and *Gyrodactylus salaris* are causing severe problems to native ecosystems and reduced biodiversity in combination with substantial economic losses. Globally, invasive alien species have been recognized as the second greatest threat to biodiversity after habitat loss

Why?: Intentional / authorized and unauthorized introductions are the reasons for undesirable introduction of invasive alien species.

Therefore: We have an Accumulated Need for Restoration-Activities throughout Europe.

Restoration by Eradication, using Rotenone as a Management Tool. Rotenone is the most valuable management tool in a restoration program. The only eradication method, other than complete dewatering to enable a 100% eradication efficacy.

Successful eradication projects in Europe

Spain: Successful Eradication of *Cyprinus carpio* in Laguna de Zóñar and Laguna de Medina in Andalucía. Several other eradication projects are in progress throughout Spain waiting for financing.

England: Many successful eradications of *Pseudorasbora parva* in England since 2005. Until now all have been successful. The eradication program will continue with increased resources.

Norway. Due to the problem with *Gyrodactylus salaris* on Atlantic salmon, the use of rotenone in Norway for 40 years has been substantial. 20 Rivers in Norway treated and declared free from *Gyrodactylus salaris*. 14 rivers treated and waiting for a free-declaration. 6 waters treated in 2013-2014. 9 infected rivers waiting for a treatment.

EU-Registration: Use of Biocides is strictly regulated in the EU under the Biocidal Products Directive (BPD) 98/8/EC In 2006 VESO, applied for an EU- registration for the active substance Rotenone and the formulated product CFT Legumine for the use as a Piscicide. Now, the review program has been extended until 2024. Piscicides have been put on the 6th priority list with a deadline for 31/6/2024!

The use of Rotenone: VESO is still able to supply Fish Managers/Authorities with Rotenone under the existing regulatory framework until a decision is made.

Please note: an Approval from Official Authorities in each member state will still be required.

- You know the problems with Invasive Fish Species

- We know how to restore aquatic systems.
- Together we can protect and maintain Europe's Native Aquatic Ecosystems.

O.3:4

CHANGES AFTER ERADICATION OF A CARP POPULATION INTRODUCED IN A LAGOON OF SOUTH OF SPAIN

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The Laguna de Zóñar (Córdoba; South of Spain), is a natural water body of about 31 Ha and 13 m maximum depth protected because is one of the scarce permanent water bodies existing in the semiarid Region of South of the Iberian Peninsula. The lagoon also represents one of the last refuges of a very interesting diving-duck community with several endangered bird species. After the introduction of common carp in the 80's, aquatic vegetation and invertebrate community disappeared and the diving-duck community was replaced by another dominated by piscivorous birds.

In July 2006 using the piscicide rotenone, CFT Legumine® the carp population was eradicated from the lagoon. In this paper we describe physic-chemical characteristics and aquatic vegetation, invertebrate and waterfowl communities before the presence of the carp in the lagoon, the changes registered in these parameters after its illegal introduction in the lagoon and finally the changes observed after the eradication of the population covering a period of different environmental situations of about 25 years.

One year after removal of 13.000 kg of carps the oxygenated part and transparency of the water column increased; carophytes community recovered and aquatic insect population increased from 1 to 16 gen. Finally the diving ducks returned to the lake while piscivorous birds left the lagoon. The sand smelt *Atherina boyeri*, native in the lake, was successful restocked after the treatments.

O.4:1

MOVEMENTS OF NATIVE CYPRINIDS IN AN UPSTREAM WEIR-FRAGMENTED STREAM.

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In fragmented river systems not all barriers are completely insurmountable, small barriers are sometimes just partial or intermittent. Nevertheless, they are full barriers for many fish species during the most important part of the year, in particular for potamodromous species that seasonally undergo upstream spawning migration. This work aims at understanding how different types of barriers affect fish movements. To achieve this goal a 6.5 km upstream segment of a permanent stream impacted only by the presence of physical barriers to longitudinal connectivity was fish sampled below and above barriers. Fish were tagged with Visible Implant Elastomer tags (VIE) and barriers were hydraulically characterized according to the index of river connectivity (ICF). A total of 982 fish of four species were tagged and 114 were recaptured during four sampling seasons (spring 2012 – winter 2013). Iberian barbels (*Luciobarbus bocagei*), a potamodromous species, was responsible for 91% (104) of all recaptures, of which only 11 fish moved past a barrier ($\chi^2=126.173$, $p<0.0001$) without a directionality preference (upstream vs downstream - $\chi^2=1.81*10^{-17}$, $p=1$). There were no differences in length either between fish that moved and fish that remained between the same barriers ($U=494.5$, $p=0.857$), nor between upstream and downstream movers ($U=12.0$, $p=0.584$). The results show that fish are able to negotiate the barriers, but they also point towards a life strategy shift of Iberian barbel upstream populations. One would expect a voluntary displacement downstream of juveniles and young adults, an involuntary downstream displacement through flushing during the winter and, during the migration season, an upstream displacement of adults. All of which did not occur, indicating that in barrier fragmented systems potamodromous fish species adjust their life-history strategy.

O.4:2

SEASONAL MOVEMENTS, HOME RANGE EXTENSION AND MICRO-HABITAT USE OF THE IBERIAN BARBEL UNDER NATURAL AND REGULATED FLOW CONDITIONS

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Hydroelectric infra-structures are responsible for changing streamflow regime and the available habitat for fishes, increasing their irregularity. Short term flow regulations may alter fishes behavior, due to the intermittency of suitable areas and other resources. To determine variations in seasonal longitudinal movements, home range extension and habitat preferences of a potamodromous cyprinid inhabiting rivers with regulated and natural flow, #30 Iberian barbels (*Luciobarbus bocagei* Steindachner, 1864) were caught, tagged with radio transmitters and released in two Portuguese rivers with similar hydromorphological pre-exploitation conditions, but distinct flow patterns. Fifteen barbels were released in River Mondego, in the highly regulated stretch located immediately downstream from a large hydropower scheme, while the other #15 fish were released in River Vouga, a natural flowing river with typical seasonal flow fluctuations. Fish were tracked once a month or bimonthly during their spawning period. Micro-habitat characteristics (e.g., depth, water velocity) were registered for each fish location.

Tracking results show that barbels from the regulated river exhibit shorter movements and smaller home ranges. In the natural flow river, fish showed higher mobility and movements above 4 km were observed in some of the tagged barbels. Barbels selected habitats near the margin, with reduced water velocity and high refuge potential, abundance of wood detritus and aquatic vegetation. These results can be useful for the definition of a flow policy that can minimize the impact of flow regulation in the Iberian freshwater fish communities.

O.4:3

STREAMFLOW VARIABILITY AS A DRIVER OF THE SWIMMING PERFORMANCE AND ECO-MORPHOLOGY OF A MEDITERRANEAN CYPRINID SPECIES

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Regional streamflow variability is responsible for considerable habitat variations to which fish respond through specific life-history strategies and morphological adaptations. We compared the swimming performance and eco-morphology of two Iberian barbel populations from permanent and temporary rivers. The permanent river was characterized by higher water persistence and a more turbulent environment, contrasting with the stable environment that is present in the temporary ecosystem during most of the time. Barbels inhabiting the permanent river had a higher critical swimming speed (U_{crit}) and a more fusiform body shape, lower body condition and longer and higher pectoral and dorsal fins, when compared with the population from the temporary watercourse. These results reflect an environmental-induced response to reduce hydrodynamic resistance and energy expenditure during locomotion and can be used as valuable information for environmental managers to understand and improve the regional specificity of common river restoration measures, such as the construction and arrangement of fishways and the adequacy of instream flow manipulations.

O.4:4

VOLITIONALLY SWIMMING PERFORMANCE OF IBERIAN FISH: DETERMINATION AND APPLICATIONS

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Knowing the swimming ability of fish is important to detect movement limitations through hydraulic structures: fish passes weirs and slots, walls of dams, gauging stations, culverts, bridges foundations and other. All these obstacles are collectively referred to "velocity barriers".

Passage of these structures is a combination of fish swimming performance and motivation. Once the fish decides to enter the barrier, must swim faster than the speed of the flow to advance. Thus, the swimming performance depends on the fish speed and fatigue time.

To estimate these values, we experiments with fish of different sizes in volitionally swimming flumes, through which flows water with known velocity. The ascending of fish is controlled by PIT telemetry systems and videorecord. The information obtained (fish speed, ascend time and distance traveled) is processed using survival analysis techniques and the results can be applied to practical problem solving velocity barriers.

So far, in the case of Iberian fish, we have worked with specimens of trout (*Salmo trutta*), Iberian barbel (*Luciobarbus bocagei*) and Northern straight-mouth nase (*Pseudochondrostoma duriense*). Swimming ability of these species do not differ greatly between them and is much higher than the values which are obtained using other methods as respirometers.

O.4:5

STUDY OF IBERIAN NASE, *PSEUDOCHONDROSTOMA POLYLEPIS* (STEINDACHNER, 1864), MOVEMENTS, BEHAVIOUR AND FATIGUE IN A VERTICAL-SLOT FISHWAY

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During the upstream migration at the breeding season in spring, the Iberian nase (*Pseudochondrostoma polylepis*) can find hydraulic infrastructures that cause a barrier effect. This effect is often mitigated by a fish pass. The aims of this study are twofold, first, to determine whether the individuals of an Iberian nase fishfarm population are able to go through a laboratory vertical-slot fishway, and second, to ascertain the fatigue status of the individuals completing the ascent. Moreover, the Iberian nase movements during the ascent were studied as well as its behaviour when crossing the slots, the critical point.

In order to study the movements, two experiments were carried out in spring with two groups of individuals in two flow conditions (100 l/s and 250 l/s, respectively).

The position of the fish was determined over a 24 h period, using a radio frequency identification system. The behaviour and fatigue status study was conducted using the individuals of the 100 l/s flow experiment. The behaviour patterns were recorded with an underwater camera. The fatigue status was characterized through samples of haematocrit lactate and glucose. The levels of the parameters of individuals that completed the ascent were compared to the levels of individuals at rest and the levels of individuals at maximum fatigue.

The percentage of individuals that completed the ascent was found to be higher in the 100 l/s experiment (78%) than in the 250 l/s one (21%). However no differences between the two groups neither in the fork length of fish that completed the ascent nor the time to complete it were found. In relation to the behaviour, we found that there is a preference to cross the slot swimming along the bottom and close to the deflector. Finally, the plasma glucose and lactate levels of the fish that ascend the fishway don't reach the levels of the fish at maximum fatigue. These results are provisional and they would need to be replicated before final conclusions related to the Iberian nase swimming ability to ascend this fishway typology are drawn.

O.4:6

DORSAL FIN FUNCTION IN CENTRARCHIDS: BIOMECHANICS AS A TOOL FOR MANAGEMENT

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Acanthomorpha, the spiny-rayed fishes, comprise one third of all living vertebrates. In these fishes, anal, dorsal, pectoral and pelvic fins can have modified lepidotrichia that lost branching and joints and are now bony spines. These spiny rays, contrarily to the highly flexible lepidotrichia, are more constrained in terms of mobility, allowing mostly cranio-caudal movement. In fish fin evolution we see a trend towards higher range of movement and flexibility. However, little attention has been given to the fact that highly derived fish share a synapomorphy of spiny and less flexible fins. The spiny portion of the dorsal fin reaches similar sizes of the soft dorsal fin in some Centrarchidae fishes and has been hypothesized to have a role as predator deterrent and/or locomotion. I sampled

green, redear and bluegill sunfish from Eastern Illinois tributaries, ponds and lakes and analyzed dorsal fin morphometrics. I also collected high speed video during steady swimming, hovering, routine maneuvers and fast starts for green and bluegill sunfish. I analyzed the movement of the dorsal fin during these behaviors in both species, as well as, the direct response of the spiny dorsal fin to hydrodynamic stimuli. Green sunfish are more streamline than bluegill sunfish, while redear have an intermediate body shape. Bluegill sunfish have the deepest body and the larger spiny dorsal fin, which seems to suggest a body shape optimized for maneuvers. Green sunfish and bluegill sunfish are proficient at escaping predator like stimuli. They employ a C-start response and deploy their spiny dorsal fin throughout the escape. Bluegill sunfish also uses this fin as a stabilizer when swimming in turbulent environments. When presented with a weak hydrodynamic stimulus, bluegill sunfish collapses the spiny dorsal fin initially but erects it to recover balance. In contrast, the soft portion of these fin moves predominately laterally. These results seem to indicate that the dorsal fin is adding stability and resisting the strong lateral forces. Thus, spiny dorsal fins play a role in fish locomotion other than protection against predators. Given the flexibility of the rest of soft fin rays, stability demands are likely to have played a role in the evolution of spiny fins in highly derived fishes. Biomechanics studies together with ecomorphological approaches hold promise in devising better freshwater ecosystem interventions. They also offer strong tools to assess the impact of habitat restoration, namely in what pertains to flow velocity and turbulence.

O.5:1

THE ECOLOGICAL WATER QUALITY IN SMALL HYDROELECTRIC PROJECTS. IMPORTANCE OF NATURAL AND ANTHROPOGENIC DYNAMICS OF THE RIVER BASIN IN THE ADEQUACY OF MONITORING PROGRAMS.

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It is notoriously difficult to analyze the degree of anthropogenic disturbance of river ecosystems due to the complexity associated with them. However, many of the environmental management priorities require sampling programs able to describe the study sites and monitor the differences found, especially when the goal is to assess the impact of anthropogenic infrastructures on the ecological quality of watercourses. If we add to this the growing need for effective environmental assessment criteria in river ecosystems in accordance with the specifications of the Water Framework Directive (WFD), it becomes clear the importance of finding effective monitoring programs and particularly suitable to each reality and their contexts.

The monitoring of ecological water quality under the hydroelectric development projects integrating quality indicators, methods and guidelines as defined in the document "Criteria for the classification of water bodies status" (INAG, 2009) for rivers type, offers semi-objective method for assessing the Ecological quality of Water in the Field of Small Hydroelectric Projects (SHP).

This paper aims to draw attention to the need to adapt and strengthen the monitoring programs that influence the accuracy and uncertainty associated with the classification of ecological status of river ecosystems, taking into account:

- The natural temporal variability, which translates into index values of different ecological status regardless of anthropogenic pressures;
- Anthropogenic pressures with origin in the use of water resources upstream, which affect the *river continuum*;
- And the contribution of watershed and management of riverine resources.

In this context, we analyze the monitoring program of a SHP in the exploration stage since 2012, located in Bugio River (Ave River Watershed), municipality of Felgueiras. The results of the ecological quality elements obtained during the campaigns of 2012 and 2013 were sampled and analyzed in accordance with the WFD/Water Law and INAG (National Institute for Water) using protocols for "fish fauna", "macrophytes", "benthic macroinvertebrates" "phytobenthos-diatoms" and also the River Habitat Survey (RHS).

The present work has shown that it is essential to develop appropriate monitoring programs, which focus not only on the particular features of SHP and the area affected by them, but also the features of the watershed and water resource use upstream. The study also revealed the importance of adjusting the monitoring programs based on the results of previous campaigns.

O.5:2

COMPARATIVE ANALYSIS OF TWO FISH INDICES: APPLICATION TO THE SADO RIVER BASIN

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In preparing a program of compensatory measures for the native fish fauna of the Sado river basin, a fish index was developed (IP-Sado) to assess the conservation value of fish assemblages. The IP-Sado consists of five metrics, with emphasis given to the conservation value of native species, particularly *Iberochondrostoma lusitanicum*, as it is the freshwater species present in this river basin with the highest degree of threat.

During the implementation of the WFD, Portugal has now developed an index to assess the biological quality of rivers based on the fish fauna (F-IBIP, Fish-based Index of Biotic Integrity for Wadeable Portuguese Streams), one of the biological elements included in the WFD. This index contains different combinations of fish metrics in accordance to a river fish typology developed specifically for its application.

In this paper, we compare the behaviour of the two indices in river Sado basin. To this end, the two indices were determined for about three dozen locations in this river basin watershed and their results were contrasted with appropriate statistics. Although the objectives of these classification tools are fairly different, the results revealed a significant relationship between the IP-Sado and the F-IBIP. The results of this study are discussed in view of the potential links between the concepts of ecological quality and biological conservation value in Iberian basins.

O.5:3

DEFINITION AND CHARACTERIZATION OF REFERENCE FISH COMMUNITIES AND FISH-BASED QUALITY INDEX AS AN ENVIRONMENTAL IMPACT ASSESSMENT TOOL

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Regarding aquatic ecosystems, and more specifically freshwater fish communities, there is a need for a standard methodology in Portugal, concerning the environmental impact assessment process, that allows the assessment of different types of impacts in these communities, including: (i) reference fish communities; (ii) fish-based quality indexes which identify ecological deviations.

Although some steps were taken to define a standard methodology for fish communities characterization and the assessment of impacts on them, with the implementation of the Water Framework Directive (WFD) in Portugal, through the setting of sampling protocols by the Portuguese Environment Agency, there is still no official document for the biotic characterization of the existing river typologies (which defines the reference communities for each type), or a fish-based quality index for the assessment of water bodies ecological status.

The present investigation aims to define and characterize reference fish communities, based on a set of sample data from the North and Centre of Portugal, resting on ecological features of the species that compose them, and also in the river continuum concept, as a basis of reference for the assessment of environmental impacts on fish communities. Three reference fish communities, typical of river's upper, middle and lower sections, were statistically and ecologically determined and validated.

In order to quantify ecological deviations in the fish communities, the first steps were taken to define a fish index, based on ecological / functional metrics (feeding, reproduction, habitat, tolerance, etc...) which reveal the communities functional profile, allowing the detection of aquatic ecosystems degradation processes. The aim is to develop an index applicable to all river basins of Portugal, adaptable to the different fish communities present along the river continuum, allowing not only to assess deviations in the functional composition of fish communities, as well as the quality of aquatic ecosystems in which they live.

O.5:4

FISH AS INDICATORS OF ECOLOGICAL STATUS IN MEDITERRANEAN ISLAND STREAMS: INSIGHTS FROM CYPRUS

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The use of fish as a Biotic Quality Element (BQE) to assess the ecological quality of inland waters is a requirement for the implementation of the EU Water Framework Directive (WFD). Mediterranean Islands pose special problems in applying fish-based indicators since they typically contain very few fish species, most often dominated by non-indigenous species. This is the case on the island of Cyprus where the problem is further exacerbated by the intermittent character of the existing lotic water bodies, most often with no long-term connection to the sea. There is also a widespread and complex anthropogenic modification of the natural conditions, namely related to water abstraction and damming. In addition there is a lack of background natural history research, further hampering the definition of reference conditions and therefore limiting the development of ecological quality indices.

To explore the potential use of fish for bioassessment purposes in lotic water bodies on Cyprus, a fish survey was conducted from 2010 to 2012 at 151 sites in 31 river basins, covering most of the environmental variability found in the island. Standard WFD-compliant electrofishing sampling surveys were performed at each site. A database was compiled, comprising three main information elements: species composition, environmental variables and stressors. The response of ten fish-based metrics to the main stressors was explored using both multivariate analysis and GLM. In a first analysis it was shown that typological consistencies in the species assemblages do exist in Cyprus. Three generic river types (mountain, middle course and coastal types) have been defined based on environmental variables, showing a good match with fish assemblage attributes.

Common roach, brown trout, rainbow trout, eel and mosquito fish were the fish species most frequently found in Cyprus lotic waters. Almost 50% of the sampling sites were fishless. The results of a constrained multivariate analysis showed the existence of a marked covariability between the effect of the stressors and the natural environment variability. Despite a high variability of fish-based biotic attributes at the sampled sites, the results indicate that some fish-based metrics can be applied on Cyprus, even when the natural variability is accounted for.

O.5:5

WATER QUALITY MONITORING OF RIVERS AND RESERVOIRS WITH LIGHT AUTONOMOUS UNDERWATER VEHICLES (LAUV)

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A joint development project between the Department of Environment - Energy for Nature – of Energia Fundamental – Serviços Energéticos, Lda. and OceanScan - Marine Systems & Technology, Lda. resulted in the project monitoring of water bodies using the technology LAUV-Light Autonomous Underwater Vehicle. This project was designed especially for mapping water quality, biological communities and hydromorphological features of large continental water bodies (rivers, reservoirs, lakes and coastal lagoons).

The use of LAUV allows to increase existing programs and networks for monitoring the water quality using measurement equipment in static locations and even replace expensive monitoring programs however mandatory under the Water Framework Directive (WFD). Given its small size and weight, LAUV is also an effective tool in monitoring and mapping of shallow water, which is usually not practical, or often impossible, using regular boats.

Monitoring with LAUV allows you to collect and provide georeferenced, high-resolution information on water quality information, biological communities and local hydromorphological features. This information and its real-time combination can be mostly critical in the protection of aquatic ecosystems, mainly while monitoring and control of exotic fish species.

When referring to reservoirs, managers are usually concerned about quality monitoring along the water body, particularly with the primary network of inlets. Nevertheless, there is a growing interest in assessing the potential effects of building various infrastructures on water bodies and to quantify and locate the entrance of pollutants and sediment loads from the watershed. Our solution allows sampling and obtains real-time data at any point of the water mass at any time of day and year and always with high resolution. This technology's potential is clear regarding its capacity to collect information of various nature, in large areas in a relatively short amount of time, with resolutions impossible to achieve by other means. Note also that the implementation of a system for collecting environmental information based on the operation of an autonomous underwater vehicle, as LAUV, allows nearly synoptic observation of natural phenomena or caused by human intervention. This is an unprecedented advantage opposed to the methodologies currently in used.

O.6:1

RESPONSES OF ESTUARINE FISH ASSEMBLAGES TO CLIMATE VARIATIONS

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Ongoing climate change and related weather extremes are among the most important drivers of marine ecosystems, which have profound implications for the life forms that co-exist on them. For marine fishes, climate change will strongly influence their distribution and abundance, through changes in growth, survival, reproduction, mortality and multiple relationships with other trophic levels. These aspects are particularly important in estuarine areas due to their transitional characteristics between marine and riverine environments, added to an already high degree of anthropogenic pressure. Given the importance of estuaries for the completion of the life-cycle of many fish species, by providing nursery grounds, migration routes, feeding areas and shelter, evaluating the long-term responses of fish to climate change in these environments conveys a significant step forward in our understanding of the effects of multiple stressors in key species, such as fish.

In this work, we will provide an overview of the impacts of extreme weather events of the fish assemblages of the Mondego estuary (Portugal) over the last 10 years, by focusing on several organizational levels: fish assemblages, taxonomic and functional groups, and single-species. Overall, changes in the fish assemblage were mostly related with variations in river flow, due to the occurrence of extreme drought events during this time frame; for instance, the abundance of typical marine species largely increased, while freshwater species were absent. In non-drought years, the most abundant species presented higher densities and secondary production values.

In contrast, in drought-affected periods, an occurrence of subtropical species and a decrease in the mean trophic level of the fish assemblage were observed, as a response to the increase in water temperatures and to the displacement of the estuarine salinity gradient towards upper reaches. Results also suggested the long-term influence of global stressors on the life cycle and population abundance of estuarine resident species, emphasizing the role of large-scale climatic patterns in fish. In sum, both local and large-scale climatic patterns seem to highly influence most aspects of the life cycle of fishes in estuaries, which might be compromised by global climate change, stressing the importance of long-term datasets for a thorough analysis of climate-species relationships.

O.6:2

CLIMATE CHANGE EFFECTS ON ESTUARINE AND COASTAL FISH

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The impact of sea-surface warming upon the fish assemblages of the Portuguese coast was assessed under a future scenario of 2°C increase, until the year 2100. A bio-climatic envelope model was applied to the fish assemblages that are currently present in the Portuguese coast and south of it. Very few species were totally eliminated from Portuguese waters. There were more new than lost species. Most of the new species are commercially important species. The datasets pertaining to the present and future fish species of the Portuguese coast, along with other published information, were used to model the present and future food webs of the Tagus estuary, establishing structural networks depicting “who eats whom” in this system. Present and future food web

networks did not present marked structural differences and no cascading secondary extinctions were detected. The role of humans, as the top predators with the most prey links, will be reinforced in the future since many of the new species are commercial species. A highly omnivorous shark is predicted to enter this system, with potential to impact the abundance of species already under fishing pressure.

O.6:3

EFFECTS OF OCEAN ACIDIFICATION IN COASTAL FISHES

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Early life stages of many marine organisms are being challenged by rising seawater temperature and CO₂ concentrations, but it is poorly known how such stages will endure under the combined effects of future ocean acidification and warming. In the present study, we show that future predictions of ocean warming (+4°C) and acidification ($\Delta\text{pH} = 0.5$ units) may compromise the early ontogeny of the commercially-important fish, namely flatfish *Solea senegalensis* and seabream *Sparus aurata*. High $p\text{CO}_2$ (~1600 μatm) and warmer temperatures significantly decreased hatching success, larval survival, growth and metabolic rates. Furthermore, larvae showed a significant higher percentage of malformation in increased CO₂ when compared to control levels (~400 μatm). Besides physiological impairments, larvae behaviour was also affected under the future environmental conditions. Swimming duration, vertical orientation frequency and capture rate were significantly decreased. These findings highlight the particular sensitivity of fish early life stages to these climate change-related variables and the above-mentioned physiological and behavioural challenges may influence the adult-fish ecology, distribution and abundance of this species.

O.7:1

MICROHABITAT PREFERENCES OF MEDITERRANEAN BARBEL (*BARBUS MERIDIONALIS*) IN MEDITERRANEAN STREAMS, NE SPAIN

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The first data on microhabitat preferences of Mediterranean barbel (*Barbus meridionalis*), an endemic fish species to the NE Spain and southern France are presented. By means of electrofishing, a *point abundance sampling* (PAS) was deployed in 350 points distributed among six similar streams. We obtained fish density (total catches) and habitat description at each sampling point, selected using a systematic procedure. Standard fork length was measured for each individual. Values of 14 environmental parameters such as depth, velocity, substrate type, presence of vegetation, distance to shore, wide of the river, degree of exposure, or presence of other species, were measured. Catches were classified in three size groups (i. 0+; ii. 1+ and iii. >1+) Ivlev's electivity index was calculated and partial canonical correspondence analysis was performed using both, catches and environmental data matrix. Partial analysis was used to keep in account possible differences between streams. A clear preference of microhabitats by each fish size was observed. The first group (0 +) showed a preference for areas near the shore with presence of vegetation and branches, substrates formed mainly for sand and gravel and low current velocities. 1+ size classes showed greater preference for areas of greater depth and presence of boulders. There is also a clear separation between groups 1+ and > 1 + so that the larger size predominated in areas of higher velocity and deep pools with large blocks and caves. These first data on microhabitat preferences of Mediterranean barbel can be useful for the management of this fish species due to the decline observed along the last years in his geographic range.

O.7:2

DISTRIBUTION AND COMPOSITION OF FRESHWATER FISH AND MUSSEL COMMUNITIES OF SABOR AND TUA RIVERS (DOURO BASIN): MAIN THREATS AND CONSERVATION MEASURES

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The autochthonous fish communities of Tua and Sabor rivers (Douro Basin) are composed by salmonid (*Salmo trutta*), cyprinid (*Squalius carolitertii*, *Squalius alburnoides*, *Pseudochondrostoma duriense*, *Luciobarbus bocagei*, *Achondrostoma* sp.) and cobitid (*Cobitis calderoni*) populations. These fishes, most of them Iberian endemic species, are severely threatened. In fact, water pollution and eutrophication, riparian and aquatic habitat degradation, introduction of exotic species (e.g. *Esox lucius*, *Micropterus salmoides*, *Lepomis gibbosus*, *Gambusia holbrooki*, *Gobio lozanoi*, *Carassius auratus*, *Cyprinus carpio*, *Sander lucioperca*) and more recently the

construction of two big dams in the final section of each river (Hydroelectric Powerplants of Baixo Sabor and Foz Tua) are factors that will lead to substantial changes in the distribution and composition in the fish fauna but also in other animal and plant communities influenced by the reservoirs. Endangered freshwater mussel populations (Bivalvia, Unionoida) such as *Margaritifera margaritifera* (only in the Upper Tua) and three unionids (*Unio delphinus*, *Anodonta anatina* and *Potomida littoralis*) are also present in both watercourses. These naiads have a complex life cycle, since the larvae (glochidia) parasitize and depend on specific fish species as hosts for metamorphosis and upstream dispersion. In the present study, it was successfully reproduced and determined the host fish species for *Anodonta anatina*, *Potomida littoralis* and *Unio delphinus* from both rivers Tua and Sabor (Douro basin). The results showed that only autochthonous fish act as effective host species for unionid species (except the exotic fish species *Oncorhynchus mykiss* for *Anodonta anatina* and *Gambusia holbrooki* for *Unio delphinus*). It was also detected a good biological quality in the headstreams, namely in the Rabaçal and Tuela rivers (Upper Tua), located inside the Montesinho Natural Park, where high density populations of brown trout cohabit with freshwater pearl mussel (*Margaritifera margaritifera*). However, in the final sections of the Tua and Sabor rivers, a lowest ecological integrity was currently detected, and it is expected a great decline in near future of native fish and the disappearance of unionid populations (*Anodonta anatina*, *Potomida littoralis* and *Unio delphinus*) due to river regulation. It will be essential the protection of remaining priority habitats located upstream of reservoirs, in order to contribute for the survival of these endangered native fish and mussel species of the Tua and Sabor rivers.

O.7:3

MONITORING REPRODUCTION ACTIVITY AND LARVAE DISTRIBUTION OF *PETROMYZON MARINUS* AND *LAMPETRA PLANERI* CANTABRIAN BASIN, NAVARRA

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Sea lamprey (*Petromyzon marinus*) and brook lamprey (*Lampetra planeri*) are the two lamprey species occurring in the province of Navarre, northern Spain. Specifically, the sea lamprey inhabits the lower Bidasoa River whilst the brook lamprey occurs in the Ugarana River (Orabidea), which is a tributary of La Nivelle River in the French Basque Country. Nowadays the information available on these species is limited to some occasional catches and observations. In order to solve this situation, several species-specific monitoring programs have been carried out within the SUDOE European Fluvial Territories Project. The monitoring of both lamprey species included, on one hand, observational counting of adults and nests during the breeding season and, on the other hand, semi-quantitative estimations of larvae by means of electric-fishing during autumn. The specific aims of these studies were: (1) to determine the breeding areas and range of both lamprey species, (2) to quantitatively evaluate the status of lamprey populations, (3) to characterize the fluvial habitats occupied by the breeding adults as well as the lamprey larvae in Navarre.

EXTENDED SPAWNING IN BROWN TROUT (*SALMO TRUTTA*) POPULATIONS FROM SOUTHERN IBERIAN PENINSULA: THE ROLE OF UNPREDICTABILITY AND TEMPERATURE

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The reproductive period of the brown trout (*Salmo trutta* Linnaeus, 1758) populations in 12 rivers from Baetic Mountains (southern Spain) was studied from 2008 to 2013. This area is an ecological and geographical limit for the distribution of this species in Europe. The results showed early beginning dates of the breeding period and a notably extended spawning season in the studied rivers. Our data suggest that the set of females from most of the populations is able to produce eggs from early October to late April/early May for a period between 150 and 170 days, the longest and most delayed brown trout reproduction period reported in the literature. Although some factors could have acted providing the basis for the development of the reproductive behavior detected, we believe that such early and protracted spawning periods are conditioned by two main factors, the unpredictability of the Mediterranean climate and the local water temperature. This hypothesis is discussed comparing our results with those found in other European brown trout populations.

O.8:1

FRESHWATER FISHES - VICTIMS OF THEIR OWN SUCCESS

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To examine the description curve of freshwater fishes, the geographical biases of the available information, the relationship between species richness and rarity as well as to assess the comparative role of different environmental factors on these variables.

ModestR was used to summarize the geographical distribution of all species of freshwater fishes using information available from geographical records. The first order jackknife richness estimator for incidence data was used to estimate the completeness of all the terrestrial world cells of 1 degree. An α -shape procedure was used to build range maps capable of providing relatively accurate species richness and rarity values for each grid cell. After studying the relationship between these two biodiversity parameters we examine the explanatory capacity of a high number of environmental variables using multiple regressions and Support Vector Machine (SVM) procedures.

Cumulative species description curves show that the current rate of description is still very high (240.2 species by year) and that a high number of species remain to be discovered. Completeness values indicate that only 199 one-degree grid cells mainly located in eastern North America and Europe could be considered as having relatively accurate inventories. Range maps provide species richness values positively and significantly related with those coming from the first order jackknife richness estimator. Higher species richness values occur in the tropical regions of South America, Africa and Asia plus to a lesser degree North America and Europe. The relationship between species richness and extent of occurrence is clearly triangular so that these species-rich cells are those with a higher proportion of distributional rare species, although some neighbouring species-poor areas located in subtropical regions also have narrowly distributed species. Species richness is well predicted by climatic and/or productivity variables on the contrary that rarity geographical variation.

O.8:2

CONSERVATION PLANNING OF FRESHWATER BIODIVERSITY USING COARSE DATASETS: HOW MUCH CURRENT PROTECTED AREAS IN IBERIAN PENINSULA PROTECT FRESHWATER BIODIVERSITY?

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The limited value of current conservation planning for freshwater biodiversity has been highlighted by researchers and managers. The examination of particularities of freshwater ecosystems has been recently explored to respond to current challenges of conservation planning of moving to a more transdisciplinary approach. Firstly we evaluate the capacity of the current network of protected freshwater biodiversity in the Iberian Peninsula. Our results reveal that current network of protected areas in Iberian Peninsula is far from covering the areas needed for assure persistence of all species. Secondly we apply a recent approach to identify priority areas to adequately represent all freshwater fish and amphibian species in a cost-effective way, and fill the gap of the current network of protected areas. We account for current threats during the prioritization process to ensure highly degraded areas are avoided to maximize the ecological role of protected areas and minimise the need for intervention to ensure species can be effectively protected. Adequate and transdisciplinary conservation planning is a necessary approach for shedding light on the multiple complexities and high degree of uncertainty about drivers of environmental change and their interactions, and the challenges associated with devising objective strategies for management.

O.8:3

USING GRAPH THEORY TO CONNECT THE DOTS IN FRAGMENTED RIVERS

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Freshwater systems are severely impacted by connectivity reduction due to the construction of dams and weirs. The breach of this longitudinal connectivity imperils freshwater fish species worldwide. There is thus an increasing need for numerical tools that help decision-makers correctly allocate resources to priority restoration actions. The present study provides a methodology for prioritizing connectivity enhancement actions on full insurmountable barriers. The proposed technique focuses on the function aspect of longitudinal connectivity and it is based on spatial graphs, which represent structural units as nodes and connections between them as links, and uses habitat suitability modeling (Boosted Regression Trees) to weight nodes. The lower Tagus river network was selected as a case study to evaluate the impact of its 29 dams, built between 1928 and 2004, on the river functional connectivity for each of two fish species (Iberian barbel *Luciobarbus bocagei* – representing large potamodromous fish; and Iberian chub *Squalius pyrenaicus* – representing small water-column residents) and for the combination of both. Results show that dam placement on the lower Tagus was responsible for a 48.4 – 54.4% reduction in longitudinal connectivity. Actions to promote connectivity in just 7 of the dams would increase connectivity by 35.0 – 37.2%. This prioritization method makes it possible to model the impact of the removal or placement of an insurmountable barrier in any given river network, facilitating resource allocation for connectivity restoration or minimizing the impact of a new barrier implantation by correctly choosing its placement.

DISTRIBUTION MODELLING OF FRESHWATER FISH USING TIME TO FIRST DETECTION

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Accounting for imperfect detection (i.e., failure to detect a species when the species is present) is an imperative when producing reliable species distribution models (SDM's). Methods have been developed to solve this problem by explicitly incorporating variation in detection probabilities across sites, species and/or seasons. The application of these methods in freshwater species is hindered because these methods rely on repeated sampling (≥ 2) assuming that the state of the site doesn't change (occupied/unoccupied) between samples. This may be impossible, impractical or just too expensive for most studies. Here we present a new approach based on time to first detection to account for differences in species detectability, which requires only a single sampling occasion and so it may find more general applicability in freshwaters. The approach uses a Bayesian framework to combine conventional occupancy modelling with techniques borrowed from parametric survival analysis, jointly modelling factors affecting the probability of occupancy and the time required to detect a species.

To illustrate this method, we will present preliminary results of our efforts to model the distribution of the fish species in the Sabor River (Douro basin; northeast Portugal) using large scale factors (elevation, stream order and precipitation), while accounting for factors potentially affecting detectability at sampling points (species abundance and stream depth and width). We fitted a modified Weibull model to time to first detection data of each species, which allow detection rates to increase or decrease across the duration of sampling.

Fish occupancies were consistently affected by stream order, elevation and, to a lesser extent, annual precipitation. Detections were primarily affected by fish abundances, while stream depth and width showed minor influence. Detection rate increased over time for most species. Maps of occupancy probability showed that the studied species mostly differ in the occupancy of upstream reaches. Uncertainty was generally higher in middle and upstream reaches. Time to detection appears to be a valuable approach for producing SDM's that account for imperfect detection. This approach requires less sampling effort than 'conventional' occupancy modelling, and so it may provide a practical alternative when resources are limited and detection is likely to be a drawback.

O.9:1

BEST MANAGEMENT PRACTICES MITIGATE THE EFFECTS OF CERTIFIED EUCALYPTUS PLANTATIONS ON MEDITERRANEAN STREAMS

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Forest management activities may cause substantial changes to river systems and its biotic communities, such as increased erosion, changes in the hydrological regime, or the increased nutrient runoff, influencing the "natural" geomorphic processes. Forest certification and Forestry Best Management Practices (BMP) rightly seek to reduce the impacts caused by forestry activities in the surrounding landscapes. BMP reduce the damage to forest ecosystems in comparison with conventional logging and include protection of native riparian zones, and creation of conservation/protection areas. To investigate the effectiveness of BMP in stream reaches associated with certified eucalyptus plantations, which include high quality riparian areas, we sampled fish assemblages in small-to medium-sized cyprinid streams in Tagus basin, representing three distinct groups: (1) reference sites located in areas dominated by semi-natural vegetation and presenting well-conserved riparian vegetative zones; (2) sites surrounded by certified eucalyptus plantations and presenting well-conserved riparian areas; (3) sites surrounded by eucalyptus plantations (including not-certified areas), albeit with degraded riparian areas. Although presenting some differences in land use, all sites revealed no significant additional pressures at different spatial scales (e.g., pollutant sources, changes in the hydrological regime), which allowed us to reduce the "noise" associated with the multiplicity of human pressures. Overall, the species composition and the functional structure of fish assemblages in reference sites and stream reaches surrounded by certified eucalyptus plantations were similar, while assemblages in degraded sites were quite distinct. The biological quality (measured by the F-IBIP index) was lower and the exotic species were significantly more abundant in the group representing stream reaches with degraded riparian areas. Our results illustrate the importance of high-quality riparian areas to stream ecosystem integrity in landscapes dominated by eucalyptus plantations.

O.9:2

RIVER ECOSYSTEMS AND FISH BIODIVERSITY OF THE MANU BIOSPHERE RESERVE, PERÚ: IMPLICATIONS OF KNOWLEDGE IN THE CONSERVATION AND MANAGEMENT

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This study analyses river ecosystems and fish assemblages in relation to certain environmental features of the Alto Madre de Dios River Basin, located between 300 and 2811 m a.s.l. on the Amazon piedmont of the Southern Peruvian Andes. The study area is located inside the Manu Biosphere Reserve and is part of the Tropical Andes biodiversity hotspot for conservation priorities, due to the exceptional concentrations of endemic species, threatened by an increasing loss of habitat.

For obtaining a complete picture of the freshwater ecosystems inside the basin, fish and aquatic invertebrates were collected and related to environmental factors, habitat characteristics and ecological integrity of the river, estimated using three environmental quality indices (QHEI, QBR and BMWP/Col).

Our results highlight the good conservation status of the studied streams corresponding to a natural and low-impacted region. However, there are some threats to the Alto Madre de Dios River Basin due to human activities, as it is a potential entrance for the exploitation of the natural resources in the Amazon. Nevertheless, the principal menace for this biodiversity hotspot (and similar places) is the lack of knowledge concerning the fauna and flora. Systematic and ecological studies of the freshwater ecosystems of this unique region are certainly needed to address appropriate management and conservation plans and measures in the future.

O.9:3

FISHES OF THE CUSIANA RIVER, MIDDLE BASIN, DEPARTMENT OF CASANARE: CONTRIBUTION TO THE IDENTIFICATION OF SAVANNAS OF HIGH CONSERVATION VALUE IN THE ORINOCO BASIN IN COLOMBIA

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Colombia is considered a megadiverse country in terms of fish not only to present their hydrogeographic áreas, Amazon, Caribbean, Catatumbo, Magdalena-Cauca, Pacific and Orinoco, but by the number of species (1435). The fishes of the Orinoco river in Colombia, has been studied not only in the main channel but also its main tributaries; its richness has been estimated at 658 species, representing 45,6% of national diversity and 66,1% of total diversity of Orinoco basin. This work aims to study the composition and structure of the fishes of the middle basin of the Cusiana river, department of Casanare, to contribute to the design of a protocol of rapid biological characterization to identify the savannas of High Conservation Value (HCV) in the Colombian Orinoco basin, following the environmental sustainability criteria relating to origin of the raw materials of biofuels and bioliquids, according to the guidelines of the Directive 2009/28/EC of the European Parliament and the Council (EU RES-D), (EU-RED). We established, between 12 and 23 November of 2013, 17 sampling stations in lotic and lentic areas of savanna with African palm (*Elaeis guineensis*), in the middle basin of the Cusiana river. 113 species were collected, establishing 55 new records for the Cusiana river, 7,1% are migratory, 56,6% are economically important ornamental and 13,3% are human consumption. This ichthyological characterization allowed HCV defined as: a) alpha diversity greater than 50% of the maximum value found, b) over 50% of the species have ornamental use, c) more than 10% of the species are the fisheries interest, and d) more than 10% of the species are valuable ornamental and fisheries. The characterization suggests that HCV are different lotic and lentic ecosystems in the middle basin of the Cusiana river, as its species have ornamental value and fisheries.

RECOLONIZATION PROCESS AND FISH ASSEMBLAGE DYNAMICS IN THE GUADAMAR RIVER (SW SPAIN) AFTER THE AZNALCÓLLAR MINE TOXIC SPILL

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The fish assemblage recovery process in the Guadamar River (SW Iberian Peninsula) was monitored over 13 years. This river received a major toxic spill (6 hm³) from a tailing pond in 1998 that defaunated 67 km of the main stem. Following early mud removal works, the fish assemblage was annually monitored at four affected sampling sites and one located in the upstream non-affected reach of the Guadamar River as reference. Abundance and fish assemblage structure were analyzed. A principal response curve (PRC) was applied to assess the recovery trends and to identify the dominant species. A non-metric multidimensional scaling (NMDS) ordination and PERMANOVA were applied to evaluate changes in fish assemblage structure between sites and years. Overall, the affected reaches harboured fish within two years of the spill. Colonists arrived mainly from the upstream and downstream non-affected Guadamar River reaches and to a lesser extent, from three lateral tributaries. It is likely that the proximity, connectivity and environmental conditions of non-affected fish sources greatly influenced the recolonization process in each site. The structure of the fish community in the affected sites was initially tending to be similar to that in the unaffected reference stretch, but changed dramatically with time and each site followed its own trajectory. Currently, long-term threats such as mining leachates, urban sewage, agricultural pollution and exotic fish species expansion, have probably exceeded the initial spill effect. This highlights the large effect of anthropogenic factors on freshwater ecosystem resilience, and the need to significantly reduce both pollution and exotic species if the affected reach of the Guadamar River is to recover fully.

EFFECTS OF LAND USE ON SIZE-RELATED VARIABLES OF FRESHWATER FISH IN URUGUAY

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One of the most important components of global change is the transformation and degradation of the natural land cover in most places of our planet. Landscape changes from forest or prairie to urban, agriculture, or pastures may strongly affect ecological integrity of aquatic ecosystems. Among other indicators, size structure is considered a good environmental health indicator because it has the potential to inform on whether external disturbances are affecting populations and communities, and, moreover, it can help identify the complex effects of biotic and abiotic influences. Body size is a key property of organisms and arguably the most important trait affecting the ecological performance of individuals. The aim of this study was to examine the effects of land use on community size structure of fish in Uruguayan's streams. In particular, we analyzed the change of size spectrum and size-related variables along a gradient in land use modification. In total, 9,800 fish were caught by electrofishing in 26 Uruguay's stream reaches, corresponding to 51 species, mainly of characiformes and siluriformes orders. Eleven size-related variables, and other structure metrics such as species richness and fish abundance, were calculated for each sampling site. The results showed that extensive land use (i.e. extensive husbandry of cows and sheep, the most natural condition that is possible to find in Uruguay) was negatively related with phosphorus and nitrogen

concentrations in water. On the other hand, when the percentage of urban and agricultural land use increased, the concentrations of nutrients also increased. Size-related community variables, and other metrics such as species richness and fish abundance, significantly varied along the land use modification gradient. In areas where the extensive land use was dominant there were higher fish densities (also detected by higher values of size spectrum intercepts), species richness, species diversity and number of size classes. On the other hand, when the integrity of stream was degraded due to an increase of urban or agricultural land uses, we found lower fish abundance, species richness, species diversity and number of size classes, but higher values of maximum length (and consequently 95th percentile and total range length), size diversity and more linear spectra. The results of our study, together with previous studies, showed that agricultural and urban land use significantly affect fish size structure, which may have potentially important consequences for ecosystem functioning.

O.9:6

THE VEZ RIVER - PLANNING AND SUSTAINABLE MANAGEMENT OF THE FISH SPECIES (*SALMO TRUTTA*)

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The study took place at the Vez River that belongs to the Lima River basin and Minho and Lima region basin located in the municipality of Arcos de Valdevez. Due to its diversity of habitat and species that shelter the Vez River area were classified as Site of Community Importance (SCI) for the Conservation. The aim of this work were conducting inventory and characterization of the fish population, the ecological characterization of the sampling sites and the implementation of a set of actions that will help improve the protection, management and planning of activities, with particular reference to sport fishing. Fieldwork was conducted in two phases (March / April and June) and it was studied a total of 16 sampling sections of the river from the source to the mouth. We proceeded to sampling of the fish species populations with electric fishing. In this context was carried out to analyze the data regarding the age, growth, physical condition and fitness or coefficient (factor "K") of the captured specimens. The results confirmed that we are facing a river course with a wide variety of habitats, which seems to have low rates of artificialization. The *Salmo trutta*, *Anguilla anguilla* and *Chondrostoma polylepis* fish species represents the most euribiontes at this river. In this sense, it appears that that Vez River has *Salmo trutta* almost from source to its confluence with the Lima River. The *Squalius carolitertii* is dominant in the middle course of the river followed by *Achondrostoma arcasii* and *Barbus bocagei*. In the last two sections (15 and 16) further downstream close to the mouth of the river, it was relevant the capture of some specimens of juvenile *Petromyzon marinus* and *Salmo trutta trutta*. No exotic species were found. For the entire sample of 16 sections *Salmo trutta* presents an isometric growth and shows a slight lack of robustness.

O.10:1

FISHES IN MOROCCAN DESERT RIVERS: THE DRY EXTREME OF MEDITERRANEITY

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The Oxford Dictionary defines a river as “a large natural stream of water flowing in a channel to the sea, a lake, or another river”. But not all rivers make their way to the sea, nor to a lake or to another river. The Draa, Ziz and Ghir basins drain the southern slopes of the High Atlas and run southwards to infiltrate in the Sahara Desert. Like most desert rivers, these are highly dynamic systems in which dry periods, frequently involving the cessation of superficial flow, alternate with violent flash floods. In spite of their territorial importance and high functional and biological diversity, desert rivers have received little attention in the scientific literature, especially in Northern Africa. Here, we present a general view of the ichthyofauna that inhabits the most important Moroccan desert river systems, based on an extensive survey of more than 80 sites, involving some 120 sampling events and a total catch of 23,400 individuals, developed during 2013.

The fish faunas of the Draa, Ziz and Ghir basins are a combination of Eurosiberian, Mediterranean and Afrotropical elements. Relict populations of tropical cichlids are scattered across northern Africa as a legacy of recent wetter periods in the Sahara, the latter of which occurred just a few millennia ago. The Draa river basin is inhabited at least by Redbelly Tilapia (*Coptodon zillii*) and blue tilapia (*Oreochromis aureus*), but it is also possible that the basin holds more native cichlid species and that cichlids occupy other basins in the area. Brown trout (*Salmo trutta*) is found in the upper reaches of the Draa (M’Goun and Dades rivers) and Ziz (Sidi Hamza river) basins. Trout in the Ziz basin belong to the widespread Atlantic mitochondrial lineage and probably occupied the basin due to river captures. Contrastingly, trout in the Draa basin form a unique, highly differentiated lineage that seems to have been isolated for over a million years and should probably be described as an independent taxon. Barbels, including *Luciobarbus lepineyi* and *Luciobarbus pallaryi*, but probably other species, form the dominant component of fish communities, with their abundance peaking at intermediate altitudes (1200-1400 masl). We detected 8 non-native fish species, with Pumpkinseed (*Lepomis gibbosus*) being the most widely distributed. The occurrence and dominance of non-native fish species was closely linked to reservoirs and to the alteration of natural flow regimes in river reaches below them.

O.10:2

POPULATION STRUCTURE AND GENE FLOW IN DESERT ENVIRONMENTS: AN APPLICATION OF MOLECULAR TOOLS TO ISOLATED FISH POPULATIONS IN WEST AFRICA

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Desert habitats are often harsh, but still can support many endemic species. Our work aims to evaluate the effects of environmental changes on rates of diversification and extinction risk in desert species using “Tilapia” fish

(*Sarotherodon*, *Tilapia* and *Oreochromis* genera) as a model. Here we report on a genetic study to identify taxonomic groups of “Tilapia” in West Africa and evaluate the dynamics of populations in the Afollé and Assaba mountains of Mauritania and the Senegal River. We used sequence data from two mtDNA regions, 16S and ND2 and 14 microsatellite markers to study “Tilapia” populations from Mauritania. From one to four divergent mtDNA clades were observed within “Tilapia” fish in West and North Africa. The analysis of microsatellite data indicated that several genetic clusters of “Tilapia” exist in the mountains of Mauritania. The clusters appear to be structured by distance, and environmental barriers may restrict gene flow among them in some cases. This study will enhance our knowledge about population dynamics and genetic diversity in “Tilapia” in West Africa, and can be used to help develop conservation plans for them.

O.10:3

A METACOMMUNITY STRUCTURE FOR STREAM FISHES IN THE UPPER PARANÁ RIVER BASIN

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Metacommunity studies seek to understand the role of biogeographical history and processes of migration and colonization/extinction in structuring biological assemblages in a particular region. The hierarchical stream system provides excellent opportunities for testing the hypothesis that fish assemblages which are more isolated in headwaters were structured by a distinct process than in streams that are in downstream water courses. We evaluated 18 surveys of ichthyofauna captured in stretches of headwater streams of the Paraná River basin (Alto Paranapanema and Sorocaba). We found that the assemblages captured in streams up the river are distinct from those found in downstream. In the surveys of headwater stretches there is an effect of the environment (3%), although not significant, whereas the spatial configuration was significant and explained 21%. On the other hand, in downstream stretches we found that the interaction between spatial configuration and environmental variables was significant and explained about 57% of the variation. These results revealed that in the upstream the fish community composition is determined by the spatial configuration, but with contribution of local environmental characteristics, typical of a "species sorting" process. The fish assemblages that are downstream are driven by dispersion and habitat patches due to significant interaction between environment and spatial configuration suggesting a "patch dynamics" model. These results can assist to answer: (i) which is the most appropriate management to preserve the diversity of fish species at different position in the river basin?; (ii) how the species composition can respond to the implementation of small hydropower (PCH) that form small reservoirs of water in these environments isolating fish communities?

O.10:4

INTERACTIVE EFFECTS OF HABITAT QUALITY AND CONNECTIVITY ON MEDITERRANEAN STREAM FISH AFTER THE SUMMER DROUGHT

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Fish in Mediterranean streams persist through the dry season in pool refugia that act as sources of colonists after flow resumption. It is thus possible that the distribution of fish during the wet season is shaped by the interplay between the quality of local habitats and their connectivity to dry-season pools. We tested this hypothesis, by examining the interactive effects of habitat quality and connectivity on fish assemblages in the Torgal stream (SW Portugal). We mapped dry-season pools in September 2005 and 2006, and sampled fish and habitat variables at 60 sites on seven occasions between February 2006 and July 2007. We used several metrics to describe the connectivity of sampling sites to dry-season pools. We built alternative candidate models relating fish variables to habitat quality, connectivity, and their interaction term, and evaluated its plausibility based on information theoretic and model averaging approaches. The richness and abundance of native, non-native and overall species, the occurrence of individual species, and the occurrence of size classes of the dominant species showed consistent relationships with habitat variables. Fish appeared primarily affected by current velocity, but the effects of substrate coarseness, submerged vegetation and tree canopy were also supported. In general, habitat quality showed a far stronger effect on fish variables than connectivity. Nevertheless, in some cases there was an interaction effect between habitat quality and connectivity, which indicated that the positive responses of fish to habitat quality were stronger in more connected habitats. Taken together, our results suggested that habitat quality may be more important than connectivity in shaping fish distribution in Mediterranean streams. However, the interactions detected suggested that connectivity should not be disregarded, and that their effects must be further evaluated.

O.10:5

EVOLUTION OF FISH ASSEMBLAGES IN THE DOWNSTREAM SECTOR OF THE TUA RIVER BASIN

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The Foz Tua hydropower scheme (FTHS) is being built in the terminal part of the Tua River and will generate a reservoir with 421 ha (at pool level), which is expected to start filling in 2016. To assess the evolution of fish assemblages in the area surrounding the FTHS, between 2011 and 2013 fish populations were surveyed by electrofishing in 17 locations. Fish collected were identified, measured and released. In these same sampling locations, several environmental characteristics (including physico- chemical and hydro-morphological parameters) were assessed.

Results were examined by incorporating the spatial (17 locations) and temporal (three years) variation and analyzes conducted included: canonical correspondence analysis (CCA) and evaluation of biological stability. The ecological quality, *sensu* Water Framework Directive, in each sampling section/year was also assessed through the use of the F-IBIP fish index (Fish-based Index of Biotic Integrity for Wadeable Portuguese Streams).

At the four sites located in smaller tributaries, fish were never found, during the study period. In the 13 sites sampled with fish presence, 11 fish species were detected, including six native and five non native *taxa*. Cyprinids

were the most common group; *Pseudochondrostoma duriense* and *Luciobarbus bocagei* were the most frequent and abundant species, being often associated with *Squalius alburnoides* and *Squalius carolitertii*. Three introduced species were found only at the sampling site located further downstream in the river Tua (*Alburnus alburnus*, *Micropterus salmoides* and *Sander lucioperca*), whereas two native species were only collected in the tributaries (*Cobitis calderoni* and *Salmo trutta fario*).

From the explanatory variables (environmental + temporal) considered for inclusion in the CCA of fish samples, five were retained by the additive selection procedure used (conductivity, total phosphorus, river slope, average annual air temperature, altitude and average annual rainfall), explaining 55 % of the total biological variation. Overall, the analysis depicted a strong spatial gradient in fish assemblage variation, but a small influence of sampling year (temporal variation). Accordingly, the sites studied generally showed fish assemblages with a low variability (Turnover index, T) and with a moderate to high stability (Kendall test). The fish index showed some overall variation, but no significant differences were detected between the biological quality of the main river and its tributaries, as well as between sampling years.

The results are discussed in view of the probable effects that the presence and operation of the FTHS will have on the fish assemblages of the studied area.

O.10:6

HEADWATER CAPTURE AND PHYLOGENETIC STRUCTURE OF STREAM FISH ASSEMBLAGES IN CENTRAL BRAZIL

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The astonishing diversity of Neotropical fishes results from historical and ecological processes intrinsically related to the geomorphological evolution of this region. Headwater captures are important biogeographic processes that promote dispersal or isolation of fish populations between watersheds. We investigate the effects of headwater captures on the phylogenetic structure of stream fish assemblages among watersheds in the Brazilian Shield highlands. From the phylogenetic relationships of 69 native fish species, we quantified the phylogenetic diversity of each basin, as well as species richness and the phylogenetic beta diversity between basins. The Upper Paraná basin showed higher richness and greater phylogenetic diversity than expected by chance, indicating phylogenetically distant species composition. The number of shared species and phylogenetic beta diversity values not differing from expected by chance indicate recent exchange of species between the basins. Our results suggest that the fish assemblage of the Upper Paraná basin is older and many species colonized recently the neighbouring Upper Tocantins and São Francisco basins via headwater captures.

O.10:7

COMPOSITION OF THE FISH COMMUNITY OF SAN PEDRO RIVER, TABASCO, MÉXICO

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In the San Pedro River sub-basin, Balancán, Tabasco, Mexico a study of a fish community was carried out between March 2007 to February 2008. From a total of 1 035 fish were collected, 33 species, 25 genera and 14 families has

been identified. The Cichlidae and Poeciliidae family were the most richness, four species are introduced *Pterygoplichthys pardalis*, *Ctenopharyngodon idella*, *Oreochromis niloticus*, *Parachromis managuensis* and two new records were found *P. pardalis* and *Potamarius usumacintae*. The most abundance species were *Thorichthys affinis* and *T. helleri* and five species were classified as rare *P. usumacintae*, *Phallichthys fairweatheri*, "Cichlasoma" *Nandopsis urophthalmus*, *C. idella* and *Batrachoides goldmani*. The highest values of diversity and abundance showed in sites I ($H' = 2.52$ bits) and II ($D = 0.38$ sp/ind). The higher values of equity were in sites III ($J' = 0.86$) and IV ($J' = .0.99$). The higher number of organisms (592) and abundance ($N_{\max} = 353$) species was showed in the site II = 592 showed the most organism with the most abundant species. Significant differences (Kruskal -Wallis $H = 15.58$, $p < 0.05$) comparing the diversity and sites were found. Canonical correspondence analysis showed that temperature, dissolved oxygen and depth are the most important factors in the distribution of species. Finally, the relative abundance of species in the two seasons was identified by *Thorichthys affinis*, *Thorichthys helleri*, *Astyanax aeneus* and *Petenia splendida*.

O.11:1

PORTUGUESE COMMERCIAL ELASMOBRANCH LANDINGS (1986-2006)

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Portuguese commercial elasmobranch landings were analyzed for the period 1986 - 2006 and totaled 108.671 ton. An average of 5.175 ton were landed yearly, representing 8 orders, 14 families and 44 species. Annual landings for the fishery generally decreased over time, with a corresponding increase in price per kilogram. The most landed group, Skates (*Raja* sp.), accounted for 33% of the landings, or 35.614 ton. They were followed by Catsharks (*Scyliorhinus* sp.), Portuguese dogfish (*Centroscyrnus coelolepis*), Leafscale gulper shark (*Centrophorus squamosus*) and Gulper shark (*Centrophorus granulosus*) (accounting for 12%, 12%, 10%, and 9% of the landings, respectively). In the absence of CPUE data, the comparative trends of landings and price were employed as an indicator of the “status” of specific elasmobranch species. *Centrophorus granulosus*, Smoothounds (*Mustelus* sp.), Torpedo rays (*Torpedo* sp.), Requiem sharks (*Carcharhinus* sp.) and Angel sharks (*Squatina* sp.) displayed indications of possible overexploitation, and merit the focus of future research.

The pattern shown by fishing effort over time (i.e. number of fishing vessels over time) displayed a marked decrease, although this was substantially lesser than the decrease shown by landings of the species mentioned earlier. It is therefore unlikely that such decrease in landings is justified solely by a decrease in number of fishing vessels. Similarly, the increase in price shown by all species was largely superior to the increase in inflation, which would suggest that the increase in inflation alone would not account for the increase in price. All the results and data seem to corroborate the notion that some species are, in fact, under over-exploitation and in need of immediate management. These findings were all substantiated by principal component analysis (MAFA and DFA), which indicated strong decreasing landings patterns in those species where previous methods suggested overfishing.

O.11:2

DEEP-SEA CHONDRICHTHYES OF THE MACARONESIAN ISLANDS (NE ATLANTIC OCEAN)

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In the framework of five major research projects carried out in waters off the Azores, Madeira, Canary and Cape Verde Islands –the Macaronesian archipelagos–, field work was done to prospect the deep-sea biodiversity and to search for new species of potential commercial interest between 250 and 2500 m.

On board of several research and fishing vessels, traps (both bottom and semi-floating) and longlines (both bottom and drifting mid-water) were used as fishing gear at seven depth strata (mean depths at 250, 500, 750, 1000, 1500, 2000 and 2500 m).

Results of this research are given herein including a systematic list of the sharks, rays and rabbit fishes collected by archipelago and depth strata, with new records for each area.

Several voucher specimens from all species found were deposited as reference collections in the Museo de Ciencias Naturales de Tenerife (TFMC) and the Museu de História Natural do Funchal (MMF).

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O.11:3

EATING THE NEIGHBOURS: IMPORTANCE OF SMALL SHARKS IN THE DIET OF THE RARE DEEP-SEA SHARK *DALATIAS LICHA*

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Knowing the feeding habits of marine predators is essential to understanding their ecological role in the ecosystem. Such knowledge can also inform conservation strategies for threatened species. Research conducted on shark species inhabiting the deep sea is very scarce although these species may play a relevant role in the dynamics of the ecosystem. In the present study, we aimed to examine the feeding ecology (dietary composition and trophic level) of the kitefin shark (*Dalatias licha*), a deep-sea shark globally considered as Near Threatened and as Data Deficient in the Mediterranean Sea. In particular, by combining the use of stomach content and stable isotopic approaches, we aimed to examine the main feeding strategies of this marine predator at different temporal scales in the western Mediterranean Sea. The results revealed the clear importance of small sharks in the diet of the kitefin shark at different temporal scales, although fin-fish, crustaceans and cephalopods were also found to make up part of its diet. This feeding behaviour also indicates its position as an important predator within the food web of the western Mediterranean deep Sea. Our results provide direction for further studies on the role that predatory species play in Mediterranean food webs.

O.11:4

FEEDING ECOLOGY AND ECOLOGICAL ROLE OF RARE ELASMOBRANCH SPECIES IN THE WESTERN MEDITERRANEAN SEA

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The conservation of elasmobranchs depends on accurate biological and ecological data to develop population assessments, ecological risk analyses and ecosystem models. Deficiencies on this information for rare elasmobranch species impair the assessment of their ecological role in marine ecosystem and of management activities necessary to conserve and recover their populations. In this study, we generated new data of the trophic habits of several elasmobranchs poorly studied in the Mediterranean Sea, a highly impacted marine ecosystem. In particular, we combined stable isotope ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values) estimates with stomach content analyses to determine the feeding ecology, trophic level and functional role of 11 demersal sharks, 12 skates and 3 electric rays. These species are either cataloged by the IUCN as critically endangered, endangered, vulnerable or near threatened, or are data deficient. Our results revealed differences in the feeding ecology of these species. The rays generally consume small crustaceans, while sharks and electric rays prefer mixed diets composed of cephalopods,

crustaceans and fish. Demersal sharks and electric rays showed higher trophic positions than skates. When comparing with other organisms of the ecosystem, results indicated that sharks and electric rays occupy similar positions than other top predators, whereas skates are more similar to medium predators. Based on the $\delta^{13}\text{C}$ values, a proxy of the habitat used, *Somniosus rostratus* showed the lowest values indicating that it segregates its foraging area from the rest of studied species.

O.12:1

FRESHWATER BLENNY (*SALARIA FLUVIATILIS*) CONSERVATION IN LAKE BANYOLES: ACTIONS TO IMPROVE ITS HABITAT, AND PREDATION IMPACT OF EXOTIC FISH

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Among other ecological effects, proliferation of exotic fish species in Lake Banyoles has led to the extinction or rarefaction of native fish. On the lake basin, Three-spined Stickleback (*Gasterosteus aculeatus*) has been extinct, while in the case of Mediterranean Barbel (*Barbus meridionalis*) and Catalan Chub (*Squalius laietanus*) only meager populations remain in small tributaries of lake. Eel (*Anguilla anguilla*) is still present at low densities in the lake. Instead, Freshwater Blenny (*Salaria fluviatilis*) is the only native species that still maintains a breeding population in the lake, although available data indicate that it was in regression in Banyoles, at least until 2010. This unique population, that is the only lake population known for this species in the Iberian Peninsula, also constitutes one of the few shelters in the inland basins of Catalonia.

In order to ensure the viability of this population of Freshwater Blenny, in 2012 we execute a conservation project funded by the Fundación Biodiversidad. This project focused on expanding the knowledge about its state, and implementing strategic improvements in the lake habitats. Among other actions 57 artificial reefs, composed of 221 modular units of 3 different types, were manufactured and installed in several sectors of the lake without suitable substrates for the establishment of this species. To evaluate its performance and obtain direct data on the effect of exotic predatory fish over the Freshwater Blenny population, an experiment with limnocorrals was designed and executed. The two main factors analyzed were the type of reef (3 treatments, one for each type) and exclusion of predators (2 treatments). The monitoring of this experiment lasted for seven months, performed by visual census and a final campaign electrofishing.

The results show a good and rapid colonization of the three types of reefs, despite a different response on time, and with a strong influence of the lake area where they settled. Moreover, there has been a clear and significant effect of predator exclusion, resulting in an increase of the relative density of Freshwater Blenny, usually between 2 and 5 times greater, depending on size group. Results of these experiments are presented in detail.

O.12:2

FOOD RESOURCE USE AND OVERLAP BETWEEN NON-NATIVE FISHES IN MEDITERRANEAN-TYPE STREAMS

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Trophic interactions between non-native fishes may be neutral, negative or positive, depending on their ecological traits and trophic positions. However, there is little information about food resource use and trophic overlap between non-natives fishes and clarifying this issue is particularly relevant in highly invaded regions to evaluate the ecological impacts of multiple invaders on aquatic ecosystems. Here we assess the diet composition, breadth

and overlap between non-native pumpkinseed sunfish *Lepomis gibbosus* and chameleon cichlid *Australoheros facetus* in the Lower Guadiana basin (Portugal) by examining the stomach contents of 494 individuals. Fish were sampled from April to September 2003 in the Degebe and Vascão rivers where each species occurred separately (allopatry) and in the Ardila and Guadiana rivers where they coexisted (sympatry).

In allopatry, diet breadth was generally higher in *A. facetus* than in *L. gibbosus*. Pumpkinseed sunfish in the Degebe river preyed mainly on Chironomids in spring and on Cladocerans and Copepods in summer. Chameleon cichlid in the Vascão river fed chiefly on Ephemeroptera and Hydracarina in spring and on Chironomids in summer. In sympatry, patterns of food resource were different between the Guadiana and Ardila rivers. In the Guadiana river, pumpkinseed sunfish diet shifted from Chironomids to Copepods and chameleon cichlids from Corixidae to Chironomids and Ostracoda between spring and summer. Diet overlap between the two species was always low and diet breadth decreased over time for both species. In the Ardila river, both species preyed largely on Chironomidae larvae and thus diet overlap was high through time.

These results indicate that patterns of food resource use and diet overlap by non-native fishes was highly variable and context-dependent. Trophic interactions between pumpkinseed sunfish and chameleon cichlid could potentially be negative (i.e. high diet overlap) or positive (i.e. food resource partitioning), contingent on prey availability. Further work is thus required to clarify factors that shape food resource use and whether heterogeneity in trophic interactions between non-native species may enhance its invasiveness.

O.12:3

WHAT IMPACT OF INVASIVE ROUND GOBY *NEOGOBIOUS MELANOSTOMUS* AND BIGHEAD GOBY *NEOGOBIOUS KESSLERI* ON NATIVE FISHES AND MACROINVERTEBRATES CAN BE EXPECTED FROM THEIR FEEDING ECOLOGY IN THE MIDDLE DANUBE (AND ELSEWHERE)

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Round goby (*Neogobius melanostomus*) and bighead goby (*Neogobius kessleri*) have been expanding from the Ponto-Caspian region into new non-native areas over the last decades successfully. They have spread into many European rivers and round goby have got as far as to the Great Lakes of North America. In this study, gut fullness, electivity, ontogenetic and sexual aspects in the diet of round goby and bighead goby were analysed, and the possible impact of these invasive predators on native fish species and macroinvertebrates from the middle Danube was evaluated. Both gobies were found to be most active in feeding during summer. Changes in diet during ontogeny of the two species were observed, but no significant differences between sexes were found. Although no study has proven diet competition posed by round goby and/or bighead goby to have serious impact on native fish fauna in the Danube, our analysis indicates that such impact is very likely. Future studies devoted to the diet of round and bighead goby combined with diet of the potentially affected native species should be focused on ontogenetic issues, whereas intersexual differences can be rather ignored. Such studies should involve analysis of feeding behaviour of small benthic native fish species, such as tubenose goby, sculpin, whitefinned gudgeon, gudgeon, stone loach, ruffe, Balon's ruffe, yellow pope and/or streber.

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INTERACTIONS BETWEEN THE INVASIVE SIGNAL CRAYFISH *PACIFASTACUS LENIUSCULUS* AND THE NATIVE FISH POPULATIONS IN THE NORTH OF THE IBERIAN PENINSULA

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Invasive alien species are the second leading cause of biodiversity loss in the world, a situation that is magnified in particularly vulnerable habitats and ecosystems as inland waters. The negative impacts triggered by these species on the aquatic ecosystem are varied, and the effects on the native fauna usually have serious consequences. However, the scientific research focused on research conducted on these interactions between invasive and native species is very limited. Aquatic ecosystems are particularly vulnerable to the introduction of invasive alien species. Fifty percent of the invasive species present in the Iberian Peninsula are fishes and crayfishes. One of the most widespread alien crayfish species in Europe is the “signal crayfish”, *Pacifastacus leniusculus*. It is endemic to the northwestern U.S.A. and southwestern Canada and was introduced to Spain in 1974. This invasive species inhabits a wide range of habitats, from small streams to large rivers and lakes. Many studies verify the aggressive and invasive behavior of the “red swamp crayfish” *Procambarus clarkii*. However, there are few studies that analyze the impacts and interactions between the invasive signal crayfish and the native fauna in the Iberian Peninsula. Besides carrying the crayfish plague pathogen, signal crayfish produce other negative impacts on macrophytes, benthic invertebrates, amphibians and reptiles. However, the interaction between signal crayfish and the freshwater community’s fishes are not well defined. While some authors suggest that signal crayfish negatively affects fish stocks others claim that there is no interaction. In order to analyze the interactions between the signal crayfish and the native fish populations a total of 43 river stretches located in the north of Spain (Navarra) were sampled. The fish and signal crayfish abundance populations were estimated by electrofishing and night handling respectively. Habitat characterization (type of substrate, water velocity, depth and shadowing) and physicochemical parameters (conductivity, water temperature, dissolved oxygen, pH) were also taken. Preliminary statistical analyses of the interaction between *Pacifastacus leniusculus* and native populations in the north of the Iberian Peninsula will be presented.

O.13:1

BIODIVERSITY OF DOGFISHES (GENUS *SQUALUS*) IN THE EASTERN ATLANTIC AND MEDITERRANEAN SEA – A MOLECULAR PERSPECTIVE

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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 *sensu lato*, 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 concerning the status of *S. megalops* and *S. blainville*. This situation has contributed to the present confusion in terms of the actual species composition 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. Furthermore, we found evidence of the presence of the *S. cubensis* lineage (currently described only for the western Atlantic) in the equatorial eastern Atlantic.

O.13:2

POPULATION STRUCTURE OF THE HAMMERHEAD SHARK, *SPHYRNA ZYGAENA*, IN THE ATLANTIC AND INDIAN OCEANS, ANALYZED BY MITOCHONDRIAL DNA

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The current overfishing which sharks have been submitted has caused drastic population declines in several species, placing them in the various lists of imminent risk of extinction. Between shark species impacted by fishing, *S. zygaena* species, occurring in all subtropical and temperate oceans, is classified as vulnerable, according to the International Union for Conservation of Nature and Natural Resources (IUCN) and was recently included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The specie is listed among the sharks with higher commercial value, mainly due to the prices achieved for its fins in the Asian market. In this paper we present results on the population genetic structure of the hammerhead, *S. zygaena*, using as molecular marker sequences of the mitochondrial DNA control region of representative sample groups of the Atlantic Ocean and Indian Ocean. The sequencing of the mitochondrial DNA control region of 176 individuals of the species *S. zygaena* led to the analysis of 710 nucleotides. For the development of the analysis of population inferences, subjects were grouped by ocean currents: the Brazil Current, Benguela Current, the Canary Current, Current Ecuador, the Agulhas Current. In total, nine haplotypes were found by the combination of eight polymorphic sites. Considering all groups, we estimated the overall value of 0.00173 for nucleotide diversity and 0.499 for haplotype diversity. In the estimation of genetic differentiation by the method of analysis of molecular variance (AMOVA) it is observed that there is strong population structure (F_{ST} : 0.68843) and low gene flow between groups of *S. zygaena* the Atlantic Ocean and Indian Ocean. These results point to the existence of very low genetic diversity for the species, an extensive evaluation for the global characterization of these stocks and the development of fishery management programs is required.

O.13:3

DOES POPULATION STRUCTURE MATCH VARIATION IN LIFE HISTORY TRAITS IN A MODEL SHARK SPECIES, *SCYLIORHINUS CANICULA* (LINNAEUS 1758)?

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The small-spotted catshark, *Scyliorhinus canicula* (Linnaeus, 1758) is one of the most common elasmobranchs in the eastern North Atlantic and the Mediterranean Sea. This small (<100 cm of total length), bottom dwelling oviparous shark ranges from off the British Isles southwards to Senegal, and is also found across the whole Mediterranean basin. In the Atlantic it is often caught as by-catch in demersal fisheries, but its commercial importance is growing through its use as whelk bait. In the Mediterranean it is targeted for consumption, where huge declines from historic levels of abundance have recently been reported. The species also constitutes an important model for understanding chondrichthyan development, physiology, neurology, behaviour and molecular biology. Previous studies have shown that *S. canicula* from different geographical locations along its range have striking differences in reproductive and life history traits, such that the Mediterranean stock has sometimes been referred to as a distinct sub-species (due to its small max. body size and smaller size at sexual maturity). Diverse environmental conditions at different locations have been suggested as a plausible explanation for this phenotypic

variability. However, this represents a classic paradigm in biology, where environment and genetic composition can contribute to the observed phenotypic variability in reproductive and life history strategies. We explored the potential for a genetic basis on the apparent variability of reproductive traits described for *S. canicula* by comparing the pattern of genetic differentiation at a suite of neutral molecular markers with reported variation in several reproductive parameters from nine locations along the species' range. The molecular markers detected strong genetic differences between the Mediterranean Sea populations (as off Mallorca, Adriatic Sea and Crete) and those from the Atlantic (North Sea, Bristol Channel, Ireland, English Channel, Cantabrian Sea and off Portugal), in agreement with the major phenotypic differences seen between the two areas in terms of reproductive traits.

O.14:1

POPULATION TRAITS OF INVASIVE BLEAK ALBURNUS ALBURNUS BETWEEN CONTRASTING HABITATS IN IBERIAN FRESHWATERS

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The bleak *Alburnus alburnus* (L.) is a cyprinid native to most of Europe, mainly inhabiting lentic environments. This fish species is a successful invader in the Iberian Peninsula, where it was first introduced to Spanish reservoirs as forage fish during the 1990s. Bleaks threaten the highly endemic Iberian fish fauna, chiefly via competition and hybridization. Data on bleak distribution is the only relevant information available for this fish in the Iberian Peninsula. To our knowledge, no data on population traits of bleaks have been provided for this region. Such information would be particularly novel and valuable from habitats different from those reservoir-like environments. Thus, the aim of this work was to compare seasonal and gender variation of size structure, body condition and reproductive investment of bleak populations between contrasting habitats in Iberian freshwaters, i.e. river versus reservoir. Sexually mature bleaks were seasonally collected and examined from the River Gévorá and the Sierra Brava Reservoir (Guadiana River Basin, southwestern Spain) to better assess the adaptive capacity at the population level and the subsequent invasiveness. Bleak was an important species among the fish assemblages from both habitat types (i.e. river and reservoir), with only mosquito fish *Gambusia holbrooki* Girard and pumpkinseed *Lepomis gibbosus* (L.) being more abundant. Chi-squared tests showed that the proportion of smaller mature bleaks was lower in the river than the reservoir during spring and the opposite pattern was observed during winter. Log-linear analysis showed that sex-ratio was strongly biased to the males in both habitats during spring and in the river during winter, whereas females were more abundant than males in the river during autumn. Two-way analysis of variance (ANOVA) showed that both males and females were larger in the river during the breeding season (i.e. spring). Two-way analysis of covariance (ANCOVA, covariate: Standard Length) showed that body condition (eviscerated mass) and reproductive investment (gonad mass) were also higher in the river than the reservoir for both genders. Overall results suggest that bleaks enhance their reproduction rate in the river to compensate for high mortality in this habitat, where environmental conditions may be harsher due to the winter floods and summer droughts typical of Mediterranean water courses. These findings highlight the high degree of plasticity in population traits of the bleak in the Iberian Peninsula, which will surely aid its ability to adapt to a wide variety of Mediterranean ecosystems, including lentic and lotic environments.

O.14:2

RELATIVE ABUNDANCE AND GROWTH PROPERTIES OF FISHES LIVING IN BÜYÜKÇEKMECE RESERVOIR (İSTANBUL, TURKEY) IN EXISTENCE OF EXOTIC *CARASSIUS GIBELIO* (BLOCH, 1782)

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Büyükdere Reservoir, providing drinking and domestic water for İstanbul city, is a lagoon lake located in the mouth of Karasu Stream emptying into the Sea of Marmara. After the dam building, the fish fauna of the lake has

changed rapidly and freshwater species replaced the marine species due to decrease in salinity over time. Previous studies in the lake was about fish fauna, however there is not any comprehensive study about the abundance and biology of the species. The aim of the present study is to determine of relative abundance and growth properties of the species living in the lake in existence of exotic *Carassius gibelio* (Bloch, 1782) detected in 1999 for the first time. The field work was carried out from March 2009 to February 2010, monthly. For fish sampling gillnets having different mesh sizes was used, and catch for unit effort (CPUE) values of the species was determined for gillnet types by monthly and annually. The length-weight relationships and conditions of the captured species were estimated. According to results, *Rutilus rutilus* (Linnaeus, 1758), *Rhodeus amarus* (Bloch, 1782) and *Perca fluviatilis* Linnaeus, 1758 were determined as dominant fish species of the lake with 35.7%, 28.3% and 13.2% rates, respectively. Although in presence of *C. gibelio* was about 20 years in the lake, it has increased its population density and became 4th dominant fish species with 7.6% rate. The species has showed positive allometrical growth ($W=0.0124L^{3.1101\pm0.0193}$) and condition of the species was estimated as 1.72 ± 0.15 , annually. With this study, present status of the fishes living in the Büyükçekmece Reservoir was determined, and the results may be used for understanding the potential impacts of the exotic *C. gibelio* for the future of the lake fishes.

O.14:3

PHYSIOLOGICAL POTENTIAL FOR THE INVASIVE FRESHWATER CICHLID *AUSTRALOHEROS FACETUS* TO INHABIT BRACKISH WATERS OF THE GUADIANA RIVER BASIN (SOUTHERN IBERIAN PENINSULA)

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One of the challenges of understanding the ecological consequences of non-native species is the difficulty in identifying the mechanisms that allow these species to establish in the new habitat. The cichlid fish *Australoheros facetus* (chanchito) is originally from South America, but is found in the streams of the Guadiana basin, Portugal. Previous studies on community ecology of fishes, mainly in Guadiana streams, have shown contradictory results regarding the relationship between salinity and the presence of chanchito. This study thus aimed to assess the chanchito's physiological potential of intrusion in brackish waters, through measurements of Na^+K^+ /ATPase in kidney and gills, plasma osmolality and circulating levels of cortisol in three salinities (0, 5 and 15psu). The fish were initially collected on the Vascão River, Guadiana Basin, through electric fishing and maintained at CCMAR facilities in natural conditions for several months prior to the experiment. The experimental period lasted for 29 days (constant temperature at 18°C, 12L/12D), where 3 fish groups (N>6) were kept at 0psu (control) or gradually acclimatized to 5 or 15psu. At the end of the experiment fish were euthanized with an overdose of MS-222 and blood, gill and kidney samples were collected. No change was found in the activity of Na^+K^+ /ATPase in kidney but the activity of Na^+K^+ /ATPase in gills, plasma osmolality and cortisol levels were significantly elevated in the highest salinity group. Gill Na^+K^+ /ATPase activity and osmolality were positively correlated, but there was no significant correlation for osmolality and renal Na^+K^+ /ATPase. The correlation between osmolality and cortisol levels was also positive. These results suggest that chanchito can occur in brackish waters, at least for a short period of time, at the expense of increased energy expenditure for osmoregulation. The high values of cortisol observed at 15psu can be responsible for the process of acclimatization to saltwater, but can also indicate high levels of stress. Further studies including temperature and dissolved oxygen levels on long-term adaptation, growth and reproduction are needed to assess whether the chanchito could settle in new locations, such as estuaries in Algarve, bringing new ecological implications on the native estuarine fauna.

VARIATIONS IN REPRODUCTIVE PARAMETERS OF AN INVASIVE POPULATION OF TOPMOUTH GUDGEON (*PSEUDORASBORA PARVA*) OVER TIME

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Invasion process generally consists of several stages, such as introduction, establishment and assimilation. At the beginning of the invasion process, features like early maturation at smaller size, higher fecundity and smaller oocytes are advantageous. However, in the subsequent stages of invasion, when density has increased and the population has established definitely, it is better to allocate more energy to somatic growth than reproduction. According to the theory of alternative ontogenies and invasive potential of freshwater fishes, these changes in life-history traits are associated with the species' capability to alternate their ontogenetic trajectories in subsequent generations, within a continuum from generalized to specialized. This way, populations can respond to actual environmental conditions and to the progress of their establishment that corresponds to the stage of invasion process. The wider is this continuum, the higher is the invasive potential of the species. This implies that high phenotypic plasticity appears to be a significant and important attribute of successful invaders. In this paper, topmouth gudgeon (*Pseudorasbora parva*) from Lake Licheńskie (Poland) was studied. Sampling took place during 2004-2011, which includes both earlier and later stages of this invasion. For the population studied, the hypothesis derived from the theory of alternative ontogenies and invasive potential of freshwater fishes predicts that females early after introduction will have statistically higher fecundity and smaller oocytes than females several years after introduction, where the trend should be opposite. The sample studied consisted of 459 females and 397 males. The standard length of females reached from 18.9 to 77.1 mm (mean 39.7 mm), body weight from 0.20 to 9.97 g (mean 1.60 g), and eviscerated weight from 0.17 to 7.57 g (mean 1.30 g). The gonadosomatic index achieved 0.06 % – 53.1 % (mean 4.71 %). Both absolute number of oocytes (ANO) and real absolute fecundity (RAF) varied significantly between the subsequent years. The most important changes in the spawning period occurred between 2006 and 2008, as well as between 2006 and 2009 (i.e. between 3 versus 5 and 6 years after the introduction), when ANO decreased. Similarly values of RAP were significantly different between 2006 and 2009 and 2006 and 2010. Thus, the results met the predictions derived from the hypothesis of alternative ontogenies and invasive potential, and the same pattern has been observed in other species, too. This study was funded by the Agency for Science and Research (APVV, Project LPP-0154-09) and Slovak Scientific Grant Agency, Project No.1/0641/11.

O.15:1

DISCRIMINATION OF *TRACHURUS PICTURATUS* STOCKS IN THE CENTRAL AND NORTH-EAST ATLANTIC USING OTOLITH ELEMENTAL AND ISOTOPIC ANALYSES

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The blue jack mackerel, *Trachurus picturatus*, is one of the most important commercial fish species of the Atlantic being captured regularly by Portuguese fisheries fleets. In spite of a decrease in fish catches in the last years, few data are available either on the population structure or on the management of the species. In this study, isotopic ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$) and calcium: elemental ratios (Sr, Ba, Mn, Mg, Fe, Pb, Cu, Li and Ni) were performed respectively with inductively coupled plasma mass spectrometry and isotopic ratio mass spectrometry in whole otoliths of 120 individuals collected in six regions around central and north-east Atlantic (Madeira, Azores, Canaries and Portugal mainland – Matosinhos, Peniche and Portimão) from May to July 2013. Univariate (ANOVA and Tukey-tests) and multivariate statistical analyses (MANOVA and DFA) provided location-specific otolith fingerprints. These new findings are further discussed according with the current ecological knowledge about this species for fisheries management purposes.

O.15:2

HABITAT RESIDENCY AND MOVEMENT PATTERNS OF *CENTROPOMUS PARALLELUS* IN A BRAZILIAN SUBTROPICAL ESTUARINE COMPLEX DETERMINED BY OTOLITH MICROCHEMISTRY (SR:CA RATIOS) AND MICROSTRUCTURE (DAILY INCREMENTS) ANALYSIS

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Fat snook, *Centropomus parallelus*, is an important amphidromous species for recreational and commercial fisheries and has aquaculture potential. It is found in coastal waters, estuaries and lagoons of the tropical and subtropical western Atlantic. Populations of fat snook are increasingly threatened by aquatic pollution, habitat loss and overfishing. Sixty *C. parallelus* juveniles were collected in March 2013 in two locations (Tromomó and Guaraguaçu) inside the Paranaguá Estuarine Complex, southern Brazil. The habitat residency and movement patterns of the individuals were study based in the Sr:Ca ratios measured through the sagittal axis from the core until the edge, using a wavelength dispersive X-ray electron microprobe, jointly with the daily age, retrospectively estimated using scanning electron microscopy images from otoliths. The data shows that *C. parallelus* could occupy diverse salinity habitats and migrate among marine, brackish and freshwater areas within the Paranaguá Estuarine Complex showing a high environmental plasticity and adaptation. This new ecological information is essential for a rational fisheries management of the species.

O.15:3

USING GENETIC MARKERS TO STUDY MARINE FISH CONNECTIVITY IN THE IBERIAN ATLANTIC COAST

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Assessing connectivity in marine populations is essential to establish their spatio-temporal dynamics, population structures, contribution to stocks, as well as to identify important ecological areas and habitats, particularly for management and conservation. However, quantification of fish movement is difficult and remains one of the major challenges in marine environments. Genetic markers have been one of the most used natural tags to assess marine fish connectivity. Nevertheless, the limitations and assumptions of those methods need to be appreciated and carefully interpreted. We will discuss these using our results on measuring connectivity among estuarine and coastal fish populations on the Iberian Atlantic coast. We have studied two species with different life histories: a marine migrant, *Platichthys flesus* (flounder) and a marine species, *Trachurus trachurus* (mackerel) screening microsatellites loci on samples from different areas of the Atlantic Iberian coast. We will also discuss the importance of integrative approaches with other natural tags for an accurate quantification and translation of marine populations' connectivity and contribution of source sites essential to delineate management and conservation strategies.

O.15:4

GAIDROPSARUS (GADIDAE, TELEOSTEI) OF THE NORTH ATLANTIC: A BRIEF PHYLOGENETIC REVIEW

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We review the phylogenetic relationships among the north Atlantic *Gaidropsarus* and between the three Gaidropsarinae genera *Gaidropsarus*, *Ciliata* and *Enchelyopus*, with the hitherto most comprehensive taxonomic sampling of this group. Phylogenetic results (Maximum Parsimony, Maximum Likelihood and Bayesian Inference) based on nuclear (rhodopsin) and concatenated mitochondrial (12S, 16S, *cytb*) markers clearly support this subfamily. For the northeastern Atlantic species of *Gaidropsarus*, two previously unreported clades were strongly supported, clarifying the relationships within the genus, and revealing fewer distinct taxa in the north Atlantic *Gaidropsarus* than previously stipulated. The data challenge the specific status of *G. mediterraneus* and *G. guttatus* and raise doubts concerning the distinctiveness of other species. A taxonomic revision of the genus is suggested.

O.16:1

UPDATE OF THE NATIONAL INVENTORY OF ICHTHYOLOGICAL BIODIVERSITY AND DEVELOPMENT AND IMPLEMENTATION OF THE SPANISH FISH DATABASE: A COLLABORATIVE PROJECT LED BY SIBIC

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Among vertebrates, freshwater fishes are one of the most imperilled groups. This is true especially for the Iberian Peninsula, where this group includes a high number of endemic and threatened species. Despite the large number of research and technical studies done on freshwater fishes, the data is disperse and not available for public use, for management or research. The main objective of the project is to compile the information of freshwater fishes found in research centres, public administrations, and available on the internet (technical reports, scientific publications, among others). Other goals include to create a database for the use of general public, a database for the use of managers and to create a web platform to facilitate the access to the information. The databases will integrate information about abundance, habitats, historical evolution, population trends, major threats, conservation actions, human impact (pollution, water extraction among others) and fishing intensity. The importance of the project includes the need to have accurate information on species distribution to help managers develop monitoring plans and conservation strategies. Moreover, the historical information on species distribution will help in the analysis of freshwater fish populations and the conservation status of the group. The project will also provide data for the Spanish National Inventory of natural heritage and biodiversity. This project is funded by Fundación Biodiversidad and Iberian Society of Ichthyology.

O.16:2

LIFE SEGURA-RIVERLINK: AN IMPLEMENTATION OF A GREEN INFRASTRUCTURE APPROACH TO RECOVER THE LONGITUDINAL CONNECTIVITY IN A HIGHLY FRAGMENTED RIVER BASIN.

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Habitat connectivity is a central factor in shaping aquatic and riverine biological communities, however, few tools exist to maintain and recover this attribute at large scale in fluvial systems. The SEGURA RIVERLINK is a LIFE

Programme project which aims to promote and support the environmental recovery of an important sector of the Segura River Basin (more than 50 Km long in its main river). The main purpose is to demonstrate and validate management measures for the development of a *Green Infrastructure* approach into the context of Mediterranean river basins characterized by a high impact in their connectivity. The project will recover the longitudinal connectivity removing a significant number of artificial barriers to restore fish passage and will also support other best practices of riverine restoration focused on the riparian forests. Restoration actions will include the removal of small weirs and the construction of effective fish passage systems. Monitoring activities will assess the performance of these actions with the hope of validating the *Green Infrastructure* approach to river basin management and its possible extension to the official River Basin Management Plan of the Segura River Basin. The project will also develop a Land Custody Network to integrate private owners in the river management and in agreeing good practices, looking for increasing the links between the river and adjacent lands.

Outcomes: This project will protect local aquatic and riverine habitats, allow fish migration along an important sector of the Segura River, improve ecosystem services, build a cadre of scientific and social knowledge to improve river management quality and help local and regional governments to comply with EU Water Framework Directive and to facilitate the implementation and enforcement of EU policy and legislation on biodiversity conservation.

O.16:3

REHABILITATION OF RIVER MONDEGO FOR THE DIADROMOUS FISH: AN INTEGRATED MANAGEMENT APPROACH

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The conservation of diadromous fish populations depends upon the implementation of management actions that are spatially representative of these species ecological needs. Freshwater, estuarine and coastal habitats are administratively linked to different governmental agencies, often belonging to different ministries, which makes the application of an integrated management plan particularly difficult, especially when it involves changes in fisheries regulations, rehabilitation of habitats and poaching eradication.

The main goal of this project, presently ongoing in the Mondego river basin, is the implementation of an integrated management approach that will insure the compatibility between the conservation of the diadromous fish, and all the other water uses in this watershed namely, hydroelectricity production, water abstraction, professional fisheries and different recreational purposes. This project was boosted by the recent construction (i.e. 2011) of a fish passage at the Açude-Ponte dam at Coimbra, which enabled the migratory fish to surmount this impassable dam built in 1981. The main action of this project involves building naturalized fish passages in other five weirs, four of which are located upstream from Açude-Ponte dam, and at the same time contribute to a sustainable fishery of sea lamprey, allis shad and twaite shad. Several studies are also being performed regarding the management of the European eel population in this river basin. Also, this project intends to increase the public awareness concerning the conservation of diadromous fish, as well as the reduction of poaching and illegal fishing in River Mondego. The project is coordinated by the University of Évora, and includes as partners the Portuguese Environment Agency (APA), Portuguese Fisheries Agency (DGRM), the Institute for Nature Conservation and Forestry (ICNF), National Fisheries Institute (IPMA), three Municipalities (Coimbra, Vila Nova de Poiares and

Penacova), the Centre of Oceanography, the Mora Freshwater Aquarium, Electrical Power Company (EDP) and the Lamprey fraternity (Confraria da Lampreia).

O.16:4

BRINGING CITIZENS CLOSER TO ICHTHYOLOGISTS! THE BIODIVERSITY4ALL PROJECT

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Recreational fishermen and divers can give valuable information about the presence of fish species during their leisure activities. However, this information is lost in anecdotal records or entertaining fishing stories. These casuistic data can be collected in an organized manner and provide useful data to the scientific community, being valuable for scientific studies and management. The BioDiversity4All (www.biodiversity4all.org) is a Portuguese project of citizen science. It is structured in an online database where everyone can share their records of biodiversity. This way it functions as a platform of cooperation between the scientific community and citizen groups that either use or share their observations of animals and plants. Ultimately, the project's mission is to encourage people to make observations of Portuguese biodiversity and register these in this open database. Increasing people's knowledge, awareness and stimulating debate on biodiversity and conservation are valuable societal benefits of citizen science projects. This online database brings citizens and scientists closer, and is an easy tool for scientists to implement their research projects, and thereby increasing the public interest and empathy for their research.

O.17:1

TROPHIC DYNAMICS OF THE PELAGIC ECOSYSTEM IN THE NORTH-WESTERN MEDITERRANEAN SEA USING STABLE ISOTOPE ANALYSIS

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Marine ecosystems in the Mediterranean Sea are fundamentally driven by their pelagic food web compartments, and some pelagic species such as anchovy and sardine species are also primary targets of commercial fisheries. Previous ecological and food web modelling studies developed in the region highlighted the crucial ecological role of small and medium-sized pelagic fish in the marine ecosystem of the NW Mediterranean Sea. The present study aims at complementing this knowledge and specifically quantifying in detail their ecological role and position within the pelagic environment. In this context, we investigated the seasonal and size-related changes in the trophic structure of the pelagic ecosystem of the Western Mediterranean Sea. Trophic ecology was analyzed using stable isotopes in thirteen species of fish and cephalopods. Community-level analysis revealed a consistency in the trophic structure throughout the year. Isotope values were also consistent with the assumption that small pelagic fishes are a potential prey for medium-size pelagic and demersal predators. Isotopic data also highlighted niche partitioning between medium pelagic fish and squid, suggesting that they may feed on a differentially pelagic prey fish guild. These results provide new insights in the trophic dynamics of the pelagic food web of Mediterranean marine ecosystems. Such information is essential to move towards an ecosystem-based management of fisheries in the NW Mediterranean region.

O.17:2

THE CAPE VERDEAN COASTAL ICHTHYOFAUNA: A SUMMARY AND REMARKS ON ENDEMISM

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The zoogeographic composition of littoral ichthyofauna in the Cape Verde archipelago (tropical West Africa) show a predominance of Guinean species, followed by tropical-subtropical (amphi-Atlantic) fishes and several endemic coastal species. Recent taxonomic revisions, new species descriptions, incipient fish records in the area and new ecological studies aiming intra-specific fish interaction as well as emergent research on seamounts in national waters warrant an up-to-date review of the Cape Verdean ichthyofauna. An upgraded percentage of endemic coastal reef fish (10.2%) attest significant speciation in Cape Verde waters. This result arises from discarding the pelagic and deep species from the reef fish endemism calculation emphasizing the need of a dissimilar approach. Almost half of the total cryptobenthic fish species richness in Cape Verde comprises endemic species, some of them newly discovered. Notable Cape Verdean reef fish endemics are discussed, focusing: white seabream *Diplodus sargus lineatus* (as an ancestral species of the *D. sargus* clade), Bulldog dentex *Dentex (Virididentex) acromegalus* (as monotypic sub-genus spread as genus rank), Kyphosid macroalgae browser *Girella stuebeli* (as a paleo-endemic species of the Atlantic Ocean), Lubbock's chromis *Chromis lubbocki* (as a endemic species, on probable dispersal event), Cape damsel *Similiparma hermani* (as a paleo-monotypic genus) and the

Guinean parrotfish *Scarus hoefleri* (as a recent Guinean – West Africa endemic species). Cape Verde diverges considerably from the other Macaronesian groups of islands in terms of its ichthyofauna and, thus, a novel marine Atlantic Province can arise in the future, based on new elements about endemism and zoogeography.

O.17:3

THE LUSITANIAN TOADFISH AS BIOMONITOR OF ESTUARINE SEDIMENT METAL BURDEN: THE INFLUENCE OF GENDER AND REPRODUCTIVE METABOLISM

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This study analyzed the accumulation of trace metals in the Lusitanian toadfish (*Halobatrachus didactylus*). To assess the species' potential as an indicator of metal contamination, muscle contents Cd, Co, Cr, Cu, Ni, Pb and Zn were compared in adult type I males (age ≥5) from two areas with distinct sediment metal loads. Non-essential metals in the muscle reflected the same differences between areas that were found in the sediment samples, evidencing *H. didactylus* as a potential indicator of those elements availability from the sediment. Concentration of the seven elements was determined in the liver of male and female specimens captured during reproductive and non-reproductive periods. The results showed that metal accumulation in the liver was related simultaneously with gender and season, with females having higher levels of Cu and Zn during the reproductive period. The metabolic roles of these elements in embryonic development explain such results, as both metals will accumulate in the female liver to be transported to the gonads afterwards. The results showed that the muscle of adult specimens of *H. didactylus* is a useful indicator of long term accumulation of heavy metals. However, spawning season should be avoided, as metabolically derived concentrations in the liver are likely to lead to an overestimate of the environmental status.

O.17:4

INCREASE OF PARASITISM IN THE GENUS *LOPHIUS* FROM THE NW MEDITERRANEAN SEA AND THE EFFECTS IN ITS MORPHOLOGY: SEARCHING FOR ANSWERS.

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Climate change could have a great impact on the spread of parasites in marine ecosystems because the increase of the temperature may cause thermal stress in aquatic animals, leading to reduced immunocompetence and increasing the susceptibility of the host to the parasite. In this study we describe two specimens of black anglerfish *Lophius budegassa* caught in the northwestern Mediterranean Sea with atypical morphological characteristics: pigment anomalies and blindness; which held a great quantity of the parasite *Spraguea lophii*. This parasite is a microsporidian (intracellular parasite related to fungi) that infects the nervous system of genus *Lophius*. It is manifested as cyst structures (xenomas) usually located along the length of the vertebral column, and on the medulla oblongata of the hind brain. Some authors consider that severe contagions might cause the anomalies mentioned above, even death. In order to evaluate the number of specimens infected in the last years, a total of

292 *L. budegassa* were examined from commercial catches along the northwestern Mediterranean Sea during 2013, and the results were compared with previous studies. The prevalence (a quantitative descriptor of parasite population) of *S. lophii* was calculated for black anglerfish with a result of 69.18%. An increase of the 58.12% in the prevalence of *S. lophii* in *L. budegassa* was observed since 1996. The consequences of this invasive process in the populations and in the fishing activity are up to date unknown.

O.17:5

AQUAGAMETE COST ACTION. RESUME OF THE FIRST GRANT PERIOD (MARCH 2013 – MAY 2014)

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AQUAGAMETE (<http://aquagamete.webs.upv.es/>) is the acronym of a 4-year COST Action in the domain of Food and Agriculture, entitled “Assessing and improving the quality of aquatic animal gametes to enhance aquatic resources - The need to harmonize and standardize evolving methodologies, and improve transfer from academia to industry” (FA1205).

The origin of this Action was the series of the biennial *International Workshops on the Biology of Fish Gametes* that were organized during the past 7 years. In these meetings, a rapid development of methodologies that encompass extensive opportunities for promising use in basic reproductive biology, genetic research, biotechnology and aquaculture practice was demonstrated. All of these can have far-reaching consequences on conservation of endangered species, assessment of anthropogenic and climatic impacts on aquatic species and application in aquaculture, as well as in fisheries management. In particular, it has been recognized that there are many highly diverting details in the practical application of these new methods among scientists and laboratories, which can cause highly variable if not contradicting results, even using the same species. There is an urgent need towards a universal scale to assess both the precise state of sexual maturation and related life history traits in teleost fish and other commercially important invertebrates used in either bioassays or aquaculture. The aim of the proposed AQUAGAMETE is to reach a consensus on protocols and guidelines that permit the use of results in relational databanks for sound and common application in aquaculture research and commerce.

Having started by March 2013 with 18 participant countries, one year after this number has increased to 26. During the first grant period, a budget of 181.000 € was distributed among the different activities of the Action, as a Training School entitled “Techniques for fish germline cryobanking” (Cádiz, Spain, May 2013), our first Management Committee meeting (Albufeira, Portugal, September 2013), or the *4th International Workshop on the Biology of Fish Gametes* (Albufeira, September 2013), which had the highest number of participants recorded in this series of workshops (118 persons from 24 countries, who presented 107 communications). AQUAGAMETE supported the organization of this workshop and covered the travelling and subsistence expenses of the members of the Management Committee (41 persons), 24 students and 2 invited speakers. Finally, a total of 31 Short Term Scientific Missions (stays in foreign laboratories) will be funded during this period.

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O.18:1

WHERE THE EEL WAS: USING HISTORICAL DATA TO DESCRIBE THE ORIGINAL RANGE OF A COLLAPSING SPECIES

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Anguillid eels are economically and culturally important fish species wherever they occur. The European eel (*Anguilla anguilla*) is one of the few professionally exploited freshwater fish species in Europe and Northern Africa. The species was once widespread and very abundant, but since the 1980s it started to collapse across its whole range for unknown reasons, which may include habitat loss, changes in ocean circulation, pollution, overfishing, effects of invasive parasites or combinations of these factors. To promote the recovery of the eel the European regulation forces member states to establish eel management plans, with the explicit aim of enabling “the escapement to the sea of at least 35% of the silver eel biomass, relative to the pristine estimated stock levels and in the absence of human influences”. The obvious difficulty for the implementation of this regulation is to know how pristine eel stocks were.

We used a historical ecology approach to describe the freshwater distribution of eel in Spain in the absence of major anthropogenic impacts (i.e. large dams). We searched the geographical dictionary edited by Pascual Madoz (1846-1850) for freshwater fish records, obtaining over 10,500 records from 5,427 localities, eels being cited in 2,837 of them. This information was latter summarized using river sub-basins (defined by water divides and confluences of water courses) as sampling units. The resulting database included information for 3,255 sub-basins, 1,926 of which had eels. The eel was a very generalist species, occupying water courses independently of most bioclimatic variables. The probability of occurrence of the species declined with altitude and distance to river mouth, but eels were cited at elevations up to 1,400 meters and in the headwaters of the main water courses. Dams exist in Iberian rivers since Roman times, but those old infrastructures did not constitute barriers for the occupation of freshwaters by eels. We used MAXENT to model the distribution of eel in Spain in the mid-19th century and produce a baseline scenario to set conservation targets for the species. Our results show that historical written sources can provide abundant data on the distribution of biodiversity in the past and be useful for the design of present-day conservation strategies.

O.18:2

PREVALENCE AND INTENSITY OF ANGUILLICOIDES CRASSUS AND ITS EFFECT ON EUROPEAN EEL CONDITION IN MEDITERRANEAN RIVERS (NE SPAIN)

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In the last 30 years there has been a significant decline in the stock of European eel. Among the many causes which explain this decline, we can found the appearance of the parasite *Anguillicoloides crassus*. This study presents, for the first time, the prevalence and intensity of parasite infection in Muga, Fluvia and Ter rivers (Catalonia, NE Spain) in eels caught using electrofishing in a total of 27 points along a longitudinal gradient. From a total of 542 eels examined, 46.22% of the individuals had parasites in adult and pre adult form. The estimated

intensity was 1,36 parasites per eel, less than observed in other Mediterranean rivers suggesting that it can be a recent infection.

Regarding the degree of alteration of the swimbladder based on the degeneration index (SDI), 91.86% of the individuals showed some level of impact with a mean of 3,37 (5 being the highest). This index allows us to evaluate previous infections despite the absence of adults parasites, based on the injury of the swimbladder. Using multiple regression analysis, no relationship has been found between SDI and body condition or degree of changing into silver eels. There are only differences between rivers so that the parasites (present or past) appear to have no effect on the wealth of the eel. The observed values of prevalence and intensity are only indicators of parasitism at the time of the capture. Further studies are needed in the area to determine the evolution of the degree of infection and its possible effects on the eel if there is a trend to increase.

O.18:3

MOVEMENTS OF YELLOW EELS (*ANGUILLA ANGUILLA* L.) MIGRATING THROUGH A FISH LIFT

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The blockage of upstream movements by high dams and subsequent reduction in availability of habitat has been reported as a key factor contributing to population decline of inland stocks of the European eel *Anguilla anguilla*. Although a significant amount of research has been carried out on the migration of descendent silver eels, much less information is available on the migratory ecology of upstream yellow eels and also on their ability in using fish lifts, the most cost-effective mitigation measures for high dams. This study aims to determine i) the seasonal and daily upstream movement patterns; ii) the environmental factors associated with the triggering of the upstream migration and iii) the ability of yellow eels in using fish lifts during their upward migration. Upstream eel passage was continuously monitored over an annual cycle in the fish lift built at the Touvedo dam on the Lima River, north Portugal. Monitoring consisted in the use of an automatic video-recording system in combination with monthly electrofishing samplings undertaken in a 200-m river segment immediately below the dam. Parallely, hydraulic characterization of the entrance collection system was performed by an Acoustic Doppler Velocimeter (ADV) to assess species capacity to negotiate existing velocities at the entrances and within the circuit. A total of 1207 eels were transferred by the lift, of which 98.4% passed during the summer and in the beginning of autumn. Movements occurred independently of time of day. Of the environmental factors considered, only moon phase (-) and daily accumulated rainfall (+) correlated significantly with daily numbers of eel. Overall the fish lift was found to be non-selective for the eel, however size-related differences were detected as the smallest size-class (< 10 cm TL) was under-represented in the facility relatively to the river downstream. The use of fish lifts by eels may be improved by reducing the free gap between retention screens and providing adequate water velocities in the entrances and within the attraction circuit.

O.18:4

SILVER EEL MIGRATION BY TELEMETRY, MORTALITY AND CORRECTIVE MEASURES ADOPTION IN A HYDROELECTRIC POWER STATION IN UROLA RIVER

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European eel stock is considered to be out of safe biological limits (ICES 1998) and one of the factors responsible for eel decline is mortality caused by hydropower turbines on downstream migrating silver eel when they migrate back to the Sargasso sea to reproduce (ICES 2002). Despite the hydropower station abundance in basque rivers, downstream migration and related mortality rate have never been studied so that corrective measures could be adopted. As a result, silver eel downstream migration and a hydropower station impact were studied by means of telemetry in the low-middle course of Urola river (Gipuzkoa) during two consecutive migrating seasons, in autumn-winter of 2011-2012 and 2012-2013. In total, 53 adult eels were pit tagged in 2011 and 89 eels in 2012, 12 eels out of them were also radiotagged, and a pit tag passive detection system was installed in the diversion channel of the hydropower station. Downstream migration of 11 silver eel could be monitored, 10 of which were also radiotagged. Preliminary results show that eel migrated primarily at night and that migrating season was activated in autumn (November) in relation with significant flow and turbidity peaks. The number of migration events differed between years due to different environment conditions. Migration was triggered when water flow was higher than $10 \text{ m}^3/\text{s}$ (Q_{73}) in 91 % of the cases ($n=10$), although migration was also confirmed among water flow peaks belonging to Q_{86} , Q_{94} y Q_{98} . The probability for eels to enter into the diversion channel seems to be low due to river flow and channel flow ratio, in favour of the river flow. Migrating eels entering the channel was less than 10 % during the study period. This study allows to suggest corrective measures for the hydropower station: high water velocity in the channel ($> 0,5\text{m/s}$) during migrating events makes difficult to adopt solutions to prevent eels from passing through the turbines and enable their safe return to the river (bypasses and related barriers); however it indicates when temporary closure of turbines could be developed.

O.18:5

HOW COULD WE REINFORCE THE EEL POPULATION IN THE ORIA (BASQUE COUNTRY)?

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The presence of obstacles restricts the eel distribution to the lower part of the Oria River (NE Spain). Thus, three different ways of moving eels upstream within the same basin were tested to encourage the entire eel potential habitat colonization in the river. Firstly, in June 2011, the migration of 5.1 kgs of elvers from a trap located in the tidal limit to a tributary upstream was assisted. Secondly, in January 2012, 3.2 kg of wild glass eel captured in the estuary were transported directly to the upper part of the Oria's main course. Finally, 1.7 kg of glass eels cultured for 45 days were released in an upper tributary in March 2012

All the release points had good water and habitat quality, and released eels will be able to migrate downstream once they reach the silver stage during flooding in autumn, when the water surpasses the obstacles. Electrofishing surveys have been made at the beginning of the first summer after the release and then yearly in September. The recapture rate has remained constant in the elvers from the trap, and has decreased with the other two methods. All the released eels were able to grow, although grow rate and condition factor of cultured glass eels were the lowest. Therefore, these preliminary results show that (1) moving eels upstream is a useful tool to reinforce the basin population and colonizing the whole river and (2) that eels should be released directly without culturing them.

GLASS EEL RECRUITMENT DYNAMICS IN A SOUTHERN EUROPE ESTUARY (ORIA, SPAIN), 2003-2012**Aizkorri ARANBURU¹, Estíbaliz DÍAZ¹ & Cédric BRIAND²**¹AZTI-Tecnalia, Marine Research Division, Txatxarramendi z/g 48395 Sukarrieta, Spain (aaranburu@azti.es, ediaz@azti.es);²Institution d'Aménagement de la Vilaine. 56130 La Roche Bernard, France (Cedric.Briand@eptb-vilaine.fr)

The ICES stated in 1997 that the European eel population was outside its safe biological limits, and has not recovered yet (ICES 2013). The index that best reflects the population decline is the glass eel recruitment that reached the 1 % of what it was before the 1980s. However, the number of recruitment data series in Europe is scarce and, in addition, mostly fishery dependent. For that reason, the ICES-EIFAC working group on eel advised to increase the number of series based on scientific monitoring of the stock, especially in the south of Europe, where recruitment series have always been scarce. The present study aims to study the recruitment dynamics in the Oria estuary (Basque Country, north Spain), a long-standing tradition glass eel fishery river.

To study recruitment dynamics, catch logbooks were collected during nine fishing seasons (2003-2012) and fishery-independent experimental surveys were carried out at two sampling points during six fishing seasons (2005 to 2012). Local environmental variables potentially related to glass eel recruitment were recorded during the whole study period.

Hydrodynamic conditions determined glass eel behavior by: migration started in the deep layers coinciding with the salinity increase at the river mouth and upstream, as the water was mixed, glass eels were distributed along the whole water column and migration started with current rise. A modelling approach was carried out to analyze glass eel density variability according to local environmental factors. The model that best fitted the data was a generalized least square (GLS) regression with a Gamma distribution and current and depth as covariates. Densities were higher in the deep layer than in surface; but, in both cases higher values were reached at intermediate current levels. Although a high daily variability was found in glass eel abundance, the general trends showed different behavior along the fishing season in the sampling points: a significant density decrease in the river mouth and an increase upstream.

The combination of the above mentioned model relating glass eel abundance to current, with a hydrological model of the Oria estuary, in which we are currently working, will allow us to determine glass eel daily recruitment.

O.19:1

SPATIAL DISTRIBUTION OF MOLECULAR LINEAGES OF THE IBERIAN COBITIDS

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The Iberian Peninsula holds a high number of endemic freshwater fishes. Iberian rivers isolated from main European drainages by the Pyrenees mountains have maintained the allopatric distribution of their freshwater fish fauna, and thus, promoting their allopatric diversification. In Europe, there are more than 25 species described for the genus *Cobitis*. Three *Cobitis* species have been described for the Iberian Peninsula being endemics of the Iberian waters: *C. paludica*, *C. calderoni*, and *C. vettonica*. In general, Central European species of *Cobitis* exhibit wider areas of distribution than *Cobitis* species inhabiting the Mediterranean peninsulas. In these meridional areas, *Cobitis* species usually show patchy or restricted distributions, being several species distributed in few localities or in a single drainage. In the Iberian Peninsula, *C. paludica* is the species with the widest distribution; it is distributed across many drainages, whereas *C. calderoni* and *C. vettonica* exhibit more restricted distribution. Here, we present the results of the genetic variability observed for the three Iberian *Cobitis* using different molecular markers (mitochondrial and nuclear). We have analysed populations across the entire range of all endemic species in most Iberian drainages where these species are present. We will show the molecular lineages found and their spatial distribution across drainages.

O.19:2

DIVERGENCE-DEPENDENT REPRODUCTIVE ISOLATION AND SEMI-PERMEABLE SPECIES BOUNDARIES IN IBERIAN BARBUS AND LUCIOBARBUS (TELEOSTEI, CYPRINIDAE)

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The study of species boundaries provides valuable information on how biodiversity is generated and maintained, but is complicated by several factors that influence the association of genetic and morphological variation with specific taxa. As taxa diverge, ancestral polymorphisms get sorted and independently evolved traits become correlated, allowing us to discriminate among different forms. Nevertheless, shared traits can often be observed among otherwise distinct taxa, reflecting recent common ancestry and incomplete sorting of characters, introgressive hybridization, or a combination of both. The two processes are difficult to separate, but the patterns they generate can potentially be discriminated using multiple markers and geographical information. The impact of these processes on the evolution of species boundaries is most easily studied in recently and rapidly radiating groups that show some degree of range overlap. Taxa that present these ideal characteristics are the speciose genera *Barbus* and *Luciobarbus*. Here we examine different classes of characters (external meristic traits, mtDNA and nuclear DNA) and their patterns of covariation in endemic Iberian barbels sampled from sympatric and allopatric populations. We show that species boundaries are permeable to gene flow, as sympatric populations of

different species show an increased number of shared alleles compared to their allopatric counterparts. Furthermore, the degree of reproductive isolation is heterogeneous throughout the genome, since distinct nuclear markers show different levels of introgression. Finally, isolation seems to spread along the genome with the establishment of new mutations, as more distantly related species are more reproductively isolated than closely related ones.

O.19:3

USING MORPHOLOGICAL CHARACTERS, GENETIC MARKERS AND HEART FATTY ACID SIGNATURE PROFILES TO INVESTIGATE THE POPULATION STRUCTURE OF SEA LAMPREY (*PETROMYZON MARINUS*, L.) IN WESTERN IBERIAN PENINSULA

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Morphological characters, genetic markers and heart tissue fatty acid signature were used to infer the population structure of sea lamprey, *Petromyzon marinus* L., in the major Portuguese river basins. In both morphological and physiological analysis, the multiple discriminant analysis revealed statistically significant differences among groups, and the overall corrected classification rate estimated from cross-validation procedure was particularly high for the cardiac muscle fatty acid profiles. Genetic analysis, however, did not reveal significant differences between groups. Fatty acid analysis showed that all lampreys from the southern Guadiana group were correctly classified and not mixing with individuals from any other group, reflecting a typical heart fatty acid signature. Our results revealed that high proportions of the individuals from the Tagus and North/Central groups were correctly classified, despite some degree of overlap between groups. Detected differences are probably related with environmental variables to which lampreys may have been exposed during their life cycle, rather than derived from a genetic basis. These results suggest the existence of sea lamprey structuring in Portugal, possibly promoted by seabed topography isolation during the oceanic phase of the life cycle. Conservation and management implications for this species will be further discussed.

O.19:4

TACKLING HYBRIDIZATION IN FISH POPULATIONS: THE SIGNIFICANCE OF MULTIDISCIPLINARY APPROACHES

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One of the major challenges in evolutionary biology remains with trying to understand the mechanisms behind diversification and speciation, and particularly to understand the role of hybridization in these processes. In order to better explore this subject, we accessed two cases of natural hybridization between *Achondrostoma oligolepis* (AOL) and either *Pseudochondrostoma duriense* (PDU) in the northern Iberian basins of Douro and Vouga or *P. polylepis* (PPO) in the central basin of Mondego using a combined analysis integrating morphological, genetic and cytogenetic data. Results were very similar in both AOLxPDU and AOLxPPO systems providing new data on independent HZs and confirming the long suspected case of AOLxPPO hybridization. Overall, hybrid morphotypes, cytogenomic data and genetic profiling agreed towards preferential backcrossing and suggested AOL as a major

genomic contributor. Moreover, results implied AOL as more permissive to introgression than PDU or PPO. While PDU- and PPO-like individuals appeared more resilient to genome modification, AOL-like individuals showed to be more affected by the ongoing hybridization events, as chromosomal translocations were only identified in the latter. Also, all hybrids evidenced extensive ribosomal DNA (rDNA) polymorphism not found in parental species, but usually falling within the range of possible parental combinations. Yet, transgressive phenotypes that cannot be explained by normal recombination (more rDNA clusters than expected or the occurrence of syntenic rDNAs) were also detected. Present results proved rapid genomic evolution likely providing the genetic novelty necessary for species to persist. However, the ultimate consequences of such apparently extensive and recurrent events remain unknown at the population and species level; modern genome-wide methodologies seem to offer great promise towards answering questions concerning the causes, dynamics and impacts of natural hybridization.

O.19:5

GENOME-WIDE ESTIMATES OF INBREEDING AND POPULATION STRUCTURE IN WILD POPULATIONS OF ATLANTIC SALMON IN SPAIN

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Atlantic salmon (*Salmo salar*) is a species of great importance for a variety of reasons, including commercial and recreational fisheries, aquaculture, ecosystem dynamics, biodiversity in species-limited northern habitats, conservation biology, and as model for studies in behavioral and evolutionary ecology. Wild populations of Atlantic salmon have worldwide shown a decline due to human activities during the last century. In Spain, which represents the South distribution limit of this species in Europe, many populations have become extinct, others very small and the distribution of age classes has also been altered. Conservation programmes based on supportive breeding practices with autochthonous individuals have been established in Spanish rivers since early 1990s in order to recover the salmon populations, but no genetic management has been implemented on them. However, maintaining genetic variation and controlling the increase in inbreeding are crucial requirements in animal conservation programs. Several studies in the literature have used classic molecular markers to characterize genetic variation and structure and to elucidate the genetic mechanisms underlying life-history traits affecting salmon population dynamics with limited results. High-throughput microarrays containing assays for thousands of SNPs are becoming now available for a number of non-model organisms, and being used more frequently in ecological and evolutionary studies, QTL identification, parentage determination and mixed stock analysis. In this study we have used the high density Atlantic salmon 220K chip (Affymetrix) recently developed by the Centre for Integrative Genetics (Norway) to characterize inbreeding and population structure patterns in the Spanish metapopulation of Atlantic salmon. We have genotypes and phenotypic information (river and sea ages, body weight and length) for 96 individuals from 6 rivers, covering all the Spanish distribution range. Preliminary results revealed that genome-wide estimates of inbreeding ranged from 0.69 to 0.71 (SE < 0.004), being these levels considerably higher than those detected in previous studies in the same areas using microsatellites. The information available will help us to obtain a deeper understanding of the biology of this species and to develop and adopt better strategies in a conservation genetics context.

CHROMOSOME STUDY IN LOCALITIES OF *P. MEXICANA* AND *P. SULPHURARIA* IN TABASCO AND CHIAPAS, MEXICO

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Tabasco is home to *Poecilia mexicana* inhabitant of freshwater streams connected to springs and streams of sulphurous water, whose physicochemical conditions are tolerated by the endemic fish *Poecilia sulphuraria*. The connections of sulfur and freshwater aquatic environments have isolated localities of these two species producing an interesting evolutive model. To date there have been no comparative studies of cytology in *P. mexicana* and *P. sulphuraria* aimed at the description of karyotypic characters as chromosome number and morphology, being This the objective of the present study.

The sampling sites include the states of Tabasco and Chiapas, Mexico. Were collected 89 specimens of *P. mexicana* in Arroyo Ignacio Allende, and Rio El Azufre, Chiapas. Were collected 70 specimens of *P. sulphuraria* in two locations: Hacienda Los Azufres, Tabasco and Rancho La Gloria, Chiapas.

The mitotic chromosomal spreads of *P. sulphuraria* from Hacienda Los Azufres showed 2n=46 chromosomes (75.73% of chromosomal spreads analyzed); in specimens from Rancho La Gloria was observed 2n=46 in 69.12%. In *P. Mexicana* from Arroyo Ignacio Allende was quantified 86.84% of metaphases showing 2n=46, while in *P. mexicana* from Rio El Azufre, 75.73% of chromosomal spreads analyzed showed 2n=46. The chromosome morphology of both species was classified in all the diploid complement of acrocentric chromosomes as monoarms type (A).

The average length of total diploid chromosome complement (LCD) of mitotic chromosomes of *P. sulphuraria* was $198 \pm 10.4 \mu\text{m}$ for organisms from Hacienda Los Azufres and $184 \pm 18.0 \mu\text{m}$ for Rancho la Gloria. In *P. mexicana* was $167 \pm 9.36 \mu\text{m}$ organisms from Arroyo Ignacio Allende and $167 \pm 10.19.5 \mu\text{m}$ in Rio El Azufre. The LCD comparison showed significant differences ($P = 0.034$) and only among species but not between locations of the same species, so the LCD of *P. sulphuraria* ($191.65 \mu\text{m}$) was higher than that shown by *P. mexicana* ($167.45 \mu\text{m}$).

Chromosome lengths were similar in comparisons within the localities of *P. mexicana* ($P < 0.05$) among the twenty-three chromosome pairs contrasted. However, when comparing the lengths of chromosome pairs in *P. sulphuraria* were recorded significant differences from the chromosome pair 15 to 21. The results denote to *P. sulphuraria* with chromosomal differences marked possibly by inbreeding process that led to the mutation of this species. However, the application of sophisticated genetic tools is necessary for detailing the current status of the species.

EVOLUTIONARY HISTORY AND POPULATION GENETICS OF A CYPRINID FISH (*IBEROCHONDROSTOMA OLISIPONENSIS*) ENDANGERED BY INTROGRESSION FROM A MORE ABUNDANT RELATIVE

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The use of molecular techniques has shown that hybridization and introgression have significant impacts in evolution, by means of transfer of genetic variation and formation of hybrid species. In this paper we use mitochondrial and nuclear sequence data to investigate the evolutionary history, levels of genetic diversity and population differentiation of a rare and endangered fish species. Our results suggest that a hybrid origin scenario of *Chondrostoma olisiponensis* is a likely explanation for the shared genetic and morphological traits with *Iberochondrostoma* and *Achondrostoma* + *Pseudochondrostoma*. The basal positioning of *C. olisiponensis* alleles in all loci analyzed indicates that hybridization events occurred before differentiation within each of these groups, most likely during Middle–Late Miocene. Originally described as *C. olisiponensis*, we suggest that this species should be placed in the genus *Iberochondrostoma* to avoid confusion with ‘real’ central European *Chondrostoma* and to (partially) reflect its evolutionary history. Analyses of levels of genetic diversity and patterns of population subdivision show that populations of the rare *Iberochondrostoma olisiponensis* are differentiated (high and significant ϕ_{ST} and F_{ST}) and genetically depauperate (very low S , π , and θ). *Iberochondrostoma olisiponensis* is simultaneously imperiled by small population sizes and contemporary bidirectional hybridization with another critically endangered sympatric species (*Iberochondrostoma lusitanicum*). Urgent ex-situ conservation measures involving supportive breeding of *I. olisiponensis* are needed to preserve present genetic variation and eventually increase in situ population sizes, along with further studies focused on different life history and behavioral characteristics of this highly endangered species.

O.20:1

CRYOPRESERVING EUROPEAN EEL (*A. ANGUILLA*) SPERM: COMPARISON OF TWO METHODS FOR STANDARDIZATION

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During the last years two groups of research have been working in parallel to develop protocols to cryopreserve European eel sperm. Each group established their own protocols in Spain (Asturiano et al., 2003; Peñaranda et al., 2009) and Hungary (Müller et al., 2004; Szabó et al., 2005). These methods are completely different in terms of cryoprotectant, volumes, freezing media, grade for dilution, etc., making clear the need of standardization (which is a usual situation in fish species).

Recent experiments being part of the PRO-EEL project (www.pro-eel.eu) proved the efficacy of the “Spanish method” by producing larvae of this species using previously frozen-thawed sperm (Asturiano et al., 2013), although the results should be improved because of the low fertilization rates. On the other hand, the Hungarian team was able to generate hybrid larvae using semen of European eel and Japanese eel eggs (Müller et al., 2012), evidencing the validity of the “Hungarian method”.

In the framework of the AQUAGAMETE COST Action (aquagamete.webs.upv.es), a series of joint experiments were carried out in order to standardize eel cryopreservation procedures. Males were matured with weekly injections of hCG and after 10 weeks of treatment sperm samples were extracted. Sperm motility was determined after activation with sea water, and only those having more than 68% of motile cells were selected for the experiment. Sperm samples were frozen using both protocols. In general, sperm was diluted with a mixture of extender and cryoprotectant, loaded into straws and frozen in the vapor of liquid nitrogen. Straws were thawed by immersion into water bath for a given period of time.

Fresh and post-thawed samples were evaluated using sperm motility and morphometry parameters (using CASA and ASMA software, respectively). Moreover, because sperm cryopreservation in fish often depends on the use of permeating cryoprotectants bearing chemically reactive methyl group, we wanted to decipher whether eel sperm DNA methylation pattern was affected by the different cryopreservation protocols. The degree of DNA methylation was evaluated in fresh and frozen-thawed samples using the restriction enzyme assay and assessing methylation by image analysis and by LUMA.

The “Hungarian method” caused the higher sperm motility results post-thawing. Spermatozoa morphometry analyses and epigenetics evaluation are still in course.

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O.20:2

RIVER MINHO VS. OTHER PORTUGUESE STREAMS - WHEN THE DARKNESS SUPPORTS EEL CONSERVATION

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The river Minho works as natural boundary between Portugal and Spain for 75 km, which correspond to the migratory fish species available habitat, and therefore this is the section of the river where artisanal fishing activity is more intense.

Among the migratory fish species from river Minho, the eel is distinctly harvested, within the national context, during the life cycle stage named locally as *meixão* (glass-eel, or *angula*). The fishing of this species is performed in a portion of the estuary, and specific regulation is in place which establishes the fishing gear features (stow net), fishing period (4 moons, from November to February), number of licenses (maximum of 200 for each country) and the maximum amount of catch (3.0 kg of glass eel per night per fishermen). Considering its extremely high economic value, the glass eel fishing is not restricted to the river Minho estuary. In fact, it comprehends an illegal activity that occurs in several Portuguese streams, where precautionary regulation was enforced following the general knowledge of stock decreasing in a European wide scale instead of the real knowledge of the habitat conditions, the biological or ecological traits of the species at the scale of the streams.

O.20:3

CAN COASTAL LAGOONS CONTRIBUTE TO THE RECOVERY OF THE EUROPEAN EEL STOCK? THE CASE OF SANTO ANDRÉ LAGOON (SW PORTUGAL)

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Understanding the dynamics of the European eel in closed coastal lagoons is critical for fisheries management and species conservation. A study on the demographic structure and activity of eels in Santo André Lagoon was conducted during the fishing season 2011/2012 (October – February). A monthly subsample of eels was gathered from fishers to identify the life stage (yellow or silver eels) and remove otoliths for age determination. From a total of 133 eels, 69 were silver and 64 were yellow eels. The proportion of silver eels increased until December and yellow eels were absent from catches in February. Male silver eels (n=65) ranged from 313 to 386 mm total length (TL) with a mean TL of 352 mm. Female silver eels were larger, with a TL ranging between 523 and 635 mm and a mean value of 583 mm. The proportion of male silver eels (94.3%) was much higher than the proportion of female silver eels. Age of silver eels ranged between 2 and 6 years for males, with a mean value of 2.9 years, and between 3 and 6 years for females, with a mean age of 4.3 years. Despite the small number of female silver eels captured/aged, the results showed a fast growth in this coastal system, reinforcing the idea that growth varies substantially within the species range and habitats it occupies, being favoured not only in southern latitudes but also in brackish water systems, particularly in coastal lagoons. Are these silver eels contributing to the reproductive stock or will they remain locked in the lagoon? Approaches that can be used to facilitate the silver eel migration are discussed.

O.20:4

THE EEL FISHERY IN SANTO ANDRÉ LAGOON: CAN SCIENCE MEDIATE THE CONFLICT BETWEEN EXPLOITATION AND CONSERVATION?

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Over the last decades the eel fishery in Santo André Lagoon experienced a dramatic decline due to the implementation of stricter rules, namely integration of the lagoon in a protected area, creation of an area of professional fishing and more recently, the establishment of a closed fishing season (October to December) to comply with the measures set by the implementation of Regulation 1100/2007 and the Portuguese Eel Management Plan (EMP). Because professional fishermen are allowed to fish eels for a very short period in this protected area, a conflict emerged between fishers and managers. This study was conducted during the fishing season 2011/2012 and it involved several stakeholders namely the fisher organization, fisheries resource managers, protected area managers and academics. Questionnaires on the fishing activity and management measures in force were made to around 60% of fishermen (n=20) and logbooks to register daily catches were distributed to 10% of fishermen who volunteered to cooperate (n=5). The results of this work were used to estimate the total catch of eels in the lagoon and to identify the needs of fishermen that did not conflict with the purpose of conservation, i.e., the limits of the area of professional fishing; changes in the fishing hours and fishing season and the number of fyke nets permitted. The research demonstrated the benefits of extending the participatory management process to fishers, once some changes to management measures proposed by them were introduced in the fishing byelaw of the following fishing seasons improving the relationship between stakeholders.

P.1

COASTAL FISH OTOLITHS: A PHOTOGRAPHIC GUIDE

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Studies of the dietary composition of marine animals, particularly the identification of teleost otoliths from the gut content of piscivorous predators, is an important element for best to understand the relationships between predators x prey and also the interactions with the commercial fishing. Without a doubt, one of the principal problems to analyze that material is the digestion rate, that can destroy great part of the structures important taxonomic for the identification of the preys. However, the identification of the teleost can be accomplished starting from the recovery of resistant structures to the gastric action, as the otoliths. Therefore, for the accomplishment of studies on diet of piscivorous animals the organization of otoliths catalogs an essential tool is considered for the largest knowledge about the relationships prey x predators. However, until the present moment publications about the otoliths characterization in Brazil are restricted the some areas of the South and Southeast and they refer to few species. In that sense, the present study had for objective (1) to enlarge the relative information to the principal structures that characterize the otoliths, (2) to supply parameters for an evaluation more lens of those structures, (3) to allow the identification of the teleosteos by the use of that tool and finally, (4) to organize the first collection of otoliths reference for the Northeast of the country. The catalog was organized by the description of otoliths sagitta of 63 coastal species distributed among 21 families that happen in the coast of the State of Rio Grande do Norte.

P.2

OTOLITH SHAPE ANALYSIS AS A TOOL FOR STOCK IDENTIFICATION OF THE BLUE JACK MACKEREL, *TRACHURUS PICTURATUS*, IN THE CENTRAL AND NORTH-EAST ATLANTIC

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The geographic variability in otolith shape of the blue Jack mackerel, *Trachurus picturatus*, was studied as a tool for stock identification. Otolith based methods have the potential to discriminate between stocks, an important requirement for sustainable management of fish.

A combination of otolith shape indices (circularity, aspect ratio, roundness and solidity) and elliptic Fourier descriptors were analysed by multivariate statistical procedures in 334 sagittal otoliths collected in six sampling areas in the central and north-east Atlantic (Portugal mainland - Matosinhos, Peniche and Portimão, Azores, Madeira and Canaries) in order to compare fish stocks or population-units of blue jack mackerel. Only otoliths from fish of 27-32 cm total length were selected in order to minimise the possible effect of size between the sampling areas. The obtained results highlight the use of otolith shape analysis for identifying and discriminate population-units or stocks of *T. picturatus* in the NE Atlantic.

P.3

ONTOGENETIC DEVELOPMENT OF THE SAGITTAL OTOLITHS OF *LIPOPHRYS PHOLIS* DURING THE EMBRYONIC, LARVAL AND SETTLEMENT STAGES

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Egg-masses of *Lipophrys pholis* were captured in a rocky beach in north of Portugal (Póvoa do Varzim) during March 2013 and 2014. The specimens were reared under controlled-laboratory conditions to assess the occurrence of different check marks in otoliths during embryonic, larval and settlement development, through scanning electron microscopy (SEM). After extraction, otoliths were ground with silicon carbide papers, polished with alumina paste and etched with chloridric acid 0.5 M during 30 seg. Prepared otoliths were vacuum-coated with gold and viewed under SEM at magnifications between 700X and 3500X. Sagittae deposited several micro-increments (~8-10) before hatching (embryos phases C and D). A visible hatching check was observed in all specimens around 28 µm from core, but no first feeding check was found. Settlers presented in the otolith edge a settlement check type Ib. Although the use of sagittae was recommended for ageing studies in *L. pholis* and daily increment deposition was validate recently in early juveniles for this species, interpretation of the microstructural growth of sagittae should be look with carefully since it can cause overestimation of individual age.

P.4

EMBRYOGENIC STAGING OF PUFFERFISH (*TAKIFUGU NIPHOBLES*) UNDER TWO THERMAL REGIMES: CLIMATE CHANGE IMPLICATIONS

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Water temperature is the environmental factor with the largest influence on the fish egg development, and both high and low temperatures can trigger a negative impact on hatching rates. Data concerning the optimal thermal ranges of different fish species are also very important in the context of overall warming of the water due to climatic changes. In this respect, fugu species present themselves as key organisms for carrying out these studies due to clear egg development. Thus, the first goal of this study was to describe a series of embryogenic staging of pufferfish, providing fundamental data to facilitate its use for developmental studies and secondly, to assess the effects of high water temperature on the egg development of pufferfish, evaluating the immediate effects of a future global warming.

Males and females pufferfish were caught at Arai Beach (Japan) during the spawning season and moved to the MMBS facilities. Genital area was cleaned to avoid the contamination and gentle abdomen pressure was applied to obtain both the male and female gametes. Eggs were divided into several batches and fresh sperm and seawater were added to activate fertilization. Eggs were then incubated in darkness at 20 or 30 °C during 8-9 days under continuously monitoring for checking the embryo stage.

We present data that suggests *T. niphobles* is a practical lab model for studies in developmental biology. The speed of development to gastrula stage was faster than closely related species such as *T. rubripes*, but timing of segmentation and the pharyngula period was lengthened. Timing to hatching was asynchronous, and pufferfish larvae born gradually from 191 to 214 h post fertilization.

Regarding temperature, this study reports that too high temperatures (30 °C) caused irregular divisions at blastula stage of development, and development was stopped at this point. Evidence of decreased or even extinction of local marine populations has been reported as a result of global warming effects, thus solutions to minimize this process should be taken to preserve fish marine species and understanding the response of fish species to these changes in surface temperatures will be key for future management.

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P.5

ESTUARINE ICHTHYOPLANKTON VERTICAL DYNAMICS: IMPLICATIONS FOR LARVAL TRANSPORT

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Vertical distribution and migration pattern of summer ichthyoplankton assemblage in the Mondego estuary were investigated in relation to diel and tidal cycle. Samples were collected during summer, at surface and bottom, over a diel cycle during spring and neap tides at a fixed station at the mouth of the estuary. *Pomatoschistus* spp., *Gobius niger* and *Parablennius pilicornis* were the main species present in the summer assemblages. Main species larval densities showed significant periodic variation associated with tide (M2) and diel (K1) cycles presenting generally, higher density at night and around low tide. Fish larvae presented some extent of vertical migration though, could not be related with diel or tidal cycle. Vertical distribution amplitude increased during periods of less stratification and lower water currents. The weak water stratification during the tidal cycle in addition to higher larval density during low tide and preference of some species for deeper waters during flood seems to indicate a strong landward transport of larvae into the estuary. Present study provides a better understanding of ichthyoplankton vertical movement patterns and of small-scale dynamics at the interface of two coastal European systems.

P.6

COMPOSITION AND SEASONAL OF FISH LARVAE INGRESSING IN THE TAGUS ESTUARY

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Estuaries are important ecosystems for biota providing a variety of habitats and food resources for a diversity of animals. These ecosystems serve as ecological filters, supply nutrients, and provide spawning and nursery habitats for fishes. Basic data on the composition and structure of larval and juvenile fish communities in estuaries can provide an important baseline to understand estuaries importance as nursery area. In this study, we describe and compare two years of fish larvae ingressing into Tagus estuary based on fortnightly sampling (Nov-2011;Nov-2013), and aim to identify temporal patterns of larval fish ingress into the estuary.

Over 90% of the total catch belongs to Gobiidae family which consists mainly of *Pomatoschistus* sp., being constant throughout the year. The second largest group was constituted by less than 5% of total catch, and included larvae of three groups: Soleidae (mostly *Solea senegalensis*), unidentified Clupeiformes and Sparidae (*Boops boops*). Occasional occurrence of fish larvae was observed for Syngnathidae, Callionymidae, Batrachoididae, Ammodytidae, Labridae and Anguillidae. Looking more closely to the seasonal patterns, *Pomatoschistus* spp. larvae mainly found between March and August, and revealed two recruitment peaks in June and August. Most of Soleidae larvae were caught from April to July and *S. senegalensis* occurred mainly from May to July. High abundance of *B. boops* occurred between May and June, while an increased diversity of fish larvae was observed during late summer (Syngnathidae, Callionymidae and Batrachoididae).

The current work describes estuarine fish larvae ingress along two years and provides information about the seasonal pattern of the fish species. This information is essential for long-term comparisons with historical changes observed in the juvenile fish community along the past decades.

P.7

SINGLE PASS ELECTROFISHING METHOD FOR ASSESSMENT AND MONITORING OF LARVAL LAMPREY POPULATIONS

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Our work aims at calibrating and standardizing the single pass protocol of electrofishing to assess and monitor larval lamprey populations, mainly for European populations of sea lamprey (*Petromyzon marinus* Linnaeus, 1758). The method is considered cost-effective and appropriate for both its use on the scale relevant to management decisions (from river or watershed to a regional, national scale) and its use as a routine assessment tool as required by the European Union Habitats Directive. Also, the larval surveys may be reconciled with routine electrofishing surveys for fish species, so as to further reduce costs. In our case, the escapement of larvae from the sampling area when using electrofishing corresponded to 18 % of larvae and 17 % of larval biomass. The general effectiveness of the protocol to determine the density and biomass of age-1 and older larvae was 68 % and 70 % respectively. This effectiveness share allows for the adjustment of observed values in order to estimate the absolute values of larval density and biomass at each river/basin. Finally, reference categories for density and biomass of larval populations of *P. marinus* in NW of the Iberian Peninsula are provided.

P.8

CONDITION ASSESSMENT AND TREND OF LARVAL SEA LAMPREY POPULATIONS (*PETROMYZON MARINUS* LINNAEUS, 1758) IN NW IBERIAN PENINSULA

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The sea lamprey *Petromyzon marinus* Linnaeus, 1758 is a threatened species in Europe where its populations have declined dramatically over the second half of the 20th century. EC Habitats Directive stipulates that Member States

have to monitor and maintain or restore the populations of this species in a condition that ensures its favourable conservation status in the community. This study investigated the status and trend of larval sea lamprey populations in the NW of the Iberian Peninsula with annual surveys carried out between 2007 and 2011. For this purpose the single pass electrofishing method was used. The average values of observed density and biomass for larval populations of Galician rivers during the study period were (mean \pm standard error) 5.5 ± 0.72 ind m^{-2} and 10.5 ± 1.85 g m^{-2} respectively. This correspond to an adjusted mean value (based on the effectiveness of the method) of larval density and biomass of 11.0 ± 1.44 ind m^{-2} and 15.1 ± 2.64 g m^{-2} respectively. Moreover, the results suggest the existence of an upward trend of larval populations during the study period which is consistent with trends recently described for sea lamprey populations in other European regions. Thus, the conservation status of sea lamprey populations in this region was considered favourable with some exceptions such as rivers Sar and Ouro, where the high organic pollution limited and prevented respectively the occurrence of *P. marinus*. Finally, our results together with the available information suggest that the NW of Spain, north of Portugal and west-southwest of France host the largest populations of *P. marinus* in Europe.

P.9

GLYCOGEN AND PROTEIN LEVELS IN DIFFERENT ORGANS OF ADULT SEA LAMPREY (*PETROMYZON MARINUS*, LINNAEUS, 1758)

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Glycogen and proteins have important, but different, biological roles as sources of energy. Most of the ATP required for fish rough exercise (attacking prey, escaping from predators, swimming against the current) is derived from the use of the glycogen stores and its subsequent glycolysis. Due to the low activity of the hexokinase glucose is not normally used to produce ATP. In addition, glycogen stores, and especially hepatic glycogen stores, are modified under stress conditions. Likewise, the amount of total protein in an individual as well as providing a measure of long-term growth is also a measure of the energy storage, since fish proteins can be used as energy source, especially under severe stress conditions.

In the case of a semelparous fish, such as the sea lamprey (*Petromyzon marinus*), a decrease or growth interruption occurs during reproduction and the supply of oxygen to the muscle tissue and other organs slows down because the blood is not pumped through the heart efficiently. As a result, the state of nutritional deficiency and depletion will have a drastic effect on the levels of stored glycogen and protein.

In the present study, we show the preliminary results of the energy reserve levels (glycogen and protein) in different organs (muscle, liver, heart and dermis) of sea lamprey adults, which have been kept without feed for four months and under controlled conditions of temperature and photoperiod.

The heart shows the highest amounts of stored glycogen, and the most variable ones, ranging from 7.66 mg/g to 0.08 mg/g, with an average of 3.07 mg/g (SD: 2.41), when compared with the remaining analyzed organs (muscle, average: 2.09, SD: 0.87; liver, average 0.31, SD 0.10; dermis, average: 0.27, SD: 0.09). Therefore, the role of cardiac glycogen in the duration of the vital activity after spawning is discussed.

Protein levels do not show important particularities, ranging from 22.98 mg/g in the muscle to 144.53 mg/g in the liver.

P.10

VARIATION IN THE RNA/DNA RATIO IN DIFFERENT ORGANS OF SEA LAMPREY ADULTS (*PETROMYZON MARINUS*, LINNAEUS, 1758)

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The RNA/DNA ratio has been proposed as a sensitive measure term (days to weeks) of growth rate in fishes. The use of this ratio is based on the premise that, although the DNA per cell remains relatively constant, the quantity of RNA is related to the amount of protein synthesis. Therefore an increment in the RNA/DNA ratio reflects a recent growth and gives information about the nutritional condition of the specimens. In semelparous fishes, such as the sea lamprey (*Petromyzon marinus*), a decrease or interruption in growth occurs during reproduction, consequently, the measure of the RNA/DNA ratio allows us to know the rate by which the fish body stops dedicating resources to its development, or reduces the activity of a specific organ.

In the present study, we show the results of the variation of the RNA/DNA ratio in different organs (muscle, liver, heart and dermis) of adults of sea lamprey, which have been kept for four months without feeding under controlled conditions of temperature and photoperiod. The highest activity is detected, in decreasing order, in the liver (average: 4.138, SD: 1.392), heart (average: 1.138, SD: 0.348), dermis (average: 1.178, SD: 0.351) and muscle (average: 0.737, SD: 0.252).

The stabling conditions ensure that the differences among the analyzed organs are due to the cellular activity of each organ. In addition, they are also useful in field sampling design, as well as to make an accurate interpretation when results from research data belonging to a single organ are compared.

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EARLY SPAWNING MIGRATION IN THE UPWELLING ZONE AND DISTRIBUTION OF ALLIS SHAD, *ALOSA ALOSA* (LINNAEUS, 1758), AND TWAITE SHAD, *ALOSA FALLAX* (LACÉPÈDE, 1803), IN GALICIA (NW SPAIN)

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Nowadays there is still a partial knowledge of the marine phase of allis shad, *Alosa alosa* (Linnaeus, 1758), and twaite shad, *Alosa fallax* (Lacépède, 1803). Since shads forms shoals and show a coastal distribution during part of the year, where generally fishing activity is more intense, often they form part of the by-catch of marine and estuarine fisheries. However, on the whole the information on shad harvest by coastal or offshore commercial fisheries is not accessible and often the data provided do not make the distinction between both shad species, making it difficult to draw any conclusion concerning the status of their populations. However, in this study we

were able to collect the official data record, separated by species, of discharges (in kg) produced in all markets of Galicia (NW Spain) and we also conducted freshwater field sampling campaigns in rivers Minho, Ulla, Anllóns and Umia using trammel nets. So this allows us: (i) to provide new information on the coastal distribution and population trends of *A. alosa* and *A. fallax* in the NW Iberian Peninsula and (ii) to describe for the first time the phenology of the early spawning migration in the coastal zone, using both data on marine landings and field sampling campaigns in Galician rivers. Our results show that both species of shad exhibit a coastal distribution close to the rivers where they spawning: the rivers Miño and Ulla. In addition, catches at sea decline since January, a phenomenon that can be understood as the onset of the migration to the rivers.

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CHARACTERIZATION OF THE SPAWNING HABITAT AND MATING BEHAVIOUR OF TWAITE SHAD, *ALOSA FALLAX* (LACÉPÈDE, 1803), IN THE RIVER ULLA (NW IBERIAN PENINSULA)

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Spawning of twaite shad, *Alosa fallax* (Lacépède, 1803), has been reported in tidal freshwater as well as in nontidal portions of rivers, with fish migrating as far as several hundred of kilometers from the sea. Courtship and eggs fertilization take place overnight by a quick circular swimming of the couple near the water surface with the emission of a splashing known as "bull phenomenon". Most information on the spawning of twaite shad comes from studies conducted on allis shad [*Alosa alosa* (Linnaeus, 1758)] which are assumed to be valid for *A. fallax* given the supposed ecological similarity between both species. Therefore, there is little information on many aspects of reproduction of this species as the characteristics of the spawning grounds or the behavior during spawning.

In this study the identification and characterization of the main spawning grounds were performed in the River Ulla (NW Iberian Peninsula) and the mating behavior of this species was studied. The localization of spawning grounds was carried out by extensive night surveys to detect the "bulls". The reproductive activity was determined *in situ* by visual and auditory recordings. Besides, water temperature was measured during the spawning period. This has allowed us to confirm the existence of two important spawning grounds that belong to a stretch of the river located about 24 km away from the sea and that are separated from each other by almost 800 meters. One of them is a typical spawning ground, a pool of approximately 50 m wide with a predominant gravel substrate, while the other, also about 50 m, is probably a forced spawning ground due to a presence of a small dam. The range of reproductive activity was from 00:00 h to 07:00 h (time in GMT+1).

BIOMETRICAL CHARACTERISTICS, GROWTH AND DIET COMPOSITION OF TWAITE SHAD, *ALOSA FALLAX* (LACÉPÈDE, 1803), JUVENILES IN THE ULLA AND MIÑO TIDAL FRESHWATER WETLANDS (NW IBERIAN PENINSULA)

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The Young-of-the-year (YOY) of twaite shad, *Alosa fallax* (Lacépède, 1803), migrate downstream in schools to the ocean during the summer and fall, before age 1. In comparison with other phases, the juvenile life stages are poorly understood. Little is known, with the exception of studies conducted in the River Elbe, about the habitat preferences, growth conditions and behavior of larvae and juveniles before they migrate seaward. Therefore, the aims of this study were to perform a preliminary study on the biometrical characteristics, growth and diet composition of YOY twaite shad in rivers Ulla and Miño (NW Iberian Peninsula). A beach seine net was used, both in the River Ulla (2012) and in the River Miño (2009-2012), from the end of summer to early winter, to sample the YOY twaite shad. The sampling effort was distributed over both the daylight hours and night. YOY were captured between August and December in the River Ulla, and between September and January in the River Miño. Mean length and weight of YOY in the River Ulla were 8.61 cm \pm 0.11 (range: 5.9-11.5 cm) and 4.38 g \pm 0.17 (range: 1.53-9.93 g) respectively. In the River Miño mean length and weight of YOY were 8.66 cm \pm 0.07 (range: 4.6-13.2 cm) and 5.18 g \pm 0.13 (range: 0.65-15.93 g). The presence of one individual 1 + and two individuals 2 + during the sampling period in the River Ulla suggests that at least part of the subadults exhibit an estuarine distribution. In both rivers, the amphipods belonging to the genus *Corophium* constituted the most important prey both in terms of abundance and frequency; although we observed some differences in the feeding behavior. YOY in the River Ulla showed a piscivorous strategy on small fishes of the genus *Pomatoschistus*, while in the River Miño YOY consumed more terrestrial invertebrates.

SPAWNING MIGRATION AND STATUS OF TWO POPULATIONS OF TWAITE SHAD, *ALOSA FALLAX* (LACÉPÈDE, 1803), IN NW IBERIAN PENINSULA

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The spawning migration of adults of twaite shad, *Alosa fallax* (Lacépède, 1803), usually begins in late winter and continues throughout the spring, nonetheless there is a latitudinal gradient, so that the southern populations penetrate rivers earlier than the northern populations. Like other diadromous fish, *A. fallax* has been progressively

disappearing from European rivers due to river fragmentation, overfishing and pollution. In order to protect this species, a detailed knowledge of their biology and ecology as well as an adequate assessment of its abundance throughout the distribution range of the species is required. In the Iberian Peninsula, there are few works that include information on the status and biology of twaite shad populations. In this work we provide data on characteristics of spawning individuals and spawning migration period of two populations in two Galician rivers (NW Iberian Peninsula): Ulla and Miño. In the River Ulla we obtained individuals by sampling with trammel nets, from a fixed trap, with two fish passes, one Denil-type scale with side baffles and one scale of thoughts and also from sport fishing. In the River Miño we obtained individuals by sampling with trammel nets and also from professional fishing. Data on reproducers are presented: fork and total length, total weight, number of gill rakers, gonadosomatic index, hepatosomatic index, condition factor, gonadal condition factor, age structure, growth and iteroparity. Our results show that twaite shads of both rivers exhibit higher values for both length and weight than most populations of this species.

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INTERSEX IN MULLET FROM THE TAGUS ESTUARY (PORTUGAL)

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Environmental contaminants from industries, agriculture, urban effluents, and other, often end up in aquatic bodies, including estuaries. Even when present in ng levels, in the water column or sediments, toxicants can cause chronic exposure effects in fish. Some of these compounds are endocrine disrupter compounds (EDCs), because they can disturb, by different ways, the endocrine physiology. Some impacts can be revealed by changes in gonad structure (like the presence of intersex/ovotestis - oocytes in fish testis), and even by reductions in fertility and reproductive success.

The aim of this work was to assess the prevalence and severity of ovotestis (by the OSI - Ovotestis Severity Index) in 60 mullets (1 *Liza ramada*, 22 *Liza aurata* and 37 *Chelon labrosus*), caught in February 2014, using nets (next to city of Seixal, in Tagus estuary); *L. ramada* has a total length (TL) of 36 cm and a total weight (TW) of 392 g, *L. aurata* had a TL of 36±4 cm (mean ± sd) and a TW of 363±91 g, while *C. labrosus* showed a TL of 38± cm and a TW of 548±194 g.

By using histology we found that 33.3% of the mullets caught were males (21/60), revealing 9.5 % (2/21) of intersex males (1 *L. ramada* and 1 *C. labrosus*), presenting ovotestis, i.e., males presenting oocytes in the testis. Similar results were found in both intersex specimens, with very low density of primary oocytes; resulting in an OSI value of about 0.04, corresponding to stage 1 (Bateman et al. 2004). The values are lower when compared with former data from mullets captured in other Portuguese estuaries; namely of the Mondego, Douro and Ave, all with approximately 20 % of ovotestis, and OSI values around 0.46 in the Mondego (stage 1), 5.4 in Douro (stage 1), and 7.4 in Ave (stage 2) (Carrola, 2011).

The low sample prevalence, together with the very low OSI is suggestive of a slight level of exposure to estrogenic EDCs. This can be related with the construction of many waste water treatment plants (WWTP) in the vicinity of the Tagus estuary (Quinta do Conde, Alcochete, Seixalinho, Afonsoeiro, Lagoínha, etc), including two recent ones (2011); the WWTP of Seixal and Barreiro/Moita. Anyway, as the intersex rate is above the expected natural one for mullets (virtually nonexistent), more field work is planned in order to strengthen the confidence in the present

scenario. Such endeavor is relevant to monitor EDCs in the area and risks for ichthyofauna and the impact of the WWTPs in the Tagus estuarine ecosystem.

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FREQUENCY OF MICRONUCLEI AND OF OTHER NUCLEAR MORPHOLOGICAL ABNORMALITIES IN ERYTHROCYTES OF MULLET FROM THE LIMA ESTUARY

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Discharges of pollutants into aquatic bodies, like streams and rivers, present serious problems to aquatic wildlife and also for public health. The complex mixture of toxics present in the water or sediments can be genotoxic and affect the fish health. Erythrocyte nuclear morphological abnormalities (ENMAs), particularly the emergence of micronuclei (EMN), can be used as biomarkers of exposure to genotoxicants. Therefore, one aim of this study is to estimate the prevalence of MN and other ENMAs in mullet from the Lima estuary, following previous studies made in other Portuguese estuaries.

For this purpose 55 mullets were fished in May of 2012 in the Lima estuary, using rods and nets, and data from 40 fish are presented herein. Blood smears were made and stained with 10% Giemsa solution. Approximately 1000-1100 erythrocytes were counted per each slide, with a final 1000x magnification.

Our preliminary data showed that in Lima Estuary the frequency of EMN were around 0.29‰, and of total ENMAs around 39.8‰. The EMN and particularly the total ENMAs values in Lima seem lower when compared with the Mondego (0.4‰ and 73.3‰) and Douro (0.4‰ and 100.6‰), and much lower than in Ave estuary (0.9‰ and 108.4‰) (Carrola *et al.*, 2014). This agree with some studies that consider the Lima river as a cleaner one (Cabral *et al.*, 2012), and thus this local is used frequently as a reference estuary. The Ave estuary is located in a basin presenting lot of agriculture and industrialized areas and with more inhabitants when compared with Lima basin (Costa-Dias *et al.*, 2010).

The frequency of ENMs and total ENMAs show that mullet from Lima estuary tend to be lower than in the Mondego<Douro<Ave, suggesting a lesser genotoxic exposure, probably linked to less industries, agriculture farms and less inhabitants all along the Lima watershed. These data are in accordance with chemical water analyses and biomonitoring studies.

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HISTOPATHOLOGY SURVEYS OF ENVIRONMENTAL POLLUTION BIOMARKERS IN THE LIVER OF FLOUNDER (*PLATICHTHYS FLESUS*) FROM THE DOURO RIVER ESTUARY - PRELIMINARY DATA

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In last decades, the majority of anthropogenic activities caused a considerable increase in consumption of natural resources and produced different types of pollutants, leading to air, soil and water degradation. These toxicants affect also the health of aquatic organisms which in turn disturb, directly or indirectly, their prey and predators. In this context fish can be used as bioindicators for biomonitoring and assessment of water ecological status. These can help in spatial-temporal diagnosis, as our group is doing, and, at last, in reducing environmental impacts and raising sustainability.

In view of the above, the principal aim of this work was to perform a histological analysis of the liver from flounders (*Platichthys flesus*) caught in the Douro river estuary, in May 2013, looking for general biomarkers of toxicant exposure/effect. Additionally, we want to look at external and internal gross lesions that could signal for disturbances of the overall fish health. Other organs and blood were collected for complementary histo/cytopathology scrutiny.

Despite no gross lesions were detected, the histology revealed non-specific reactive changes and microlesions. Indeed, accumulation of macrophage aggregates was seen in 9% of the fish, whereas inflammatory foci occurred in 13% of the specimens. Focal necrosis existed in 35% of the sample. Anyway, all the conditions were viewed as of low grade/severity. We saw only one fish with an intrahepatic focus of extracellular parasites (still undiagnosed).

Other studies made with this species, namely in polluted estuaries of the United Kingdom or Germany, frequently showed liver nodules (often associated with neoplastic changes), as well as various types of pre-neoplastic lesions. The number and severity of the conditions that we detected are far from those kinds of reports from that estuaries. Our data are in line with the fact that we did not observed ovotestis in the same fish; a frequent condition found in this species from polluted estuaries. In spite of the relative small sample size we studied so far (n = 23), our data suggest a much lower level of sediment/water pollution when compared with other parallel European estuaries. Anyway, it is possible that our histopathological data are actually connected with effects of pollutants, because the degree of parasitosis was very low. As this study is preliminary, and because chemical analyses have been detecting diverse toxics in the estuary, we aim to refine the present approach with further analyses, such immunohistochemistry and chemistry.

Acknowledgments: to CITAB, and technicians from Histology Laboratory (DeBA/UTAD).

LOOKING FOR INTERSEX IN FLOUNDER (*PLATICHTHYS FLESUS*) FROM THE DOURO ESTUARY (NORTH PORTUGAL) – PRELIMINARY DATA

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A wide range of anthropogenic activities, release daily numerous kinds of chemicals to the environment, which cause from acute to chronic exposure effects in wildlife and humans. Such toxicants form complex mixtures that affect air, soil and water bodies, often leading to extensive degradation of ecosystems. Many pollutants that end in estuarine water/sediment act as endocrine disruptors compounds (EDCs) because they can disturb, by different ways, the endocrine physiology. Thus, the ovotestis presence in male fish (oocytes in testis) typically reflects hormonal disruption caused by xenoestrogens.

In June 2013, flounders (*Platichthys flesus*) were captured (n=23) using nets and a small boat, in the estuary of Douro River (closed to Porto city) in order to: a) study the gonads histology; b) assess the prevalence of ovotestis (oocytes in male testis) and c) determine severity of that condition (via the Ovotestis Severity Index - OSI).

Total length and weight of flounders were: 35 ± 3 cm and 399 ± 127 g. No external or internal gross lesions were observed. Males made only 13% of the caught fish. Under histology scrutiny, gonads present normal histology and no oocytes were seen in the testes. This fact agrees with a former study in the Douro estuary, with the same species (Carrola et al., 2010).

Contrary to what was found in some estuaries in the north Europe, our data suggest that the Douro flatfish were not being exposed to enough levels of xenoestrogens so to induce ovotestis. Yet, we know by chemical analyses that there are xenoestrogens in the water column of the Douro estuary (Rocha et al., 2013). Also, male mullet populations from the same estuary consistently display some percent ovotestis. The flounder's benthic behavior and migratory life history may explain differential inter species scenarios; together with eventual dissimilar species sensitivities. As the absence of ovotestis does not mean that the flounder were not being exposed, we will now further look for the eventual presence of vitellogenin in male liver (using immunohistochemical methods). Also, a broader seasonal approach is needed as the gonadal status change along the year.

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EARLY CONTAMINATION OF EUROPEAN FLOUNDER (*PLATICHTHYS FLESUS*) BY PCDD/FS AND DIOXIN-LIKE PCBS IN EUROPEAN WATERS

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Estuarine and coastal habitats constitute nursery areas for the European flounder (*Platichthys flesus*) during its critical juvenile period. However, these systems are also known to accumulate various chemical contaminants. Therefore, the present work aimed to investigate the contamination levels and profiles of 7 polychlorinated-p-dioxins, 10 polychlorinated furans (PCDD/FS) and 12 dioxin-like polychlorinated biphenyls (dl-PCBs) in juvenile *P. flesus* captured in different nursery areas in the eastern Atlantic coast across its geographical distribution range (Portugal, France, The Netherlands and Norway). The toxic equivalency concentrations (WHO-TEQfish) were also determined in order to evaluate which *P. flesus* population was more exposed to dioxin-like toxicity. Juveniles caught in the Sørkjord (Norway) showed the lowest WHO-TEQfish concentration (0.052 pg g⁻¹ wet weight), whereas the highest value was observed in fish from the Wadden Sea (0.291 pg g⁻¹ ww), mainly due to the greater contribution of 2,3,7,8-tetrachlorodibenzo-p-dioxin, the most toxic congener. Nonetheless, the PCDD/F and dl-PCB concentrations detected in the muscle of juvenile flounder are not expected to adversely affect fish.

EGG CHORION ULTRASTRUCTURE OF *LOPHIUS* SPECIES FROM THE MEDITERRANEAN SEA

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Identification of fish eggs is one of the most difficult problems faced when working with ichthyoplankton. In marine teleosts the structure of the egg chorion is an indication of the systematic status of the species and it has a morphology which is species-specific; because of that some authors consider the possibility of use it in identifying eggs of different species. For this reason chorion surface and micropyle of unfertilized eggs of black anglerfish *Lophius budegassa* and white anglerfish *Lophius piscatorius* were examined by scanning electron microscopy. *Lophius* eggs are spherical. The chorion of both species was smooth, with pores distributed evenly over the surface. It consists of a thin outer zone and a thicker laminated inner zone. The micropyle is funnel-shaped, at the bottom of which is a circular aperture leading to the micropyle canal which traverses the entire chorion layer.

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TROPHIC NICHE OF AN EXPANDING PELAGIC FISH SPECIES IN THE MEDITERRANEAN SEA

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Global change has been recognized as the main driver of the expansion of species outside to their native range, posing an important modification in the ecosystems through their potential effects on native biodiversity and community structure and functioning. Although a variety of factors may influence expansion success, how expanding species manage trophic resources may be the most critical factor to ensure survival and reproduction and one of the most important ways to impact native communities. Two main trophic pathways have been suggested to explain resource acquisition by expanding species: expanding species may behave aggressively over the resources exploited by natives, displacing them from their niches, or they may exploit niche opportunities that most native species are unable to use efficiently. The recent expansion in the Mediterranean Sea by the round sardinella *Sardinella aurita*, a tropical pelagic fish, as a consequence of the increase in the temperature of the Mediterranean waters provides an excellent field-laboratory to investigate the trophic strategies of marine species in expansion, as well as to quantify the trophic impact of these new species on populations and communities of ecological similar native species. We examined the main trophic pathways of the round sardinella and the trophic relationships with other ecological similar pelagic fish species in the North-Western Mediterranean Sea by analysing their stable isotopic values throughout the year. Results revealed that round sardinella overlapped its trophic niche with medium pelagic species (Atlantic horse mackerel *Trachurus trachurus* and Atlantic chub *Scomber colias*). Isotopic mixing models indicate that round sardinella is acting as a predator of small pelagic species (European anchovy *Engraulis encrasicolus* and sardine *Sardina pilchardus*). These results have clear implications to understand the ecological role of the round sardinella in the Mediterranean Sea.

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ESTRUTURA DE UMA POPULAÇÃO E ASPECTOS BIOLÓGICOS DE *STELLIFER NASO* (JORDAN, 1889) (OSTEICHTHYES, SCIAENIDAE), EM UM MANGUEZAL DA ILHA DE SÃO LUIS, MARANHÃO, BRASIL

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Neste estudo são abordados aspectos da população de *Stellifer naso* presente em um manguezal na localidade Raposa, ilha de São Luis, Maranhão, Brasil; abrangendo distribuição de comprimento, proporção sexual, análises macroscópicas das gônadas e comprimento médio de primeira maturação. A amostragem foi mensal, durante o período de agosto de 1999 a novembro de 2000. Foram coletados 277 exemplares de peixes, 31 machos, 50 fêmeas e 196 com sexo indeterminado. A amplitude de comprimento variou entre 101 a 196 mm com média de 132,35 mm e desvio padrão de 12,79. A proporção sexual foi testada pelo método do qui-quadrado, com um grau de liberdade e 0,05 de grau de significância ($\chi^2 < 3,840$) o qui-quadrado obtido foi de 4,46*, logo há diferença significativa ao nível de 5%, portanto a hipótese de igualdade entre os sexos (1:1) foi rejeitada. O comprimento médio de primeira maturação (L_{50}) obtido para *Stellifer naso* foi de 148,87 mm e o L_{100} foi de 212,87 mm para sexos grupados. *Stellifer naso* não completa seu ciclo de vida no manguezal, porque só foram observados indivíduos imaturos e maduros, nenhum indivíduo com indícios de desova.

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CROAKERS OF SOFALA BANK-MOZAMBIQUE

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Otolithes ruber, commonly known as croakers is the main species of the family Sciaenidae belonging to the shallow water shrimp by catch in Sofala Bank, Mozambique. Demersal species make up a large part of the by catch of the shrimp trawlers and thus seem to be more vulnerable than the pelagic species to an increase in fishing effort.

Due to the importance and commercial value it was studied by (Gislason, 1985; Palha de Sousa, 2002; Palha de Sousa 2003; Palha de Sousa 2004). It is caught by three different sectors: artisanal, semi industrial and industrial fleet targeting shallow water shrimp composed mainly by *Penaeus indicus* and *Metapenaeus monoceros*.

Shallow water shrimp by catch estimates are undertaken yearly and during 2013 were around 12968 tonnes of which 3112 tonnes were Sciaenidae.

This paper summarizes available information for this species regarding species composition and biological characteristics.

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COMPARATIVE FEEDING ECOLOGY OF TWO ELASMOBRANCH SPECIES, *SQUALUS BLAINVILLE* AND *SCYLIORHINUS CANICULA*, OFF THE PORTUGUESE COAST

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The small-spotted catshark *Scyliorhinus canicula* (Linnaeus, 1758) and the longnose spurdog *Squalus blainville* (Risso, 1826) are two species occurring in the European and western African continental shelves, with a wide geographical distribution. In this work, the diet of *S. blainville* and *S. canicula* off the Portuguese western Atlantic coast was investigated in 2006, based on monthly samples collected by local fishing vessels. In both species, crustaceans and teleosts were the dominant prey items, with molluscs, polychaetes, echinoderms, and sipunculids occurring in lower abundance. In *S. canicula*, Urochordate and Chondrichthyan species were also observed in the stomach contents, being classified as accidental prey items. *S. canicula* consumed a broader group of prey items than *S. blainville*. A significant diet overlap was observed, despite both species occupying different depth ranges over the continental shelf. *S. canicula* exhibited consistency in diet composition among seasons, sexes, and maturity stages. Nonetheless, in both adults and juveniles, an increase in relative abundance of teleosts in the diet was observed in the spring and summer. This study illustrates the importance of *S. canicula* and *S. blainville* as benthic and pelagic predators along the western Atlantic coast.

MITOCHONDRIAL MOLECULAR MARK AS A TOOL FOR THE IDENTIFICATION AND CONSERVATION OF SHARK *ISURUS OXYRINCHUS* STOCKS IN THE ATLANTIC OCEAN

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Until a few decades ago, shark fishing was almost incidental and had no significant effects on their populations. However, due to the large increase in the value of shark's fins in Asia and the decline of more traditional fish populations for human consumption, sharks became target fishing around the world, promoting the inclusion of several species in the list of endangered species. Among the most exploited sharks, the pelagic species exhibit greater complexity in the assessment and monitoring of their populations due to their distribution in broad geographical areas. From these species, the mako shark, *Isurus oxyrinchus*, of global occurrence, is among the main species that show vulnerability signs, with a trend to deplete population, and however, evaluations that facilitate appropriate management of fisheries of the species are still inconsistent. Studies related to genetic structure of fish populations have contributed substantially to the elucidation of issues such as genetic variability, geographical distribution, migration patterns, reproductive stocks, taxonomy, systematics, and historical events. These aspects are especially relevant to the fisheries sector, providing subsidies for the management and conservation of fish stocks. Considering the urgent need for a sustainable control of fisheries, hampered mainly by the lack of information, this study aimed to characterize the population genetic structure of the shark *I. oxyrinchus* in the Atlantic Ocean, using sequences of mitochondrial DNA control region (D-loop) as a tool for conservation and delimitation of fisheries stocks. We analyzed 144 individuals and analysis of 729 nucleotide base pairs of this specific genomic region allowed the characterization of 27 haplotypes, with 18 of these haplotypes (67%) being shared by individuals of all regions sampled. The results indicate the occurrence of a moderate genetic variability ($\pi = 0.004$, and $h = 0.791 \pm 0.029$), with high population structure between the northern and southern hemispheres (F_{ST} values: 0.245), characterizing two fish stocks in the sampled area. The analysis also revealed the existence of a relationship between geographic distance and genetic variability among the groups mentioned, plus a possible interference of ocean currents of warm waters in the migration of individuals. Understanding how these populations behave, their patterns of gene flow and the distinction of different evolutionary units must be taken into consideration for the planning of effective conservationist actions of *I. oxyrinchus*.

CURRENT STATUS OF THE EEL IN REGION OF MURCIA

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The eel (*Anguilla anguilla*) was a widely distributed species on historical times both on permanent water courses and in the Mar Menor lagoon. Recent reviews on the epicontinental ichthyofauna and on the species on the Region of Murcia, pointed out to its extinction on the Segura river. In order to know the status of the species in the Region of Murcia they were compiled cites and fishery statistics (from 1988) about the species. Moreover, the species was accidentally captured during a sampling scheme oriented to the Mediterranean turtle and they were carried out specific sampling with eel creels on different water bodies.

The fishery statistics show an important decline of the eel captures on the Mar Menor lagoon on the second half of 1990s, sharply contrasting with the recommendations of the Regional Recovery Plan for the species.

New localities were detected in water courses and canals discharging in the Mediterranean and in the Mar Menor lagoon, and they were obtained cites of the species in the Segura river suggesting a recolonization process. The information obtained recommends to update the Recovery Plan of the species for the Region of Murcia including the Segura river in the distribution area as well as to evaluate the decline of the captures in the Mar Menor lagoon

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GROWTH, SURVIVAL AND RETENTION RATES OF PIT-TAG MARKS IN EUROPEAN EEL (*ANGUILLA ANGUILLA*), IN CULTURING TRIAL

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Management plans for the recovery of the European eel (*Anguilla anguilla*) often included the monitoring of wild or restocked individuals using mark-recapture techniques. One of the more popular mark are electronic PIT-tags. Although it has been widely used, there are few studies on the possible effects on the growth or survival of the European eel, as well as mark retention. Regarding this issue, it has been developed a study using culturing trials to determine the effect and long term retention. A total of 120 eels divides in three size groups (I: 200-300 mm , II : 300-400 mm and III :> 400 mm) were tagged with PIT-tag (HP79 , Biomark) in two positions (1) insertion in the abdominal body cavity and (2) insertion into the dorsa muscle. In both cases the insertion was performed using an injector MK7 after anesthetizing the fish. Case-control eels were anesthetized and handled in the same way, except for the incision of the tag. All individuals were kept in tanks for a total of 213 days. In order to estimate the growth, survival and mark retention fish were examined every 60 days and both length and weight were recorded for each individual. At the end of the experiment the 95 % of tagged and untagged eels survived showing the logistic regression significant differences in the case of group I.

This group also presented lower tag retention in the dorsal zone. For the rest of cases, the retention was 99% until the end of the experiment. No significant differences in growth between tagged and untagged individuals were observed. Significant differences were observed on growth rate between individuals of the same group marked, which is common in stocked individuals where access to resources is not equal. The results suggest that the use of PIT-tag type has no significant effects on the growth rate of individuals with a minimum total length of 200 mm, although it is suitable tagging eels larger than 300 mm in order to improve tag retention.

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IMPACT OF ILLEGAL GLASS EEL (*ANGUILLA ANGUILLA*) FISHERY ON ESTUARINE FISH STOCKS: A CASE STUDY IN THE MONDEGO ESTUARY

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In estuaries, illegal fishing is one of main activities that affects a wide range of species during their life cycle, leading to the decline of total abundances, damage in fish stocks and overexploitation of juveniles in both the target species and incidental ones (by-catch). In North-eastern Atlantic estuaries, the European eel (*Anguilla anguilla*) juveniles are particularly targeted during the glass eel stage This European eel is a catadromous species, whose larval stages and juveniles migrate to European rivers, using estuaries as feeding grounds and as a part of their migratory route towards freshwaters. In Portugal, fishing eel juveniles is not allowed (with the exception of the Minho river); despite this, a substantial amount of illegal fishing takes place during the migratory season, which influences this species' stocks, as well as other species that are retained in these nets.

Our case study aimed at studying of the impacts of illegal fishing of these juvenile stages in the Mondego estuary (Portugal) in both target and non-target species. With this work, the specific objectives were to quantify the total amount of glass eels captured during a fishing season, to determine inter annual variability in glass eel catches and in specific marine/estuarine fish species, and to infer the existence of interannual variability in total catches, taking into account different hydrological scenarios (Dry vs Regular; Autumn vs Winter). Focus was given on the European eel, as well as on five other species, due to their high abundance and/or economic importance: *Platichthys flesus*, *Solea solea*, *Dicentrarchus labrax*, *Pomatoschistus minutus* and *Pomatoschistus microps*.

Data corresponded to 17 fishing nets collected in the Mondego estuary between November 2011 and March 2013. The contents of each net were sorted, and all fish identified, measured (total length) and weighed (wet weight) individually. Preliminary results showed differences between the two fishing seasons: a higher number of glass eel juveniles were observed in 2012-2013 (regular year), particularly in autumn. Results also indicated higher species diversity in the regular year, during the autumn months, as well as the highest number of individuals. Higher catches of the most abundant species were also observed in the regular period, when compared to the dry period, suggesting that the magnitude of impact of these illegal practices might be related with the hydrological cycles. Our case study is a contribution to the understanding the impacts of illegal fisheries in fish stocks, especially in estuarine areas.

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EELS IN A TIDAL FRESHWATER WETLAND OF RIVER MINHO: HOW DO THEY GROW?

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European eel, *Anguilla anguilla* (L.) is distributed throughout the European continent and the North of Africa and performs a long and complex life cycle. Inland ecosystems play important roles for this species, as they are used during several years for growth prior to a stoical migration. In this sense, Tidal Freshwater Wetlands (TFWs) are gaining extreme importance following the fragmentation of freshwater habitats in European streams in recent years. Therefore, with this work, we aim at understanding the role of the TFW for eels from river Minho.

The study of growth, age, abundance, sexual maturity was performed in 1002 eels which were collected with fyke nets. The content of the 5 fyke nets (minimum mesh size: 10 cm) was removed periodically (7 days between collection in average) between January 2007 and December 2013. The eels were marked with Passive Integrated Transponder (PIT) Tags and injected with Terramycin for otolith mark, and released in the same TFW. Biometrical parameters (total length in cm, total weight in g, pectoral fin and vertical and horizontal eye diameter in mm) were also recorded for silvering stage determination.

A total of 234 eels were recaptured (23.3%) and biometrical parameters were measured. Eels marked more than one year before (n=106) were additionally used for otolith readings (54 of them were used for validation of age) and sex determination (n=110).

Our results revealed that eels growth in this TFW do not show any relationship with time, and overall growth values grouped by size class ranged between 1.1 and 11.7 cm per year. Besides, eels with similar length had different ages. The females were always more abundant than males (range from 59 to 78 % per year) and silver eels were not abundant in the TFW (0.12 % of females, and 0.84 % of males) and therefore it may indicate that TFWs are important habitats for pre-migrant eels. However, the abundance of eels during the period of the study seemed to decrease and such fact should be further studied.

MAKING FISH ECOLOGY EASIER: EXTRACTING REPRODUCTION INFORMATION FROM LENGTH-WEIGHT RELATIONSHIP

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Ecological data are data intensive, generally expensive to collect and individual observations are often irreplaceable. Thus, extract the maximum information from a given dataset is interesting to improve the viability of the study. As length-weight data are available for many fish species, extract additional information from this relationship may be useful, so, the aim of this work is to identify the size of first sexual maturity using the length-weight relationship. We use a databank with 3811 length-weight information of *M. Furnieri* collected in Rio Grande, Southern Brazil. The first step was to adjust a simple Huxley equation. By plotting proportional residuals as function of the observed standard length we identify the growth pattern. Any residual pattern different from zero-centered horizontal distribution suggests the presence of a growth anomaly, and this specific trend may be related to the attainment of sexual maturity. The second step was to adjust the polyphasic equation. Each phase was described by an independent power equation controlled by a switch function. Was identified a change in the growth pattern in 36.8 cm (± 0.88 cm). According to published data, females and males of *M. furnieri* reaches the size at first maturity in Southern Brazil at 35 and 33 cm in length respectively, close to our results. Thus, the length-weight relationship, when studied with complex models that considers the changes in the growth pattern, can be useful extract reproduction information, providing a better description of relative growth. Furthermore, the use of a model that considers changes in growth pattern of the species, although more complex, is justified by the increase of biological representation.

LIFE-HISTORY VARIABILITY OF A CYPRINID SPECIES WITHIN NON-REGULATED AND REGULATED RIVERS FROM PERMANENT AND TEMPORARY MEDITERRANEAN BASINS

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Streamflow variability has been suggested as a driver of intra-specific life-history variations among freshwater fish populations. During one year we collected bi-monthly and fortnightly samples within four populations of Iberian barbel, inhabiting permanent and temporary non-regulated and regulated Mediterranean rivers. We analyzed data for fish age, growth and reproduction in order to: (i) compare barbel life-cycles between permanent and temporary non-regulated rivers; (ii) assess the effect of two types of flow regulation on these traits; and (iii) identify flow variables significantly related with growth and reproductive cycles. Regional life-history differences were mainly related with the age of first maturation, growth rate and timing and duration of reproductive season. Flow regulation promoted a decrease of fish growth rate, condition and gonad activity, and an increase of maximal length and longevity. Growth and reproductive intra-annual variations were related with temperature and some streamflow components, namely the duration of high flow peaks and fall rates, and the number of null flow days. This study offers a multi-regional perspective on the relationship between fish biological cycles and streamflow variability, and provides water resource managers with a much needed perspective on the effect of anthropogenic alteration of streamflow magnitudes.

REPRODUCTIVE ECOLOGY OF *PROCHILODUS BREVIS* AN ENDEMIC FISH FROM THE SEMIARID REGION OF BRAZIL

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The commercially important migratory fish *Prochilodus brevis* is from the Neotropical region, and understanding the reproductive ecology of this potamodromous fish is essential for its conservation and management. This study investigated the length-mass relationship, sex ratio, length at first gonadal maturity, gonadal development stages, gonadosomatic index, condition factor, and reproductive period of *P. brevis*. Temporal distribution of rainfall, temperature, dissolved oxygen concentration, pH, and electrical conductivity of the water were related to the reproductive period of this fish. Rainfall seems to be the main environmental factor which modulates changes in limnological parameters and the timing of the spawning period of this fish. *P. brevis* migrates into lower reaches of the river to feed during the dry season and returns to the upper reaches during the rainy season to spawn. Inadequate facilities for migration create obstacles for spawning success of this ecologically important fish.

REPRODUCTIVE BIOLOGY OF *APHANIUS VILLWOCKI*, IN ÖZDERE CREEK, TURKEY

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Understanding biology and ecology of endemic fish species, is key to conduct conservation plans and therefore to hand them down to the next generations. *Aphanius* is the only representative of Cyprinodontidae family in Turkey and has nine valid species in Anatolia. *Aphanius villwocki* is an endemic and poorly known species which was described in the upper Sakarya River Basin in 2003 (Hrberk and Wildekamp, 2003). It is distinguished from the other Anatolian *Aphanius* species by maximum size, adult color pattern and mitochondrial DNA sequences.

We studied reproduction characteristics of *Aphanius villwocki* from Özdere Creek/Sakarya River/Turkey. Fish specimens were caught monthly intervals between June 2012 and June 2013 by using a dip net having 4 mm mesh size. The samples were anesthetized by clove oil and fixed in 4% formalin solution to be transported to the laboratory. We captured 1793 fish specimens for determining ratio of males to females. After recording their sex, we chose 40 – 50 specimens among all and released the remaining. The length, weight and sex of 748 individuals were recorded. Maximum total length and body weight was recorded as 70.6 mm and 6.865 g, respectively for females. Maximum total length and body weight of the males were recorded as 61.5 mm and 3.968 g, respectively. Females have higher values of length and weight than males.

Of the total fish examined, % 52.14 (390) were females, %45.59 (341) males and % 2.27 (17) were unsexed juveniles. Overall ratio of males to females was 1 : 1.78 . The gonadosomatic index values indicated spawning to be from March to August. The maximum fecundity was found as 85 eggs. Relationships between fecundity-length, and fecundity-weight were described by the following equations : $F = 23,999 \times TL^{0.1993}$ ($R^2 = 0,4981$), $F = 0,1924 \times W^{0.6767}$ ($R^2 = 0,5185$).

The mean egg diameter was 1.80 mm. The egg diameters of the examined specimens range between 1.3 mm and 2.72 mm.

THE CONDITION FACTOR AND HISTOPATHOLOGIC EVALUATION IN NEOTROPICAL FISHES (*ASTYANAX SPP*, CHARACIDAE: TETRAGONOPTERINAE) FROM AQUATIC ENVIRONMENTS UNDER DIFFERENT LEVELS OF HUMAN IMPACT

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Somatic Indices (length-weight - L_s / W_t , hepatosomatic - IHS, gonadosomatic - GSI and condition factor - K), histopathology of gills and liver tissue were evaluated in *Astyanax* spp., sampled in rivers from Neotropical region, which have different levels of human interference. The females reached the highest values of the length-weight and the growth of the individuals in the study area was negative allometric. Fishes of Piava river, which is inserted in the area of environmental protection - APA showed the highest values of condition factor, while the fish collected in the same river, but outside of the APA, presented lower values. The fish of the Antas River showed the highest values of the IHS, which may indicate altered metabolic state. The observed changes in the structures of fish gills may be related to the chronic and sublethal effects of exposure to pollutants. The highest incidences of histopathological changes in liver and gills, occurred in areas located close to urban areas which receive strong organic load and pollutants. The Pinhalzinho River receives domestic and industrial sewage and showed high concentrations of PAHs, which may be contaminating the water body, as revealed by histopathological examination of liver and gills, and this justifies the high rate of neoplasms recorded. The lesions observed indicate that in this environment the fish are suffering the effects of toxic agents present in the water. Histopathology revealed that fish in the environments studied showed signs of stress by parasites and environmental pollutants. Histopathological analysis of liver and gills showed to be a sensitive tool that can be used as a biomarker in the assessment of aquatic contamination in environmental monitoring programs, especially when it comes of sources of public water supply, which requires prior environmental risk assessment before use, besides of presentation of measures for environmental protection and conservation.

THE OCCURRENCE OF *LIGULA INTESTINALIS* IN ITS FISH HOST *RUTILUS RUTILUS* (L.) LIVING IN BÜYÜKÇEKMECE RESERVOIR (İSTANBUL, TURKEY) AND EFFECTS ON THE CONDITION OF THE FISH

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Roach *Rutilus rutilus* (Linnaeus, 1758) is a very common fish species for Turkish inland waters, especially in Büyükçekmece Reservoir (İstanbul). The species is one of the most caught fish species and is of economic value as food even though it is mostly infected by *Ligula intestinalis* (Linnaeus, 1758), a pseudophyllidean cestode causing severe pathological effects on fishes. The aim of the study is to determine the presence of *L. intestinalis* plerocercoids in its fish host *R. rutilus* and investigate the effects of the parasite on the condition of the fish. With this purpose, the fish specimens have captured from Büyükçekmece Reservoir with using gillnets having different mesh sizes (10 × 10 mm, 20 × 20 mm, 30 × 30 mm, 40 × 40 mm and 50 × 50 mm) from March 2009 to April 2010. The fork length and body weight of captured specimens (n = 783) were varied between 6.0–29.0 cm and 2.99–561.00 g. In total, 10.73% of specimens were infected by the plerocercoids. Infection by *L. intestinalis* was observed during summer, autumn and winter months but not spring. Parasitic index (IP %), prevalence (%) and mean intensity of plerocercoids for infected fishes were calculated monthly and, IP was estimated maximum in January as 18.49% while prevalence was 32.31% in July and mean intensity of plerocercoids is 6.0 in October. The mean condition factors of non – infected and infected fishes were 1.7806 and 1.5578, respectively and a significant

difference was recorded in mean condition factors between two groups (Mann-Whitney U Test, $p < 0.05$). Results showed that, *L. intestinalis* plerocercoids seem to be affected significantly on the condition and body health of its host *R. rutilus*.

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TEMPORAL EVALUATION OF EXOGENOUS FOOD OFFER FOR ENTOMOPHAGOUS FISH IN A GALICIAN RIVER

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The main source of food for entomophagous fish is macrozoobenthos, but the contributions of exogenous fauna are an important food resource. This contribution that conforms the surface drift is closely related to the riparian vegetation and weather conditions present at each moment and can be a very important part of the diet of these fish, especially in summer.

In order to carry out the temporal evaluation of exogenous food offer for entomophagous fish chose two sampling stations located in the River Xallas (29T 498362 4757775) and its tributary, the River Beba (29T 497473 4755057) located in Galicia (NW Iberian Peninsula), were selected in areas with heterogeneous habitats, characterized by a narrow riparian forest and meadow on both sides.

To collect riparian insects during the daylight an entomological net was used and for nightlife insects a black light trap was used, which allows to obtain a significant representation of the abundance and diversity of Insects throughout the day.

Samplings were carried out in a weekly basis, since mid-March to late September 2012. This period was limited by the adverse weather conditions that allowed performing efficient samplings only during spring and summer. Despite this, the samples were sufficient to assess the temporal variation of exogenous food offer for entomophagous fish, both in terms of diversity and abundance.

Furthermore, the air and water temperatures were recorded every 30 minutes during the entire sampling period because the temperature is a decisive factor affecting the insect's emergence and their flight.

Finally, the samples were analyzed, identifying the taxa and obtaining as resulted the presence of 3 orders on March, as the minimum value, and 9 on July, as the maximum value was recorded.

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MORPHOLOGICAL CHARACTERS OF *GOBIO LOZANOI* POPULATIONS (SEGURA RIVER BASIN): COMPARISON AT CHANGING FLOW REGIMES.

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Fish inhabit environments greatly varying in intensity of water velocity, and these flow regimes are generally believed to be of major evolutionary significance. The relationship between body shape and swimming performance in order to achieve an optimal energy uptake could also be an important factor for the persistence of fish populations in highly regulated streams. River sectors with non-natural flow regimes that promote fish stress could influence on developmental stability of individuals changing their body shape and losing bilateralism.

This study tested the ability of fish morphology to predict flow regulation effects in their body shape and swimming performance. It attempted to provide effects of flow regulation on morphological traits in order to enhance our understanding of the predictability of phenotypic variation. We compared morphometrical characteristics and the level of fluctuating asymmetry (FA) between two populations of *Gobio lozanoi* (Doadrio & Madeira, 2004), an allochthonous cyprinid to the Segura basin widely distributed in the Iberian Peninsula. The *control* site is situated in the Tus River (TUS), which presents natural flow regime. The *regulated* site is localized in a regulated sector of the Segura River (SEG), between two large reservoirs and downstream from a hydropower plant. It has lost the temporal variation typical of the upper basin and suffers daily flow changes. Four morphometrical measures, eight non-bilateral indexes and two bilateral indexes obtained were compared between the two populations. These parameters were selected to evaluate streamlined shape, fin surface and the level of FA.

The total of 72 specimens caught during autumn 2011 were measured (fork length and total weight) and a sample of 45 individuals (24 in TUS, 21 in SEG) with similar size was selected to obtain morphometrical measures. Populations showed significant differences in somatic condition and fork length with higher values in the regulated site. TUS presented higher body depth, lower values of depth and taper indexes, and longer heads than in SEG population. SEG population showed lower values of peduncle depth and compression metrics and higher values of head width index. Only pectoral fin length showed partial significant differences in FA index with higher values of asymmetry in TUS population.

We cannot conclude about a direct relationship between fish morphology and flow changes with our studied populations, and it is necessary to carry out further research to know the level of flow effects in the body stability shape and bilateral asymmetry in fishes.

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MODELING THE SWIMMING PERFORMANCE OF BARBEL (*LUCIOBARBUS BOCAGEI*) AND NASE (*PSEUDOCHONDROSTOMA DURIENSE*) TO TRAVERSE VELOCITY BARRIERS

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The existence of obstacles in rivers (dams, weirs, culverts, bridges, etc.) that prevent or restrict migration, can lead to significant negative implications for the biology of the species: delays in migration, genetic isolation and even in extreme cases, extinction. Knowledge (quantitative and qualitative) of the swimming ability of the fish is an important aspect that helps to identify barriers to movement. This information is currently scarce, it is necessary to develop design criteria for hydraulic structures that are compatible with the conservation of the fish fauna. Learn to preserve.

Thus, this study focuses on determining the swimming ability, at the period of migration, two Iberian species, barbel (*Luciobarbus bocagei*) and nase (*Pseudochondrostoma duriense*) experimenting in an open channel flow (25 m long, 0.5 m wide and 0.5 m deep and zero slope) allowing fish swim volitionally against different flow velocities. Monitoring is performed by videocameras above on the flume and by PIT system (Passive Integrated Transponder) that consists of 8 antennas located longitudinally every 2 m that are activated by passing a fish with its identifier (TAG) through them. Log: identity of the fish, date, time and antenna.

This information was processed using statistical techniques of survival analysis, modeling the maximum distance by three models: semi-parametric (Cox), parametric and based on swim speed-fatigue time relationship. Models obtained perform an estimation of maximum swimming distance in function of the variables mass, length and condition factor of the fish and the flow velocity.

Making a comparison of these models and their estimates with observed data of the maximum distance reached provides a good approximation to the most appropriate technique to explain the swimming performance of these species.

IBERIAN BARBEL *LUCIOBARBUS BOCAGEI* (STEINDACHNER, 1864) MORPHOLOGY AND SUCCESSFUL FISHWAY ASCENT

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The main objective of this study was to determinate the relationship between the morphology of the cyprinid species Iberian barbel, *Luciobarbus bocagei* (Steindachner, 1864), an endemic potamodromous fish from the Iberian Peninsula that migrates upstream to spawn during spring, and the successful ascent through a fishway.

The knowledge of the relationships among fish morphology, behaviour and swimming capability helps to understand, on the one hand, how the morphology influences in the successful ascent of a fishway and, on the other, how the selection pressure is exerted by the fishway on fish populations.

In this study, 111 individuals of Iberian barbel coming from Cofio River's wild populations (San Martin de la Vega, Madrid) were used to study the effectiveness of a vertical slot fishway, a physical model that was built at Hydrographic Studies Centre-CEDEX. The individuals were marked with PIT tags and released in a downstream pool permitting them to volitionally pass through the fishway during a period of 24 hours with two different flows (100 and 250 litres/second). Furcal length, time to detection by the first downstream antenna and time in the first downstream pool were measured and differences between individuals were analysed using appropriate tests Time to detection scores for the first group, those that passed the fishway successfully, (mean rank = 62,74) were statistically significantly higher than for the second group (mean rank = 46.59), those that did not ($U = 752$, $z = -2.536$, $p = 0.011$). Time in the first pool scores for the first group (mean rank = 61.17) were statistically significantly higher than for the second group (mean rank = 38.13) ($U = 184$, $z = -3.096$, $p = 0.002$).

A MANOVA was carried out to find out morphological differences between behavioural groups and significant differences in shape have been found out (F-statistic: 3.1137, p-value: 0.01162). A Discriminant Analysis (DA) was used to assess differences between the two behavioural groups with a classification total success rate of 72.72%.

Finally, a model, encompassing all the morphological variables as well as other parameters such as flow, was developed to explain the behavioural response. The best model was selected according to the Akaike criterion.

A relationship between shape and behaviour was, therefore, found. It was, moreover, concluded that the fishway exerted a selection pressure on fish population. This study also proves the way in which population shape differences determine the successful passage of the fishway.

METABOLIC INDICATORS (RNA/DNA RATIO AND TOTAL PROTEIN) OF TWO BROWN TROUT POPULATIONS (*SALMO TRUTTA LINNAEUS*, 1758)

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The total protein concentration and the RNA/DNA ratio are two metabolic indicators commonly used in the field of marine ecology for assessing the status of fish condition. These two parameters have been studied in this work for two brown trout (*Salmo trutta* Linnaeus, 1758) populations from the NW of the Iberian Peninsula. Individuals were captured by electrofishing in 2010 and 2011 in the river Landro (UTM: 29T 611269E 4816204N) and Vilameá (UTM: 29T 574278E 4636228N). The sampling stations were located near to the source, both with few signs of human

disturbance. The main difference between the two sites is the higher latitude and height above sea level of the river Landro, which probably implies a different thermal and precipitation conditions.

The trouts were sacrificed at the time of capture and transported under refrigeration at 4 °C to the laboratory. There total and somatic weight, total and fork length, liver weight and gonad weight values were measured and scales were taken for ageing individuals. Furthermore muscle samples were weighed and frozen at -80 °C until be used for protein quantification and RNA/DNA extractions.

Protein extraction was performed with Tris-EDTA (40 mM TRIS, pH 7.8 1mM EDTA) buffer containing protease inhibitor. Quantification was conducted by the BCA colotrimetric method using the commercial kit: *Pierce BCA Protein Assay*. For the extraction of nucleic acids the TRIzol reagent (Invitrogen) was used, allowing the nucleic acids extraction from the same sample. When the extractions were done the RNA was treated with DNase and the DNA with RNase. DNA quantification was performed using a NanoDrop 1000 Spectrophotometer (Thermo) and RNA with Qubit 2.0 fluorometer and RNA BR Assay Kit of Life Technologies

To detect possible differences in the indicators used, due to sex or location conditions, statistical analysis between populations and sexes were performed. A study of correlations of protein levels and RNA/DNA ratio was also performed to check if there was any close relationship between some metabolic and some morphometric indicator index. The results obtained are shown in several graphs and discussed with literature about the theme.

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HEPATIC AND MUSCULAR GLYCOGEN VALUES IN BROWN TROUT (*SALMO TRUTTA* LINNAEUS, 1758), FROM TWO MOUNTAIN RIVERS WITH DIFFERENT THERMAL CONDITIONS

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Throughout 2010 and 2011 several surveys were conducted in two Galician mountain rivers: River Landro (UTM: 29T 611269E 4816204N) and River Vilameá (UTM: 29T 574278E 4636228N). The aim of these surveys was to detect some sign of the possible influence of different thermal regimes on the metabolism of wild brown trout (*Salmo trutta* Linnaeus, 1758) populations. These rivers and the selected sampling sites have similar hydromorphological features; but they differ in latitude and altitude above sea level. River Landro sampling site is located in northernmost position and higher altitude (590 m above sea level at the lowest point of the sampling station), while the station located in the Vilameá River is 180 km further south than the Landro one and about 372 m a.s.l. at its lowest point.

Brown trouts were captured in both rivers by electrofishing, they were sacrificed and transported to the laboratory at 4 °C, where the processing of the samples was carried out and that included: extraction, weighing and storage at -80 °C of different bodies and fragments of muscle and liver tissue for further analysis, and measurement of several morphometric characters.

The fragments of liver and muscle of between 6 and 38 mg were homogenized and processed for extraction of glycogen, which begins with digestion in hot alkali and followed by several precipitations with cold ethanol and a saturated solution of sodium sulfate. Precipitated glycogen was quantified using the anthrone colorimetric method on a cuvette spectrophotometer.

The concentration results obtained were standardized to the weight of the sample to obtain concentration values per gram of fresh tissue. Statistical tests were performed to check for significant differences in the values of liver and muscle glycogen. The values of some morphometric indices calculated were compared and calculating correlations between the concentrations of glycogen and morphometric indices were also performed. Statistical

tests performed using SPSS 19.0 (IBM) reported statistically significant differences between the values of concentration of liver glycogen and condition factor between the two populations studied.

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HONESTY OF A PLASTIC VISUAL SIGNAL IS MAINTAINED BY RECEIVER RETALIATION IN A CICHLID FISH

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Reliability of animal communication has been hotly debated by theoreticians and is still largely undetermined empirically. Variation in how different receivers, such as mates or competitors, acquire and process information requires context-dependent signaling, which increases cheating opportunities. Because of strong conflicts of interest, theory predicts that communication in territorial species should be under strong selection for clear, reliable, signaling. We propose that the facial mask of lifelong territorial cichlid *Neolamprologus brichardi* is one such signal. Using signaling theory, visual models and behavioral experimentation we offer unique insights into a visual signal that evolved stable chromatic and plastic achromatic properties to communicate aggressive intent effectively. Importantly, we provide behavioral evidence that signal honesty is maintained by receiver retaliation costs, keeping the chances for cheating at a low. Hence selection has shaped a pigmentation trait in sexually monochromatic cichlids used in social interactions that simultaneously fulfills criteria of design and honesty.

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EFFECTS OF ENVIRONMENTAL VARIABLES ON FISH USE OF SUBMERGED HABITATS IN BOADELLA RESERVOIR, NE SPAIN

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Fish use of artificial macrophytes and rocky shores was assessed throughout the first 3 months of the 2007 summer drawdown and related to changes in reservoir volume and water temperature, dissolved oxygen, transparency, conductivity and pH. In total, 1,832 individuals of seven fish species were recorded through visual censuses, with introduced perch *Perca fluviatilis* being the prevalent species. Canonical analysis of principal coordinates (CAP) revealed significant differences (axis 1 = 46.1% of total variance; $Tr = 2.89$; $p < 0.001$) between the fish assemblages associated with artificial macrophytes and rocky shores, with the introduced *P. fluviatilis* and *Rutilus rutilus* as the main species of the first habitat and *Micropterus salmoides* being more associated with the latter. The first axis (60.7% of total variance) of the Principal Component Analysis (PCA) showed a trend of increased conductivity and transparency and decreased pH and temperature with the advance of drawdown. Generalized additive models (GAMs) found that total fish abundance and richness at artificial macrophytes were overall positively related to pH and temperature, decreasing gradually with the advance of drawdown and increment of water conductivity and transparency. When applied for the abundances of each fish species separately, GAMs revealed that *P. fluviatilis* and *Abramis brama* were those that most contributed to the general trend found, while *Lepomis gibbosus* showed the opposite pattern, increasing the use of artificial macrophytes with increased water conductivity and transparency. For rocky shores, a single and similar relationship was found for *Cyprinus carpio*, suggesting that environmental variables can affect differentially the fish use of submerged habitats in this mesotrophic and highly-variable reservoir, depending on species- and habitat-specific features.

HABITAT PATCHINESS AFFECTS DISTRIBUTION AND MICROHABITAT USE OF ENDANGERED MIRA CHUB *SQUALIUS TORGALENSIS*

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Despite increasing recognition that resource use by stream fishes may be influenced by resource patchiness and vary over time and throughout ontogeny, few studies analyse both the distribution of resource points in space and time and their effects on different size/age classes of fishes. This likely limits our ability to identify factors influencing the distribution and abundance of fishes, particularly in streams with high habitat and hydrologic variability.

In this study, we examined the influence of patchiness in physical resources on the distribution and microhabitat use of the critically endangered Mira chub *Squalius torgalensis* in the Torgal stream (SW Portugal), using spatially explicit methods. During the study, the stream was characterized by low flows, thus providing important information for the conservation of the species in altered future environments.

We mapped fish abundance and sampled microhabitat use and availability via snorkelling in two stream reaches, in spring 2009 and 2010. We used the coefficient of dispersion in abundance and spatial autocorrelation analyses to characterize chub distribution, and Hurdle models to relate chub presence and abundance to habitat characteristics.

We showed that chub displayed an aggregated distribution, apparently in association with patchily distributed and autocorrelated physical resources, such as debris, roots and aquatic vegetation. Microhabitat use generally was unrelated to velocity, and ontogenetic differences in microhabitat use were not substantial. Nevertheless, sometimes small chub preferred low velocity patches with coarse substrata, debris and roots whereas large chub preferred deeper patches with roots and aquatic vegetation.

Our results indicate that chub respond to resource patchiness by congregating in favourable microhabitats, and that in normal and dry years, velocity may be a poor predictor of fish microhabitat use. Moreover, our results suggest that maintenance of mosaics of patches with variable substrata, cover and depth may be particularly important for the persistence of fish in Mediterranean streams in the face of low flow conditions.

***SQUALIUS MALACITANUS*: HABITAT PREFERENCES AND EVIDENCES OF HYBRIDIZATION WITH *PSEUDUCHONDROSTOMA WILLKOMMII* IN GENAL RIVER (GUADIARO BASIN).**

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Squalius malacitanus is an Iberian endemism inhabiting a set of small mediterranean basins in southern Iberia, such as Guadiaro, Guadalmina and Guadaíza basins. The species is considered Endangered following IUCN criteria. This work analyses the habitat preferences of the species regarding a set of habitat gradients in Genal river (Guadiaro basin), along an annual hydrological cycle. Fish community was sampled by electrofishing techniques, and habitat characterization included physico-chemical and stream structure variables (dissolved oxygen, conductivity, turbidity, N and P concentrations, channel width, current velocity, depth, substrate coarseness ...). Habitat gradients were defined by applying a PCA to the habitat variables described above. A χ^2 -test was used to determine the preferences of *S. malacitanus* with respect to the defined ecological gradients. This analysis is useful for describing species' preference for (or rejection of) certain areas in environmental gradients or to determine whether they are randomly distributed along the gradients. *S. malacitanus* showed a clear preference for the

middle reaches of the stream characterized by intermediate values of current velocity (nearly 0.4 m/s), depth (40 cm depth) and channel width (nearly 11 m). Furthermore, the preferred zones of *S. malacitanus* showed a high level of dissolved oxygen (> 10 mg/L) and water transparency (turbidity <0,70 FTU). Finally, the presence of individuals with intermediate morphological characteristics between *S. malacitanus* and *Pseudochondrostoma willkommii* suggests the existence of hybridization processes among both species in Genal river.

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MONITORING SYMPATRIC NATIVE FISH POPULATIONS (*SALMO TRUTTA*, *SQUALIUS CAROLITERTII*, *SQUALIUS ALBURNOIDES*, *PSEUDOCHONDROSTOMA DURIENSE* AND *LUCIOBARBUS BOCAGEI*) IN THE SABOR RIVER (DOURO BASIN, PORTUGAL) USING PIT TELEMETRY

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Passive integrated transponder (PIT) technology was used to monitor the fish movement and habitat use in a salmonid/cyprinid transition zone of the River Sabor. PIT tags (12 mm long x 2.1 mm diameter) were surgically implanted into 30 autochthonous fish, equally distributed (6 PIT-tags for each species) by five following species: 1) *Salmo trutta* (Total length: 18.7±2.7cm; weight: 70.6±29.9 g), 2) *Squalius carolitertii*, (10.8±0.9cm; 14.9±4.2 g), 3) *Pseudochondrostoma duriense* (11.2±1.0cm; 12.6±3.3 g), 4), *Luciobarbus bocagei* (13.0±0.4cm; 23.1±2.6 g) and 5) *Squalius alburnoides* (7.1±3.5 cm; 5.6±2.7 g). All fishes were captured by electrofishing in the study site. Eight independent antennae, connected to a multi-point decoder (MPD reader) unit, were randomly replaced every three days, in different microhabitats of a blocked reach (30m x 5m) during an observation period of 4 weeks, in august 2010. Fish habitat was previously improved with the incorporation of some boulders and vegetation. All fishes were detected, in spite of more events (antenna detections) were observed for cyprinid than salmonid fishes. The results showed a distinct movement and habitat use by the sympatric fish assemblage. Multivariate techniques (dbRDA, NMDS and CLUSTER analyses) confirmed the distinct interspecies behaviour, more obviously between salmonid and cyprinid fishes. Wild brown trout tended to occupy and maintain the best refugia areas, near riffle and habitat improvement zones, where insect drift provide food. Individual size seems to play a crucial role, since *Squalius alburnoides* and other small fishes are located in the middle of the channel and without cover. Furthermore, these fishes displayed a greater mobility and a diel activity pattern different from wild trout, which displayed a better adaptation to the wild environment. The knowledge of autochthonous fish species behaviour is essential to define adequate management plans, in order to promote their conservation in different threatened ecosystems of northern Portugal.

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ARCHAEO-ICHTHYOLOGICAL EVIDENCE FOR PIKE (*ESOX LUCIUS*): DECIPHERING SPECIES DISTRIBUTION IN THE IBERIAN PENINSULA

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The archaeo-ichthyological analysis of prehistoric sites in the Iberian Peninsula often reveals unexpected faunal assemblages. Despite the spatial and temporal resolution of prehistoric data, those records often go unnoticed in historical ecology and conservation.

We present a revision of the ichthyological assemblages identified in archaeological sites from the Pleistocene and Holocene periods (ca. 300000 – 140000 years and ca. 7000 years BP) across the Iberian Peninsula. The presence of

pike in these archaeological sites raises questions regarding its presence earlier in Pleistocene and Holocene. However, this species was introduced in Iberian Peninsula in 1949, with considerable impacts on the native fishes in Iberian rivers.

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MITOCHONDRIAL GENETIC VARIATIONS IN EASTERN MOSQUITOFISH, *GAMBUSIA HOLBROOKI* INTRODUCED TO WESTERN ANATOLIA, TURKEY: PROXIMITY TO EUROPE RATHER THAN NORTH AMERICA?

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Biotic homogenization through the introduction of invasive species and the extinction of native species are now recognized as the main threats to biodiversity and ecosystem function, particularly in freshwater ecosystems. Eastern mosquitofish (*Gambusia holbrooki*) are native to the south-eastern United States but notoriously invasive elsewhere, and are aggressive predators in ecosystems in which they inhabit. The genetics and evolution of alien species have received far less attention than their ecology but undoubtedly such studies could offer further insights into invasion dynamics since genetic and evolutionary processes may be the key features in determining whether invasive species establish and spread. In the present study, molecular approaches were used to characterize genetic diversity of *G. holbrooki* to understand its role on the species' establishment success in western Anatolia, Turkey. Fish specimens were collected by using electrofishing from shallow parts of several water bodies. Muscle tissue samples were taken from each specimen and used in DNA extraction. Amplifications of mitochondrial cytochrome c oxidase subunit I gene (DNA barcode) were carried out using different combinations of two universal primer pairs. Phylogenetic analyses were conducted using MEGA 5.0 and DnaSP 4.5. Pairwise genetic distance among haplotypes were determined using the Jukes-Cantor model. Maximum Likelihood tree was constructed using the Tamura-Nei method. A phylogenetic network of haplotypes was constructed with the Median-Joining method using Network 4.6. Bootstrap method with 1000 replicates was used to calculate the variance of the difference. Results of this study clearly demonstrate low genetic diversity in Turkish inland waters and three different haplotypes were detected among three populations. Although relatively little information of DNA barcode in GenBank for European populations of *G. holbrooki*, our haplotypes are proximate to the ones in American populations, which are in native range. A comprehensive sampling scheme covering whole Anatolia should provide better insights on *G. holbrooki*.

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IMPACT OF EXOTIC FISH ON THE SOMATIC CONDITION OF ENDANGERED FISH *CYPRINODON MACULARIUS* (CYPRINODONTIFORMES: CYPRINODONTIDAE) IN THE LOWER COLORADO RIVER BASIN (MEXICO)

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We assessed the somatic condition (the y-intercept of the mass-length relationship) of the endangered "desert pupfish" (*Cyprinodon macularius*) and its relationships with the abundance of exotic fishes and environmental variables in the lower Rio Colorado basin, Mexico. The fish catches expressed as catch-per-unit-effort were performed from September 1996 to August 1997 in four localities of Baja California and Sonora. The relationships between the y-intercept of desert pupfish and 16 variables were analyzed using multiple regressions. Values of the

y-intercept for the desert pupfish varied among sampling sites. The study revealed that exotic species biomass was the ecological variable that better explained the variation of somatic condition for the desert pupfish.

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INTRAESPECIFIC VARIABILITY OF *GOBIO LOZANOI* BIOLOGICAL TRAITS BETWEEN DIFFERENT RIVER-TYPE SECTIONS IN A HIGHLY REGULATED MEDITERRANEAN BASIN

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The great plasticity in life history traits of invasive fish species has been proposed as an important factor to understand their invasion success. Moreover, these species usually thrive in modified aquatic ecosystems due to a series of processes which could enhance population fitness (e.g. through attenuation of natural disturbances).

Segura River Basin is an intensely regulated basin located in a semiarid climate region of the southeastern Iberian Peninsula. Its fish assemblage is characterised by low native species richness and the dominance of introduced species. The Pyrenean gudgeon *Gobio lozanoi* is one of the most widespread introduced species in the basin, reaching high densities in several sectors of the Segura and Mundo rivers.

The main objective of this study was to compare several biological traits of *G. lozanoi* populations inhabiting two different river-type sections in the Segura River Basin. Specifically, we compared length, age, growth and condition parameters between populations located upstream river sections in close proximity to reservoirs and those away from reservoirs, and between Segura and Mundo rivers.

Results showed that eviscerated body mass was higher in river sections close to reservoirs than those away from reservoirs, but liver mass did not show significant differences between river-type sections. Eviscerated mass was higher in Segura River than in Mundo River, whereas there was no difference in liver mass. Mean and maximum total lengths and proportion of individuals reaching 4+ and 5+ ages were higher in river sections close to reservoirs. Growth rates g_2 and g_3 did not show significant differences between river sections and between rivers, but g_1 in Mundo River was higher in locations away from reservoirs than those close to reservoirs.

These results suggest the existence of positive effects on several biological traits of *G. lozanoi* populations inhabiting river sections close to reservoirs. This situation was probably related to the fact that reservoirs provide more stable habitat and the species could benefit from these favourable conditions during environmental disturbance periods (e.g. flood or overwintering refuge).

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LIFE-HISTORY TRAITS OF THE INVASIVE SPECIES *ALBURNUS ALBURNUS* IN THE SEGURA RIVER BASIN (SE IBERIAN PENINSULA): VARIABILITY ALONG THE LONGITUDINAL GRADIENTS

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The bleak *Alburnus alburnus* (L., 1758) (Cypriniformes, Cyprinidae) is widely distributed in Europe, and it has rapidly spread to almost the whole Iberian Peninsula as an invasive species. It has been repeatedly introduced as a forage species by anglers in relation to the introduction of major fish predators mainly in lentic aquatic systems. Its rapid expansion and colonization of fluvial habitats illustrates the speed and extent of the dispersal of exotics in Iberian waters. However, few studies exist on its biology and ecology in these aquatic systems.

The purpose of the present study was to analyse the spatial variation in life-history traits of the *A. alburnus* populations in the Segura River basin. This river basin is probably in the most arid zone from Europe and one of the most regulated basins from the Iberian Peninsula. We analysed populations at site level (10 sampling localities in

river sections) estimated from fish parameters (abundance, size and age structure, sex ratio and organosomatic conditions) along the longitudinal gradient in the main rivers of the basin (Segura and Mundo).

The total of 1285 specimens caught during autumn 2009 was measured for length and a sample of 474 individuals was processed to obtain the eviscerated weight, sex determination and organ masses.

The most abundant populations were located in the upper part of the basin, just in the area with major number of larger reservoirs. Fish population traits significantly differed at site level. Both the longitudinal gradient pattern and the environmental variables that accounted for most of the variation in *A. alburnus* biological traits were difficult to explain probably because the relationships were clouded by the high complexity of the ecological interactions. The life history of the species was characterized by a relatively short life span, with five age-classes detected (0+ to 4+). Population size structure showed a range between 3.7 and 17.6 cm of fork length and females were dominant. The average fish size and somatic conditions showed highest values in Mundo River and in the middle part of Segura River, where hepatosomatic and gonadosomatic indices were also higher.

At present, the studied parameters show that *A. alburnus* presents a great ability to adapt to lotic systems because the population traits confirm the viability of this species in the Segura river basin. However, the extreme southeastern environmental conditions and the high hydrological alteration could be critical factors controlling the species in some fluvial sectors. To analyse these assumptions in depth, specific studies should be carried out.

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POPULATION STRUCTURE AND GROWTH PATTERNS OF *LEPOMIS GIBBOSUS* IN MOROCCAN DESERT RIVERS

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Fish introductions are a widespread and increasing phenomenon worldwide, with non-native fish occupying a wide variety of aquatic environments and ecosystems. The successful establishment and spread of non-native fishes is likely related to their biological traits, with tolerance to variable and harsh conditions being key in the invasion of new ecosystems. The pumpkinseed sunfish, *Lepomis gibbosus*, has been introduced in more than 23 countries worldwide, occupying a wide variety of habitats from Scandinavia to the Saharan desert. This species, native to the Great Lakes region in North-America, has successfully invaded rivers in arid areas of Morocco, namely the Draa, Ziz and Ghir basins. These rivers present highly variable environmental conditions, both spatially and temporally. Upstream reaches are cold and little productive habitats, while lower areas are characterized by high temperatures and salinities and by severe drought conditions. The goal of this study is to evaluate the structure and growth patterns of eight populations of pumpkinseed sunfish from the Draa, Ziz and Ghir rivers (6, 1 and 1 population, respectively). Pumpkinseed was frequent and occasionally abundant, particularly in the two large reservoirs of the study area and in regulated downstream reaches. There was considerable variation in size and age structure among pumpkinseed populations. Young (0+ and 1+) small (<40mm) fish dominated in Ghir river, where the pumpkinseed population seems to be recent. In contrast older (>2+) and larger (>50mm) individuals were prevalent in the Ziz river. Maximum longevity of 6 years was recorded in both the Ziz and Draa rivers. Body condition also varied among populations, being the highest in that from the Ziz river. These results suggest that pumpkinseed may show considerable plasticity in life history traits and be able to resist and adapt to local conditions. Based on this and previous results obtained elsewhere, we advance that pumpkinseed has become a successful invader on arid rivers.

TROPHIC PLASTICITY OF A SUCCESSFUL NON-NATIVE FISH PERSISTS THROUGH TIME

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To date, the long-term effects of non-native species on ecosystem functioning are still poorly understood. While it is usually assumed that impacts of non-native species decrease to tolerable levels over time, few studies have, however, monitored invasions to determine their long-term impacts on natural patterns and processes. Pumpkinseed sunfish, *Lepomis gibbosus*, poses serious threats to native fish faunas worldwide, with competition for food resources being often considered as the key driver of negative impact on native biota. However the extent to which *L. gibbosus* may modify its diet over long time frames and have variable impacts on natural ecosystems following initial stages of invasion are unclear.

Here, we investigated this issue by analyzing variation in the diet of pumpkinseed sunfish in 2003 and in 2013 in Lower Guadiana Basin. Fish were sampled at the end of the dry season (September) in the Guadiana, Ardila and Degebe rivers. Stomach contents of a total of 88 individuals were examined and the relative importance of different prey categories was evaluated using the percentage occurrence and the numeric abundance of animal preys. Principal Component Analysis (PCA) was used to summarize variation in diet among years, rivers and throughout ontogeny, with diet breadth and overlap being further evaluated using the Schoener and Shannon-Weaver indices, respectively. We found that there was considerable variation in diet among sites in both years, with small (30-60mm SL) and large fish (61-90mm SL) generally showing similar diets. Variation over time was not consistent among rivers, with diets experiencing considerable shifts in the Guadiana but remaining largely stable in the Ardila. In the Guadiana large fish mainly preyed on Cladocerans and Copepods in 2003 but shifted to Ephemeroptera and Chironomids in 2013. In the Degebe Cladocerans were the staple prey in both years but Copepods were replaced by Ostracods and Molluscs as important preys between 2003 and 2013. In the Ardila, Chironomids were always prevalent in the diet. Diet breadth was particularly low in the Ardila, while diet overlap, among size classes, was the highest. Although prey availability was not known, our results suggest that *L. gibbosus* maintains considerable trophic plasticity over time, with changes in diet occurring locally for both small and large individuals. The extent to which these changes might impact local assemblages will be contingent upon prey availability and on the trophic plasticity of native species.

THE ALTERED HABITATS IN IBERIAN RIVERS DO THEY GO IN FAVOUR OF THE PRESENCE AND ABUNDANCE OF THE EXOTIC PUMPKINSEED SUNFISH?

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The pumpkinseed sunfish (*Lepomis gibbosus*) has been described as one of the most invasive fish species in Europe, thanks to its high biological plasticity. The increase of altered habitat, due to either anthropogenic causes or climate change, can lead exotic species to have positive trends in their distribution and abundance. From 2009 to 2010, 27 river stretches in Muga, Fluvia and Ter rivers (NE Iberian Peninsula) were sampled seasonally (May-June, August-September and February). Electrofishing was used to catch fish and, size structure, fish density, fish condition and diversity of sizes were estimated. Moreover, a description of the habitat was obtained based on various parameters related to the alteration or impacts over the watershed. The results show that the distribution

and abundance of pumpkinseed sunfish in the studied rivers are favoured by anthropogenic river disturbance. River stretches with greater presence of lentic habitats (still water habitats) mainly originate from anthropogenic disturbances, show higher values of fish abundance of this species. The distribution of pumpkinseed sunfish in the studied rivers follows different patterns that are related to anthropogenic disturbance and not a longitudinal gradient. This work demonstrates how an alien species, the pumpkinseed sunfish in this case, is favoured by habitat degradation and disturbance to the detriment of native fish species.

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CARASSIUS GIBELIO A NEW INVADER IN IBERIAN PENINSULA

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Iberian Peninsula faces rapid invasions of non-native species over the past decades. Some of these invaders are perceptible but there are those which arrive “silently”. Genus *Carassius* have been represented there by feral goldfish *Carassius auratus*. The goldfish populations are descendant of released ornamental individuals and little is known about their potential impacts. Recently, significant increase of putative goldfish individuals in Iberian watersheds raised doubts if all *Carassius* fishes belong to this taxon. Here we present genetic analysis showing multiple occurrence of another taxon - invasive polyploid biotype of Prussian carp *Carassius gibelio*. We can state that, by invading Iberian Peninsula, spreading of this highly invasive species all over the Europe is, unfortunately, complete.

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NON-INDIGENOUS FISH IN THE FRESH AND MARINE WATERS OF THE MADEIRA ARCHIPELAGO

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Non-indigenous species (NIS) invasions occur in aquatic and terrestrial ecosystems on a global scale and can create major ecological, evolutionary, economic and social pressures. In the last decade, lists of non-indigenous species have been produced for several European countries. To the best of our knowledge there are only three NIS inventories for Portugal: i) marine invertebrates and algae of the Azores; ii) marine invertebrates and algae of Madeira; and iii) freshwater fishes of Portugal, Madeira and Azores. For the past 20 years, several species of marine fishes from tropical and subtropical seas have been registered for Madeira, possible due to global warming. As a result, these new records have been expanding their distribution range, particularly its north limit. Here we present the first account of marine and freshwater non-indigenous fishes of the Madeira island system, including what we believe are range expansions. We have identified a total of 23 fish species that are either introduced to Madeira or are considered range expansions. Two freshwater fishes and one marine fish are non-indigenous while twenty marine fish species are range expansions.

GLOBAL GENETIC DIVERSITY OF NATIVE CYPRINIDS IN THE IBERIAN PENINSULA

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One of the main goals of the FISHATLAS project was to characterize the genetic diversity of native Iberian cyprinids. The analysis of the cytochrome *b* gene diversity of over 300 populations of *Squalius*, *Barbus*, *Achondrostoma*, *Iberochondrostoma* and *Pseudochondrostoma* showed a latitudinal gradient, with the northern populations being less diversified than the southern ones.

MOLECULAR SYSTEMATIC OF THE GENUS PHOXINUS RAFINESQUE, 1820 (ACTYNOPTERYGII: CYPRINIDAE) IN THE IBERIAN PENINSULA

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Genus *Phoxinus* has, during these last years, undergone numerous taxonomic changes. Since the early 20th century, it has been accepted that there is a single species in Western Europe, *Phoxinus phoxinus* (L., 1758). A current systematic revision (Kottelat, 2007) based on morphological characters differentiated three European species within the genus: *P. bigerri* from Adour drainage, France and the upper Ebro drainage, Spain, *P. septimaniae* from Languedoc, France, and *P. strymonicus* from Strymon drainage, Greece. Kottelat and Freyhof (2007) warn that the identification of the Iberian minnow populations as *P. bigerri* is tentative, as Kottelat (2007) did not analyze samples from Iberia. However, in a recent international standardization of common names of Iberian endemic freshwater fishes, Iberian minnow populations have been renamed as Pyrenean minnow *P. bigerri* Kottelat, 2007 (Leunda *et al.* 2009). The species is considered to be endemic to the Adour (SW France) and Ebro (NE Spain) basins, as well as some small watersheds in North Spain (Kottelat 2007; Kottelat and Freyhof 2007) forming a continuum in its Northern distribution, in the Cantabric slope (Doadrio, 2001). A recent study (Sánchez-Fernández *et al.*, 2012) includes the Atlantic slope of Galicia (Northeast of Spain) within the distribution of *P. bigerri*. Thus, systematic of genus *Phoxinus* in South Europe in general, and in the Iberian Peninsula in particular, is based only on morphological characters. There are no previous molecular studies that analyze these populations. The aim of this study was to offer nuclear and mitochondrial molecular data to our better comprehension of the taxonomy of the genus *Phoxinus* in the Iberian Peninsula.

INTEGRATING MITOCHONDRIAL GENETIC DIVERSITY AND CLIMATIC NICHE MODELLING IN THE IBERIAN ENDEMIC SPECIES *SQUALIUS VALENTINUS* DOADRIO AND CARMONA, 2006 (ACTINOPTERYGII, CYPRINIDAE)

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The Spanish Levantine region is characterized by irregular and poorly predictable patterns defined by the Mediterranean climate. These climatic patterns sometimes are catastrophic and they have influenced aquatic communities since Middle Pliocene, when summer droughts become established. One endemic freshwater fish species inhabiting this region is *Squalius valentinus* (Doadrio and Carmona, 2006). The distribution range of *S. valentinus* in the Spanish Levantine area offers the opportunity to assess the response of primary freshwater fishes to fluctuating, and sometimes extreme, Mediterranean climatic conditions. In order to understand how past climatic processes have shaped the current genetic diversity of *S. valentinus* the aims of this study were as follow: 1) to draw the mitochondrial genetic diversity of *S. valentinus* along its distribution range; 2) to model potential species distribution through different time periods based on climatic variables. Our findings evidence the important role of stable environmental conditions found in small springs from the Spanish Levantine area as habitat refuge for keeping well-preserved and genetically diverse *S. valentinus* populations. These populations from stable habitats retain high values of genetic diversity. On the other hand, we found a lower genetic diversity in the margins of the distribution range populations.

EFFECTS OF PLEISTOCENE MARINE TRANSGRESIONS ON THE EVOLUTIONARY HISTORY OF THE GENUS *SQUALIUS* (ACTINOPTERYGII, CYPRINIDAE) IN SOUTHERN IBERIA

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Primary freshwater fishes, whose dispersion is limited mainly to inside river basins, which could be regarded as terrestrial islands, are commonly used with biogeographical purposes. The Gibraltar Strait area is one of the most complex biogeographical regions during the Cenozoic due to tectonical and climatic processes, which must severely affect to populations of organisms inhabiting this area. To study the effects that these geological and climatic events could have had above populations of freshwater fishes inhabiting Southern Spain, we realized a phylogeographical and demographic approach of two species: *Squalius malacitanus* and *Squalius pyrenaicus*, using cytochrome *b* (mtDNA) and RAG-1 (nDNA) as molecular markers. Both *S. malacitanus* and *S. pyrenaicus* are primary fish belonging to Cyprinidae family and are endemic from the Iberian Peninsula. The species *S. malacitanus* has a more restricted distribution area, is only present in southern Spain, and has been listed as endangered (Kottelat and Freyhof, 2007). We carried out a study of *S. malacitanus* habitat availability to predict its future distribution and the most important variables to improve its conservation status. In the phylogenetic study our results showed four well-differenced groups, divided into two main phylogroups, belonging to each studied species and reflecting an allopatric distribution. The two groups found in the species *Squalius malacitanus* have higher divergences than *S. pyrenaicus* and are distributed one by the Atlantic slope of Gibraltar Strait and the other by the Mediterranean one. In both species, Mediterranean populations showed a lower genetic diversity than Atlantic populations and we observed a correlation between area basin and genetic diversity. Moreover, we conducted a molecular and morphometric study of Atlantic and Mediterranean populations to characterize the two populations from a taxonomic point of view.

PHYLOGENY AND PHYLOGEOGRAPHY OF *SQUALIUS SQUALUS* (BONAPARTE, 1837) AND *SQUALIUS JANAE* (BOGUTSKAYA AND ZUPANCIC, 2010) (ACTINOPTERYGII, CYPRINIDAE): EVIDENCE FOR CRYPTIC DIVERSITY

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The genus *Squalius* is distributed throughout Mediterranean basin and it has almost fifty described species, most of them endemic from southern Mediterranean peninsulas. The Italian Peninsula and the Eastern Adriatic region are inhabited by several *Squalius* species, the majority restricted to a few river basins, although one species, *Squalius squalus*, show a wide distribution range across the region. The Istrian Peninsula is inhabited by two species, *S. squalius* and *S. janae*. The morphological distinguishing between both species is clear, however, the molecular interspecific differentiation between them and the intraspecific diversity of each species across their entire distribution range is unknown. In this paper we disentangle the phylogenetic and phylogeographic relationships of *S. squalus* and *S. janae* on the basis of mitochondrial and nuclear markers. We found a complex mitochondrial genetic structure when both species are analysed together. Populations from the Eastern Adriatic slope as well as those from the Isonzo basin constituted isolated haplogroups and point out the presence of cryptic diversity within the group. However, the lack of nuclear structure found suggests that processes such incomplete lineage sorting or recent speciation may be involved within the species tandem formed by *S. squalius* and *S. janae*.

FIRST APPROXIMATIONS TO THE EVOLUTIONARY HISTORY OF THE NEW *SQUALIUS* ALLOPOLYPLOID COMPLEX IN THE GUADIANA RIVER

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The colonization of the Guadiana basin by hybrid-genetic complex of *Squalius alburnoides* is dated to the last 700.000 years. However, in the last decade, the existence of a new hybrid complex (called "rare") with similar reproductive strategies to *S. alburnoides* was recorded. Its origin is possibly the result of strong climatic variations or historical phenomena configuration of the basin. Unlike *S. alburnoides*, triploid and diploid females are the new complex. Using molecular markers, it has been determined that the new complex has the same mitochondrial lineage of *S. alburnoides* and *S. pyrenaicus* (P genome) with the participation of both parent species: *S. alburnoides* (genome A) and a sister species representatives of the genus in Portugal, *S. torgalensis* and *S. aradensis* (R genome). While, *S. alburnoides* crossbreed with *S. pyrenaicus*, the new complex apparently crossbreeds with non-hybrid males of *S. alburnoides* (AA), the genome P was no detected and there are no records of tetraploid individuals. This suggests that happened a number of historical events of connection and disconnection of the habitat, which was isolated *S. pyrenaicus* long enough until a gamete incompatibility between it and the new complex was established, even older than speciation event of *S. aradensis* and *S. torgalensis*. Such isolation could also lead to loss of sexuality. This incompatibility was not established with *S. alburnoides*, possibly due to the high ability of the latter to hybridize. So far, we have inferred the impact that this condition has: the reduction of polyploidy, reduction in genetic diversity, genome-level competition with the genome A, morphological variation and population reduction. The new complex may be an example of a group of organisms that, when exposed to a multitude of historical and climatic events in combination with other species colonization, has continued evolutionary strategies with less success than *S. alburnoides* to maintain their populations. The comparison of the strategies followed by *S. alburnoides* and the new complex *Squalius sp* are key to understand the pathways that lead to speciation in hybrid fish complex.

DYNAMICS OF THE RETROSTRANSPOSON REX3 IN IBERIAN FISH GENOMES: HOMOPLOID VS. POLYPLOID COMPLEXES

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The Iberian species complexes of *Chondrostoma s.l.* and *Squalius* (Cyprinidae) are good models to study chromosome evolution in a hybrid context (homoploid or polyploid). These complexes are highly diversified despite maintaining the karyotype macrostructure. The best known case of hybridization amongst Iberian *Chondrostoma s.l.* involves *Achondrostoma oligolepis* and either *Pseudochondrostoma duriense* or *P. polylepis*, originating diploid hybrids. The *Squalius alburnoides* complex resulted from the hybridization between *S. pyrenaicus* females (P genome) and males from an unknown species (A genome) closely related to *Anaocypris hispanica* (H genome). It includes males and females with different ploidy levels (2n, 3n, 4n) and genomic compositions (most common: PA, PAA, PPA, PPAA, PPPA, PAAA, AA), interconnected by diverse modes of reproduction from normal meiosis to hybridogenesis or meiotic hybridogenesis (exclusion of one of the genomes from gamete formation). Given the great sub-chromosomal diversity observed in these species, in this work we performed the mapping of Rex3 retroelements to better understand their chromosome evolution. The species *Anaocypris hispanica*, *A. oligolepis* (AOL), *Iberochondrostoma lemmingii*, *I. lusitanicum* (ILU), *P. duriense* (PDU), *P. polylepis* (PPO), *S. pyrenaicus* (SPY) and *S. alburnoides* (SAL) with different genomic compositions (AA, HA, PAA) were included as representatives of both species complexes. Overall, Rex3 evidenced accumulation to centromeres and some telomeres correlating with constitutive heterochromatin and other highly repetitive sequences. However, while in *Chondrostoma s.l.* it did not particularly associate with ribosomal DNAs (rDNAs), in SAL complex this association was found in ≥ 1 pair of chromosomes with 5S rDNA. This accumulation was obvious in ≥ 10 pairs of chromosomes, a pattern that seems to be shared by all the inspected species, likely preceding their divergence. Notwithstanding, species-specific clusters were also found for ILU, PDU and PPO suggesting some differentiation. Most (≥ 15) of the bi-armed chromosomes in the homoploid hybrids evidenced great centromeric accumulation of Rex3 this time also correlating with 5S rDNA. Additionally, big telomeric clusters at the short arms of some chromosome pairs may be associated with translocated 45S rDNA. Conversely, HA and PAA hybrids did not show a higher amount or size of Rex3 clusters. The sequences of Rex3 obtained for AOL and SPY did not render the typical phylogeny for these species. However, its distribution pattern is consistent with an evolutionary tendency to protect its activity and a robust regulatory system. This is the first report of retroelement mapping in Cyprinidae helping to define conceivable ancestral homeologies and to recognize Rex3 activation in homoploid hybrids.

UNDERSTANDING THE REPRODUCTIVE DYNAMICS OF THE *SQUALIUS ALBURNOIDES* ALLOPOLYPLOID COMPLEX: DIFFERENTIAL OOCYTE ALLOCATION AND OFFSPRING VIABILITY AND SURVIVAL

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The viability of crosses between individuals of different species frequently prevents the persistence of hybridization events. However, many exceptions are known in which the hybrid offspring is viable and fertile. The *Squalius alburnoides* allopolyploid complex is an example of great success, being composed by males and females of different genotypes (genomic combinations) and ploidies, whose proportions differ between and within populations, although triploid females are normally dominant. All known genotypes, with sexual and nonsexual reproductive modes, are fertile and cross with each other and with the sympatric *Squalius* species. Factors such as differential viability and survival might be responsible for the observed differences in the proportion of each

genomotype in natural populations. Thus, the present work was aimed at studying these factors by evaluating different parameters in directional crosses occurring between the genomotypes of a target population.

S. alburnoides (PAA females and PA, PAA, PPA and PPAA males) and the sympatric species *S. pyrenaicus* (PP males) individuals were captured in Ocreza river (Tagus river basin) in two consecutive reproductive seasons. The collected individuals mated naturally in compartmentalized tanks which allowed an efficient separation of the eggs from each couple. Each of these experimental tanks was assigned to a single cross type and each compartment contained a single couple (replicated). Oocyte allocation was assessed in all spawning events and the viability and survival of the eggs/larvae were daily monitored. A differential allocation of oocytes easily leads to differences in the reproductive success of males and, therefore, might play a key role in *S. alburnoides* population dynamics.

Significant differences between cross types were found for all studied variables and these discrepancies were analyzed and compared according to the data collected in natural populations. The results revealed that factors such as viability, survival and, in general, the reproductive success may indeed play an important role in the reproductive dynamics of the *S. alburnoides* complex.

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UNDERSTANDING THE REPRODUCTIVE DYNAMICS OF THE *SQUALIUS ALBURNOIDES* ALLOPOLYPLOID COMPLEX: ASSESSING MALE FITNESS WITH PATERNITY ANALYSIS IN A SEMI-NATURAL ENVIRONMENT

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The *Squalius alburnoides* hybrid complex is composed by males and females of different genomotypes (genomic combinations) and ploidies which vary within and among populations, although they are dominated by triploid females. The reproductive dynamics of the complex comprises multiple interactions between genomotypes and with the sympatric bisexual *Squalius* species. All genomotypes are fertile with gametes being produced through several reproductive modes (either sexual or nonsexual). If mate choice occurs differentially, the occurrence of each cross type is not equally probable. However, *S. alburnoides* sexual selection is poorly known and has only been studied in captivity. Therefore, the main objective of this work was to evaluate the reproductive success of the different male genomotypes in a semi-natural environment.

A representative sample of the original population (Ocreza river, Tagus river basin), composed by *S. alburnoides* (PAA females and PA, PAA and PPAA males) and by the sympatric species *S. pyrenaicus* (PP males and females), was transferred to an outdoor pond simulating the habitat natural conditions aimed at allowing the reproduction of the individuals.

Offspring's ploidy, genomic constitution and gender were determined in order to search for similarities between the obtained results and the data collected from the population of origin. Ten microsatellites were genotyped for the initial sample and for an offspring sub-sample ($N=100$) in order to determine the paternity of each descendant and, therefore, evaluating the reproductive success of each male genomotype.

The offspring was mainly composed by triploid females. Microsatellites' genotyping indicated that (a) both males and females mated with more than one individual and (b) the different male genomotypes presented a differential reproductive success. A diploid male (PA), defined as an outlier, produced the great majority of the offspring ($\approx 70\%$). These and some more specific results, as well as their impact in the intra-population dynamics, will be presented and discussed.

PHYLOGEOGRAPHY AND DEMOGRAPHY OF THE CRITICALLY ENDANGERED *ANAECYPRIS HISPANICA*

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We used mitochondrial and nuclear markers to address phylogeographic and demographic data on the critically endangered *Anaecypris hispanica*, using a broad sampling set which covered its known distribution area in the Iberian Peninsula. Our results showed that the populations of *A. hispanica* are strongly differentiated (high and significant Φ_{ST} and F_{ST} values, corroborated by the results from AMOVA and SAMOVA) and genetically diversified. We suggest that the restricted gene flow between populations may have been potentiated by ecological, hydrological and anthropogenic causes. Bayesian skyline plots revealed a signal for expansion for all populations (t_{MRC} between 68kya and 1.33Mya) and a genetic diversity latitudinal gradient was detected between the populations from the Upper (more diversified) and the Lower (less diversified) Guadiana river basin. We postulate a Pleistocenic westwards colonization route for *A. hispanica* in the Guadiana river basin, which is in agreement with the tempo and mode of paleoevolution of this drainage. The colonization of River Guadalquivir around 60kya with migrants from the Upper Guadiana, most likely by stream capture, is also suggested.

DIFFERENT STOCKS OF BROOK LAMPREYS IN SPAIN AND THEIR ORIGIN FROM *LAMPETRA FLUVIATILIS* AT TWO DISTINCT TIMES AND PLACES

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Two *Lampetra planeri* populations are present in the north and northeast Spain (Cares-Deva and Olabidea-Ugarana rivers), being the first of them discovered recently. In this paper the hypothesis that the brook lampreys from these rivers correspond to two distinct and isolated lineages was tested. DNA sequences of the mitochondrial non-coding region I from 49 larvae of the Cares-Deva were used, as well as sequences from the same marker already published from *L. fluviatilis* and from *L. planeri* of the Olabidea-Ugarana. Results obtained show that the two Spanish populations correspond to different genetic units and that the Cares-Deva population is probably a recent offshoot of *L. fluviatilis*, being the Olabidea population less diverse and of more ancient origin.

PHYLOGENETIC RELATIONSHIPS OF THE 'CHUBBYHEAD *BARBUS* SPECIES COMPLEX' FROM SOUTHERN AFRICA

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In southern Africa, there are 8 genera and more than 80 species of Cyprinidae with about 50 species in the genus *Barbus sensu lato* (s.l.). Despite a large number of described species, few studies have focused on the phylogeny of *Barbus* s.l. species.

The 'Chubbyhead Barbs Species Complex' ("small-sized *Barbus*" diploid group; CBSC), with five related and recognised species (*Barbus amatolicus*, *B. anoplus*, *B. breviceps*, *B. gurneyi*, and *B. motebensis*), is one of several putative groups of barbs that need to be tested for monophyly before being accepted in a further formal taxonomic classification. Moreover, because *Barbus anoplus* presents a widespread distribution and high plasticity of morphological features, several authors, based on morphological and cytogenetic approaches, suggested that *B. anoplus* populations from distinct and distant hydrological systems should be differentiated on genetic grounds. Furthermore, it is considered that *B. anoplus* is part of a relatively old fauna originally distributed in the Orange River system from which adjacent populations have been derived through drainage evolution. There would therefore have been enough time for speciation to occur between different populations of this species complex, especially between distinct drainages by including palaeoriver system processes events along the entire South African coast by rising sea levels.

The main objective of this study was to reanalyze the systematics of CBSC and to assess the phylogenetic relationships between and within the five currently described species. In order to achieve such goals, distinct morphologic and molecular analyses were performed to accurately assess the intra- and inter-populations variability patterns. Only phylogenetic relationships are presented.

A total of 321 specimens from 23 river systems were sequenced for three genes: *cytb*, *COI* and *RAG1*. All phylogenetic analyses were performed considering each gene independently.

The final results evidenced that original species represent at least nine lineages corresponding to 11 populations named as following: *B. ?anoplus typica* "Karoo", *B. ?anoplus oraniensis* "HighVeld", *B. ?anoplus* "Southern Cape", *?B. motebensis* "LowVeld-Incomati", *?B. motebensis* "LowVeld-Phongolo", '*Barbus*' "Transkei-Amatola", '*Barbus*' "Transkei-KwaZulu Natal"; three described species (*B. amatolicus*, *B. gurneyi*, and *B. breviceps*) and one undescribed species ('*Barbus*' "Mozambique").

All three genes indicate similar lineages relationships by increasing the number of taxa compared to initial species descriptions. However, not all lineages should be considered as new taxa.

In conclusion, to complete the present study, a revision of CBSC group is necessary based on new lineages proposed. Furthermore, new species descriptions might be anticipated eventually rehabilitating previous CBSC designations.

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HOW MUCH IS A DECADE? GENE POOL VARIATION AND DIVERSITY INDICES IN *LIPOPHRYS PHOLIS* (BLENNIIDAE, TELEOSTEI) IN CENTRAL PORTUGAL

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The shanny *Lipophrys pholis* is a typical benthic rocky intertidal fish and its dispersion is limited to its long larval stage. Previous studies revealed no population structure along European coasts and deep and complex genealogies. A total of 127 specimens, comprising individuals collected in 2003 and 2012-2013, were screened for genetic variation using the mitochondrial control region. Genetic diversity indices were similar and only 3 haplotypes were shared between the two periods. The haplotype network showed a deep genealogy with multiple levels of diversification. Significant genetic differentiation was detected between the two periods ($F_{ST} = 0.035$; P -value = 0.009). The results demonstrate that temporal changes in the gene pool composition need to be considered when evaluating population structure of *L. pholis*.

PHYLOGEOGRAPHIC PATTERN AND GLACIAL REFUGIA OF A ROCKY SHORE SPECIES WITH LIMITED DISPERSAL CAPABILITY: THE CASE OF MONTAGU'S BLENNY (*CORYPHOBLENNIUS GALERITA*, BLENNIIDAE)

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Phylogeographic patterns among coastal fishes are expected to be influenced by distinct ecological, biological and life-history traits, along with historical events and oceanography (past and present). This study focuses on the broad range phylogeography of the Montagu's blenny *Coryphoblennius galerita*, a species with well-known ecological features, strictly tied to rocky environments and with limited dispersal capability. We sampled eleven locations from the western Mediterranean to the Bay of Biscay, including samples from the Macaronesian archipelagos. Mitochondrial DNA control region and the first intron of the S7 ribosomal protein gene were used to address the population structure, the signatures of expansion/contraction events retained in the genealogies and potential glacial refugia. The genetic diversity of the Montagu's blenny was high throughout the sampled area, reaching maximum values in the Mediterranean and western Iberian Peninsula. The results revealed a marked structure of *C. galerita* along the sampled area, with a major separation found between the Mediterranean and the Atlantic populations, and suggesting also a separation between the Azores and the remaining Atlantic locations. Another important feature of this phylogeographic study is the complexity and depth of the genealogies found, as the Montagu's blenny populations showed signatures of events clearly older than the Last Glacial Maximum, with lineages coalescing in early Pleistocene and Pliocene. Three potential glacial refugia where this species might have survived Pleistocene glaciations and from where the recolonization process might have taken place are suggested: South of Iberian Peninsula / North Africa, Mediterranean and Azores.

RESPONSE OF FISH COMMUNITIES TO FISHERIES MANAGEMENT

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This study aimed to evaluate the consequences of fish fauna communities in river Olo to the management imposed by local authorities in 2008 (ZPR river Olo - Regulation No. 206/2008 of 25 February). This is the only case of fisheries management applied to the entire river course. In this context, fish sampling was performed by electrofishing in 12 sections distributed throughout the watercourse. In each section 3 replicates were taken (20 m length each).

The spatial patterns of fish community were obtained by hierarchical classification (cluster) and n-MDS ordination (non-metric Multidimensional Scaling) using Bray-Curtis distance for similarity matrix. These analyses showed the existence of 3 distinct groups, corresponding to a longitudinal typology, allowing a definition of distinct upstream, intermediate and downstream assemblages. ANOSIM and SIMPER similarity analyses. allowed also to identify the contribution of taxa in such similarities/dissimilarities between groups, revealing that *Gobio lozanoi*, contributed to identify the downstream group, followed by *Pseudochondrostoma duriense*, *Squalius carolitertii* and *Luciobarbus bocagei*. On the other hand, *P. duriense*, *Salmo trutta* and *S. carolitertii* were the taxa that contributed mainly to the separation of the intermediate group, whereas *S. carolitertii* and *S. trutta* discriminated the upper group. With

the exception of exotic *G. lozanoi*, the remaining exotic species *Micropterus salmoides* and *Lepomis gibbosus* were limited to the last downstream section (T12), due to the confluence with river Tamega. The *Anguilla anguilla*, was only reported in the downstream section (T11). We must highlight that *Squalius alburnoides* (specie listed as Vulnerable by IUCN) appears only in the lower 3 sites, in spite of the increasing of anthropogenic impacts.

R. Olo presents after the management actions the progressive recover of the intolerant *S. trutta* along, which is present now in the entire river course, and represents a high value for sport fisheries. Thus, the preservation and management of the river Olo is an example of positive actions towards the conservation of native fish populations, increasing the economic value of local resources.

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ECONOMIC FISH TAGGING USED IN TROPICAL SPECIES FROM TABASCO, MÉXICO

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Marking procedures in aquatic organisms have provided important information about biology and ecology of species, as characterization of movements and associations with other animals; based primarily on the identification of specific individuals. The high cost of advanced techniques has hampered its application leading to the search for new alternatives for tagging.

The aim of the study was to test an economic and efficient tagging technique applied to tropical fish from Tabasco, Mexico.

Were used 20 individuals of *Atractosteus tropicus*, 27 of *Vieja synspila*, 17 of *Cichlasoma urophthalmus*, 21 of *Oreochromis niloticus*. Were selected four tagging sites along the fish's body. In *A. tropicus* marking points were: Peduncle (P) and Caudal Fin (CF). In cichlid species: Dorsal Part (DP), Dorsal Fin Base (DFB) and Peduncle (P).

Labeling consisted of external tags that were prepared by glass beads of diameter 3 mm, the assigning of unique codes was based on the imposition of different colors of beads, conforming a specific color for the site where the tag will be placed (Green = peduncle, caudal fin = Yellow, Dorsal part = Blue, Dorsal fin = Red) and a complementary combination indicating the specific record per individual. Tags were set in the body of the fish using steel needles and nylon thread. The evaluation consisted of permanence of tags in the marking sites selected during 40 days. The results in marking site Peduncle in *A. tropicus* showed total prevalence (100%), while results in caudal fin were contrary, where the labels are not persisted. In *V. synspila*, tags persisted in DP point in 27 individuals (100%), in DFB 16 (59.26%) and in P site 23 (85.18%). For *C. urophthalmus*, labels corresponding to DP remained in 17 individuals (100%), the DFB point persisted in 5 (29.41%) in the P site and 23 individuals (41.17%). For *V. synspila* labels persisted in DP point 27 in individuals (100%), DFB 16 (59.26%) and P 23 (85.18%). In *O. niloticus*, tags lasted in DP point in 17 organisms (85.71%), DFB 11 (52.38%) and in the case of only one P (4.76%).

The best marking site in *A. tropicus* proved be peduncle, while in cichlids, the best marking site showed be dorsal part. The cost per label corresponds to \$ 1.14 Mexican pesos (\$ 0.04 UD). The technique demonstrated efficiency and low cost, so it is proposed as an economical alternative to fish tagging.

GESTÃO DA PESCA DO PIRARUCU (*ARAPAIMA GIGAS*) NAS UNIDADES DE CONSERVAÇÃO ESTADUAIS DO AMAZONAS-BRASIL

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O pirarucu (*Arapaima gigas*) é uma espécie de peixe que tem sua pesca proibida no estado do Amazonas, pelas Instruções Normativas do IBAMA 34/2004 (1 de dezembro a 31 de maio) e 01/2005 (1 de junho a 30 de novembro), com exceção da pesca proveniente de áreas manejadas em Unidades de Conservação (UC) e áreas de acordo de pesca regulamentados. Nesse contexto, a gestão da pesca do pirarucu é realizada pelo Centro Estadual de Unidades de Conservação do Amazonas (CEUC), nas Reservas de Desenvolvimento Sustentável Mamirauá, Amanã, Piagaçu Purus e Uacari, através da avaliação das etapas contidas no macroprocesso do manejo (procedimento interno do CEUC que baliza a atividade de manejo pesqueiro), com destaque para a análise das contagens dos estoques que é a referência para a emissão de anuência para a pesca manejada. A contagem é realizada, por manejadores comunitários certificados, através do método de contagem visual para estimar a sua abundância (Castello, 2004), o qual é fundamentado na habilidade de pescadores artesanais experientes em contar o número de pirarucus (tanto adultos como os jovens) no momento que vêm à superfície da água para realizar a respiração aérea. Nessa metodologia adota-se o resultado da contagem de pirarucus adultos do ano anterior como base para solicitar a cota do ano seguinte, prevendo-se a remoção de no máximo 30% dos peixes adultos contados, deixando-se os 70% do restante como forma de assegurar a reprodução e a continuidade da população (Castello 2004; Viana et al.2007). O controle da pesca pelo Estado iniciou em 2007, apesar dessa atividade ser realizada desde 1999. Os dados foram obtidos a partir de análise de relatórios e solicitações de cota enviados ao CEUC por instituições que realizam assessoramento técnico aos manejadores das UCs. A série de dados analisados é referente ao período de 2008 a 2012. Nos últimos seis anos, a produção média de pirarucu proveniente de ambientes aquáticos em UC estadual foi 634,77 toneladas, com destaque para o ano de 2009 com 695 toneladas, a média do faturamento bruto foi de R\$ 2.756.057,47, o faturamento médio por pescador foi de R\$ 1.541,42, o número médio de pescadores envolvidos no manejo foi de 1.787, pertencente a 126 comunidades e o de ambientes aquáticos manejados foi de 618, sendo 98% composto por lagos de várzea. Em 2012, as UCs estaduais foram responsáveis por 74% da produção de pirarucu em todas as 16 áreas manejadas no estado do Amazonas.

MONITORAMENTO PARTICIPATIVO DA PESCA DE ARTESANAL EM UNIDADES DE CONSERVAÇÃO (UC) - RESERVA DE DESENVOLVIMENTO SUSTENTÁVEL (RDS) DE UACARI, AMAZONAS, BRASIL

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A RDS de Uacari é uma UC de Uso Sustentável localizada na Bacia do Rio Juruá. Nela residem 242 famílias de ribeirinhos que sobrevivem da pesca, da caça de subsistência, extrativismo, agricultura e da extração madeireira. O uso de recursos nesta UC vem sendo monitorado de forma participativa desde 2007 pelos próprios moradores locais através do Programa de Monitoramento da Biodiversidade e Uso de Recursos Naturais em UC (ProBUC) sendo a pesca artesanal um dos componentes. Neste programa os moradores, detentores do saber tradicional sobre recursos naturais locais, são capacitados para monitorar esse uso. Os dados foram obtidos através de entrevistas estruturadas padronizadas aplicadas junto ao chefe da família numa amostra de 10 domicílios por comunidade. O formulário traz informações de espécie, quantidade, local, consumo/comércio dos dois dias anteriores a data da entrevista. A série de dados analisadas é do período de 2007 a 2010 (entrevistas semanais) e de 2012 a 2013 (entrevistas quinzenais). Esse monitoramento envolveu 24 monitores em 24 comunidades obtendo como resultado dessa amostra, 33.046 registros de eventos de pesca e o número total de entorno de 263.000 peixes retirados. Na Bacia Amazônica são utilizadas para o consumo, 100 espécies de peixes, sendo que 12 representam 80% do desembarque pesqueiro. Na RDS de Uacari, consideramos que a população local utiliza entorno de 87 espécies para o consumo identificadas localmente com seus respectivos nomes vulgares. Dessas, 39 foram identificados ao nível de espécie, 15 até o gênero, 14 até família e 10 não foram identificados. Espécies importantes como branquinha, cará, piau e piranha foram identificados apenas ao nível de família. Estão distribuídos em 18 famílias e 5 ordens sendo as mais representativas Characiformes com 42,5% seguida de Siluriforme com 33,3%. O pacu (*Mylossoma spp*) aparece como o grupo de espécies mais pescado com 16,3% dos registros com média 15 peixes por registro, seguido do surubim (*Pseudoplatystoma fasciatum*) com 8% e média de 4 peixes, curimatã (*Prochilodus nigricans*) 7,6% e média de 6 peixes, aruanã (*Osteoglossum bicirrhosum*) 7% e média de 3,5 peixes, matrinhã (*Brycon amazonicus*) 6,2% e média de 15 peixes, piau (Characiformes) 5,9% e média de 7 peixes, sardinha (*Triportheus sp.*) 4,8% e média de 17 peixes e piranha (Characiformes) 4,7% e média de 9 peixes. Essa variação demonstra a importância sazonal de disponibilidade de certas espécies de peixes para a população humana local que utilizam de inúmeras espécies não acarretando pressão sobre as populações de peixes.

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PROTECTED AREAS AND STREAM FISH CONSERVATION IN CENTRAL BRAZIL

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Facing the increasing biodiversity loss, protected areas are the main strategy for conservation. However, these protected areas do not always preserve the integrity of the limnic biodiversity. The present study examined if protected areas effectively preserve the diversity of streams fishes in central Brazil. Protected areas had lower species richness and phylogenetic diversity compared to unprotected areas, regardless the presence of exotic species. Protected areas were not designed with the objective of preserving the limnic environments, aiming at complementary habitat and a higher diversity; some species may not be adequately protected. However, populations of endemic species (i.e., restricted-range) and lower occurrences of exotic species were observed in the preserved areas. Definition of protected areas should consider the complementarity of habitats, as well as their connectivity. Similarity (taxonomic and phylogenetic) between areas can be used to maximize the representativeness of regional diversity, while minimizing costs. The management and monitoring of native species populations, especially endemics, contributes to greater efficiency in stream fish conservation.

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MEDITERRANEAN RIVERS WITH LOW HYDROMORPHOLOGICAL IMPACTS CONSTITUTE A REFUGE FOR NATIVE FISH AND AMPHIBIANS, IN FRONT EXPANSION OF EXOTIC AQUATIC SPECIES: THE CASE OF SEVERAL BASINS IN NORTHEAST CATALONIA.

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Several fish surveys in some Mediterranean rivers in northeast Catalonia have been done from 2006 to 2011. These rivers include a wide range of hydromorphological situations, from pristine status to highly degraded situations with hard modifications of flow regime, river bed, riparian forest and even the presence of artificial barriers. Over 300 stations have been sampled, all along 7 hydrologic basins. Fish surveys were based on passive capture techniques. In each sampling station between 3 and 8 small fyke-nets were left on the river along a day, at least, to estimate relative density (CPUE). This capture technique has been useful to detect other species of aquatic fauna, mainly herpetofauna. All the amphibians potentially present have been captured.

In the surveyed rivers 7 native freshwater fish are present, and till 11 species of amphibians can appear on these river habitats. On the other hand, a large number of exotic fish and other aquatic fauna have been established in the area, and have appeared on surveys.

Non altered Mediterranean rivers, with a low or none hydromorphological impacts, are the principal refuge for all these native species, where on the other hand the presence of exotic species is generally very low. These rivers have orders between 3 and 4, mainly. On the lowland plains, in natural conditions, this kind of rivers are typically intermittent during summer, when most of the river bed is dry and the only refuge for fish are isolated pools. In contrast, most of the principal fluvial axis of the area (orders above 4), with high degree of hydromorphological transformations, are intensively invaded with exotic species, native species are absent or scarce, both fish and amphibians.

In this context, only some well preserved Mediterranean rivers arise as refuges for native species in front the progressive establishment and expansion of exotics in impacted fluvial rivers. Unfortunately, these refuges constitute isolated river sections in the context of basins widely modified.

LIFE POTAMO FAUNA, A PROJECT FOR THE RECOVERY AND CONSERVATION OF ENDANGERED RIVER FAUNA IN THE BASINS OF THE TER, FLUVIÀ AND MUGA RIVERS (CATALONIA)

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In January 2014 has started Potamo Fauna LIFE project: "Conservation of river fauna of European interest in the Natura 2000 Network of the basins of the Ter, Muga and Fluvia rivers" (LIFE12 NAT/ES/001091). With a total budget of 1.9 million euros, involve six partners (Consorti de l'Estany, Consorci del Ter, Generalitat de Catalunya, Associació d'Amics de la Tortuga de l'Albera, Forestal Catalana y Universidad del País Vasco) an 6 cofinancers, appart from the European Union, which provides 50% of the overall budget. The overall objective of this project is the recovery and long-term preservation 12 endangered native species of aquatic fauna, including 3 species endangered in Catalonia and Spain, through a wide range of measures: captive breeding, population reinforcements, habitat improvement, control of exotic species, and dissemination and research on the status of these species and the value of river and lake systems.

Among the planned conservation action, the main lines of action planned are:

- Conservation and recovery of riverine populations of three threatened species of aquatic fauna, mainly with specimens coming from captive breeding centers: *Unio elongatulus*, the native crayfish (*Austropotamobius pallipes*) and European Pond Turtle (*Emys orbicularis*).
- Conservation and recovery of populations of three endangered species of aquatic fauna, mainly through translocations of individuals coming from healthy populations into each basin: *Vertigo moulinsiana* and *V. angustior*, and Mediterranean Barbel (*Barbus meridionalis*).
- Improvement of populations of an aquatic turtle and of 5 amphibians in the Ter river, by creating micro wetlands: Mediterranean Turtle (*Mauremys leprosa*), Marbled Newt (*Triturus marmoratus*), Common Midwife Toad (*Alytes obstetricans*), Western Spadefoot (*Pelobates cultripes*), Natterjack Toad (*Bufo calamita*) y Mediterranean Tree Frog (*Hyla meridionalis*).
- Fight against various invasive alien species of crabs, fish, and freshwater mollusks, to mitigate its negative effects on aquatic fauna and their habitats, through a battery of different actions: population control in specific sectors, experiments against aphanomycosis, prevention of penetration, and other.

Plans and milestones of this project are presented.

AN OVERVIEW OF THE FIRST SEVEN YEARS OF THE *EX-SITU* CONSERVATION OF ENDANGERED FISH SPECIES PROJECT

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A pioneer project of *ex-situ* conservation of endangered freshwater fish species started in 2007, aiming to preserve the genetic pool of populations in eminent risk of extinction until their habitats are restored and restocking with captive bred individuals may be accomplished. Stocks from populations of six endangered species were successfully bred under a “naturalistic approach” of reproduction. Eleven restocking actions were already performed, with the release of over 6000 captive bred individuals.

CREATION OF CAPTIVE POPULATION OF SPANISH TOOTHCARP IN IRRIGATION PONDS: BRINGING BIODIVERSITY CLOSER TO FARMERS

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The Spanish toothcarp (*Aphanius iberus*) is a Spanish endemic freshwater fish, with a Mediterranean distribution, which is listed as Endangered in Murcia Region, and nationally, and included in Annex II of the Habitat Directive 92/43/EEC.

Spanish toothcarp groups were released in irrigation ponds of Cartagena -Murcia, Spain in order to create genetic pool of captive population. To do this, we captured individuals from Salinas de Marchamalo population, which is considered the most threatened in Región de Murcia.

Ten irrigation ponds were selected, by their location in Campo de Cartagena, in areas influenced by Mar Menor, the place of origin of the source population. After being visited and prospected, 8 of them were considered appropriate to settle a captive population, due to we do not detect mosquitofish (*Gambusia holbrooki*).

Farmers who own or manage irrigation ponds containing Spanish toothcarp populations received guidance to improve the pond management, and avoid the discharge of toxic substances or the release of alien species that could affect to released fish.

Since the action was launched, some farmers have asked to join the project. The release of Spanish toothcarp in irrigation ponds is shown as an effective measure for the creation of genetic pool of captive population, but especially for bringing the native biodiversity closer to the population in general, and farmers in particular.

EX-SITU BREEDING OF NATIVE UNIONIDS OF LAKE BANYOLES (CATALONIA) IN THE CONTEXT OF A LIFE PROJECT

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Lake Banyoles is the second largest natural lake in the Iberian Peninsula. It is one of the first places in the Iberian Peninsula where planned massive fish introductions. Among other ecological effects, the proliferation of alien fish directly explains the actual rarity of native fish, which constitute the natural host for the parasitic larvae of unionids situation, a dramatic regression of the 4 native unionids of this lake (*Unio mancus*, *U. ravoisieri*, *Potomida littoralis*, and *Anodonta anatina*) has been observed.

Over the past decades, an ecological improvement of this natural site has occurred, thanks to a management geared towards the preservation of natural heritage. However, nowadays the main challenge for the management of the lake and its surroundings is to be found in the invasive alien species. "Projecte Estany" (LIFE 08/NAT/E/000078) is a four year project, from 2010 to 2013. The main objective is to design and implement a large scale intervention to combat, slow down and revert the decline in species and habitats of Community interest through the control of invasive alien species, the population strengthening of seriously threatened native species, and restoration of key patches of riparian habitats.

For the recovery of two *Unio* species, a breeding laboratory has been set up. During the two first years of the Project, several methodologies have been tested in order to obtain mussel gloquidia (larvae), to optimize fish infections, and to achieve a way to growth up juveniles.

Up to 3 different native fish species have been tested as host for local *Unio* larvae: *Barbus meridionalis*, *Squalius laietanus*, and *Salarias fluviatilis*. All them have demonstrated their capacity to play as host and to release viable juveniles, but due to its bigger size, now only the two first are used for posterior intensive mussel breeding, joint with *Luciobarbus graellsii*. Protocol implemented and the results on captive breeding of *Unio* species are shown.

FISH ASSEMBLAGE STRUCTURE IN A RIVER WITH A MODIFIED FLOW REGIME: FIRST INSIGHTS OF THE TOUVEDO DAM ENVIRONMENTAL FLOWS MONITORING PROGRAM

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Environmental flow is a key factor to mitigate the impacts of damming on natural flow regimes and aquatic ecosystems. In specific hydropower schemes, hydropeaking is an additional pressure on fish communities, by imposing changes on daily and seasonal flow patterns according to energy demands. During off-peak periods, fish rely on environmental flow that must provide minimal ecological conditions to sustain fish assemblages. Here we present the first results of the ongoing environment flow monitoring plan of the Touvedo Hydropower Dam Station (Lima river, northern Portugal), for the fish fauna component. Fish assemblages were sampled between 2010 and 2014, in springtime, by electrofishing, in three sites, ranging from 140 to 9800 meters downstream the Touvedo dam. Data collected was used to assess fish assemblage structure variation across the monitoring period by evaluating differences in species turnover rate, constancy in species rank abundances, species richness, relative abundance, and assemblage composition. Fish assemblages were dominated by native species, although non-native *Gobio lozanoi* was subdominant in the most downstream station in 2013. In the upstream station, fish

assemblage was dominated by the European eel, probably due to its capability to avoid drifting and by the barrier effect caused by the Touvedo dam blocking migration, despite the good performance of the existing fish lift. Juveniles represented important components of fish assemblages of downstream stations, but were absent upstream. Species richness and evenness tended to be lower in the upstream station but we found no differences among stations in abundance. Species turnover tended to be higher in the upstream station, but constancy in species rank was similar in the three stations. Overall results indicate that despite regular changes of local habitat quality, fish assemblages tend to be relatively stable in their composition in the medium-long term. The current flow regime appears to allow species to undertake different phases of life cycle, namely migration and reproduction, although impacts on population structure and individuals fitness remain unevaluated. Nevertheless, the monitoring plan is a first step in assessing ecological consequences of the current operation scheme of the Touvedo dam, constituting a reference for future evaluations of alternative schemes and environmental flows.

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MONITORING THE EFFICIENCY OF POOL-TYPE FISHWAY: TWO YEARS RESULTS FROM THE COIMBRA BRIDGE-WEIR

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Fishways are one of the most common measures for the restoration of longitudinal connectivity in rivers impounded by dams or weirs. The Açude-Ponte dam at Coimbra, managed by the Portuguese Environment Agency, is a 6.20 m high weir built in River Mondego mainly for industrial, agricultural and flood control purposes. Since its construction, this structure is blocking the migration of several commercially and ecologically important species such as the sea lamprey (*Petromyzon marinus* L.), the allis shad (*Alosa alosa* L.) and the European eel (*Anguilla anguilla* L.), limiting the distribution and sometimes preventing the life-cycle completion of these and other diadromous and potamodromous fish species inhabiting the Mondego basin. In 2011, a pool type fishway was built in this structure to restore river connectivity and, since then, its efficiency and effectiveness for the target species are being evaluated using several methodologies, namely visual counts, bio-telemetry (radio, physiological EMG, PIT Tags), electrofishing and inquires to the local professional fishermen. Results from the first two years of monitoring indicate that the fishway is already improving fish migration upwards River Mondego. Visual counts revealed that, since its construction and until this moment, about 1,250.000 fish successfully negotiated the infra-structure. These included several autochthonous species, namely, *P. marinus*, *Alosa sp.*, *A. anguilla*, *Salmo trutta*, *Luciobarbus bocagei*, *Pseudochondrostoma polylepis*, *Liza ramada*, and exotic species *Cyprinus carpio*, *Micropterus salmoides*, *Lepomis gibbosus* and *Sander lucioperca*.

From the 28 sea lampreys tagged with radio transmitters and released downstream of the weir, eight (~30%) managed to enter and successfully surpass the fishway, reaching the spawning areas located upstream in the River Mondego and in its tributaries. Electrofishing campaigns conducted before and after fishway construction reveal a tendency to the increase in the abundancy of sea lamprey larvae upstream the weir. Within the project, almost 60 local fishermen were contacted and 10% of them are actively providing their capture data, but efforts are continuously being made to increase this number. Studies for monitoring the fishway efficiency include also the use of a PIT-tag antenna system placed inside of the structure, with a total of 1000 tagged fish from four of the target species, and the use of electromyogram transmitters (EMG) to analyze sea lamprey behavior and muscular effort during fishway negotiation. Results from this study can help to improve the success of the Açude-Ponte fishway in restoring migratory fish populations in River Mondego and can be applied to other similar structures.

PEDRÓGÃO DAM FISH LIFT (PORTUGAL, BEJA) – MONITORING AND EFFECTIVENESS

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The fish lift, was constructed on Pedrógão dam as a mitigation measure to minimize Alqueva and Pedrógão dams barrier effect on Guadiana river fish assemblages.

This measure pretends to reduce the dam barrier effect, allowing to transpose the obstacle and maintain migratory or dispersive movements of diadromous and potamodromous species.

This infrastructure is functioning since 2006, and some monitoring works have been done along this time. In March 2011, EDIA started a project to evaluate and benefit the fish lift effectiveness.

The fish lift survey conditions allowed to make a bathymetric chart of the entrance area, to determine velocity, water temperature and oxygen profiles in different water flow, to clean the entrance channel and collect several water parameters in this area, to evaluate the lift cage and the discharge area. From this work, resulted a set of relevant information to optimize the fish lift operation and measures to improve its effectiveness.

EDIA conducts follow-up actions that allow detecting some fish lift problems contributing to maximize its operation. We are also working to understand if autochthonous species are using Ardila river as reproductive migration destination.

This paper briefly describes some monitoring methods and effectiveness improvement measures.

DESIGN AND MONITORING OF THE EFFECTIVENESS OF A NEW FISH PASSAGE DEVICE IN A STRATEGIC POINT IN THE MARSHES OF THE AIGUAMOLLS NATURAL PARK (CATALONIA)

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A new fish passage device has been built in the Aiguamolls Natural Park, in a strategic position of a channel which is the main hydrological connection between the Integral Natural Reserve of the Llaunes, an extensive area of marshes and coastal lagoons, and the mouth of the river Fluvià. In this channel there's a gate for regulating water level, preventing the free movement of fish in both directions, at least before the construction of this device. The difference in water level between the two sides of the gate ranges from a few centimeters to 1,2meters.

The device consists on a lateral channel with successive panels, with v section, and arranged at a minimum distance of 2 meters apart, so that a gradual decrease of the water level occurs. The difference in water level between both sides of each panel is between 10 and 15cm, but given the shape of the panels there is no a net waterfall. Except in summer, when the gate opens and the water levels are equal, for the remainder of the year all the flow passes through the device, except at specific times of strong avenues or major flooding of the marsh.

Since its opening, and until now, the effectiveness of this device has been monitored, through a continuous sampling by means a fixed trap installed at the top. This trap, large and with mesh size of 0,4 cm, enables the capture and storage of all fish flowing upstream. It has been revised periodically, processing the catch before release at the top: identification of each individual and measurement of its total length or fork length. The water level on both sides of the channel is available continuously through a fixed station with automated data taking. The difference in level is correlated with the circulating flow.

The results indicate an optimum operation of this device. Were detected 18 different species circulating: the native *Angilla anguilla*, *Atherina boyeri*, *Aphanius iberus*, *Pomatoschistus microps*, *Gasterosteus aculeatus*, *Salaria pavo*, *Liza saliens*, *Liza aurata*, *Liza ramada*, *Chelon labrosus*, *Mugil cephalus* and *Dicentrarchus labrax*, but also

some individuals from the exotic species *Scardinius erythrophthalmus*, *Carassius auratus*, *Cyprinus carpio*, *Lepomis gibbosus*, *Micropterus salmoides* and *Gambusia holbrooki*. A general analysis of the results is presented.

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DESIGN AND MONITORING OF A FISH BARRIER TO PREVENT THE PENETRATION OF ALIEN SPECIES IN AN AREA OF HIGH INTEREST BANYOLES LAKE AREA (CATALUNYA)

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The Riera de Can Morgat is a small stream that flows into the lake of Banyoles. This stream, of small but very stable flow, rises in an artesian well located north of the lake. It is the main refuge within the lake basin for both native cyprinids, Mediterranean Barbel (*Barbus meridionalis*) and Catalan Chub (*Squalius laietanus*). Also, the water of this stream is used to flood three shallow lagoons, created in 2004 within the framework of a LIFE project (LIFE03 NAT/E/000067) for the recovery of suitable habitats for amphibians and invertebrates of European interest. Although the stream is not a suitable habitat for most of exotic species of fish set out in the lake, fish from various non native species had been observed in the middle and lower watercourse: Carp (*Cyprinus carpio*), Gambusia (*Gambusia holbrooki*), Pumpkinseed (*Lepomis gibbosus*) and Largemouth Bass (*Micropterus salmoides*). The last two penetrate only sparingly in the lower reaches, but there was a great risk of its penetration to the lagoons. Gambusia, however, entered quickly in all lagoons, and is also set in a small section of the middle reaches of the stream. About the carp, some fish going up the creek regularly during spring were observed, probably looking for spawning habitats not found in the lake. Some specimens of carp finally entered one of the lagoons, where quickly appeared a dense monocohort population, causing a drastic deterioration of water quality and aquatic habitats. This forced to dry temporarily this lagoon and organize a campaign to remove carp.

To prevent reproduce this situation, and to protect both the stream and the lagoons, in 2009 a fish barrier was constructed in the lower reaches of the Riera de Can Morgat. It consists of a small weir with a net fall of 60cm of water, with no pool at its base. It has been observed that some specimens of Mediterranean Barbel, jumping, manages to overcome this barrier. However, posterior monitoring of the fish assemblage in stream and lagoons, indicate that neither the Carp or other exotic species can overcome the barrier.

The results of this monitoring, as well as the design and features of the fish barrier, are presented.

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LIGHT MANIPULATION FOR EUTROPHICATION CONTROL IN RESERVOIRS USING FISH CAPTURED IN ANGLING COMPETITIONS

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Recreational angling is a popular leisure activity in Portugal with near 200 000 anglers licensed for inland waters. Most Portuguese recreational angling occurs during spring and summer (Mar–Sep) in organized competitions that can gather more than 100 anglers aiming to catch the maximum fish weight. Frequently reservoirs located in southern Portugal are the chosen waterbodies for these competitions.

In angling competitions groundbaiting and voluntary catch-and-release angling are two common practices. To attract fish to the fishing area anglers normally use commercial groundbait powders with different compositions depending on the target species. Through groundbaiting loads of nutrients occurs into the waterbody that may negatively affect the water quality and alter its trophic status. During the competition, that typically lasts 4 hours,

every angler has a keepnet to maintain fish caught, and in the end all the catches are weighted and fish are released back to the reservoir. Although this practice is seen by anglers as an ecological and conservationist attitude it may induce to overcrowding of fish in reservoirs, not allowing the control of fish biomass, especially of nuisance species, and the reduction of nutrients in the system through the removal of fish captured. So, it would be positive to intervene on the ecosystem in order to maintain well-structured fish populations and to improve water quality in an expeditious and inexpensive way, which may be achieved by an effective management of angling competitions.

This study presents an analysis of results for light biomanipulation management scenarios using angling competitions occurring in Maranhão reservoir, the most popular reservoir for those events, by considering the antagonistic effects of groundbait-originated eutrophication and the capture and removal of fish biomass by anglers. The nutrient budget in the reservoir was determined with: (1) total phosphorus (TP) and total nitrogen (TN) loads entering the waterbody through the use of commercial groundbait powders in competitions (*inputs*), considering different groundbait brands; and (2) TP and TN removal from the reservoir through the sacrifice of the fishes captured (*outputs*) evaluating different scenarios of light biomanipulation. Chemical analyses to groundbait powders most purchased for Portuguese anglers and to fish species most captured in competitions were made. Results demonstrated that an effective management of fish caught in angling competitions could promote a better structure and composition of fish assemblages, balancing out nutrients and eutrophication from angling in reservoirs.

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THE APPLICATION OF BIOTIC INTEGRITY INDICES TO ASSESS THE IMPACTS OF AGRICULTURAL INTENSIFICATION ON FISH ASSEMBLAGES

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In southern Portugal, the expansion of irrigation schemes and the associated intensification of cultural practices are promoting important changes in the freshwater ecosystems of the region. Thus, in order to assess the impacts of agricultural intensification on freshwater ecosystems, fish assemblages were sampled in streams draining a new irrigated area sited in the the Guadiana river basin.

More specifically, the fish associations from six sites located on tributary streams of the Alqueva reservoir were sampled for six years simultaneously with the development of a new irrigation scheme (Monte Novo). Concurrently with fish sampling several environmental variables potentially related to the development of the irrigation scheme were evaluated. Two multimetric fish indices of biological quality were determined: i) the EFI, European Fish Index; and ii) the F-IBIP (Fish-based Index of Biotic Integrity for Wadeable Streams Portuguese).

The ratings obtained with the two indices were spatially consistent, but the F-IBIP presented higher correlations with pressure indicators related to increases in agricultural intensification. Results support the hypothesis that increases in irrigated area impact the biological quality of Iberian stream ecosystems, recommending the implementation of mitigation measures so that the development of irrigation schemes does not jeopardize the ecological value of streams.

PHYSICO-CHEMICAL AND BIOLOGICAL ANALYSIS OF THE IMPLEMENTATION OF THE FRESHWATER FISH DIRECTIVE (DIRECTIVE 2006/44/EC OF 6 SEPTEMBER 2006), IN PORTUGAL

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The Freshwater Fish Directive (2006/44/EC) of the European Parliament and of the Council, of 6 September 2006, which repealed the Directive 78/659/EEC, of 18 July 1978, transposed into national law by Decree-Law nº 236/98, of 1 August, seeks to protect freshwater identified by Member States as waters suitable for sustaining fish populations.

This Directive establishes the quality standards for a set of parameters applicable to salmonids waters and cyprinids waters. Portugal designated 81 freshwaters fish sections, 35 to salmonids and 46 to cyprinids. These 81 classified sections were associated with 101 water quality stations.

The Directive 2006/44/EC was repealed in 31 December 2013, by the Water Framework Directive (WFD), Directive nº 2000/60/EC of 23 October, which establish a framework for community action in the field of water policy and pursues that all categories of water bodies, surface and groundwater, reach the good condition, good ecological status and good chemical status in 2015.

In the case of rivers, the ecological state is characterized by biological quality elements, including fish fauna, elements of chemical and physical support, chemicals, including the parameters in the Freshwater Fish Directive, specific pollutants, as well as the elements of hydromorphological support.

That this, the WFD to revoke the policy of Fisheries Waters, ensures the fulfillment of their goals, but goes further in assessing the capacity of the aquatic environment to sustain a fish community, considering their composition and abundance, and not only if the water quality is suitable for fish life.

In this context, this work presents an analysis of the implementation of the Freshwater Fish Directive, in terms of the monitoring carried out, the evolution of water quality and the percentage of sections suitable, and compare these results with those obtained for the biological element ichthyofauna, considering the monitoring carried out between the years 2009-2011 in the scope of the WFD.

ASSESSING THE EFFECTS OF GYPSUM QUARRY EFFLUENTS IN A TEMPORARY STREAM FISH ASSEMBLAGE

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Quarrying activities can originate effluents which, if discharged into streams, can cause changes in stream habitat quality, and negatively affect aquatic biota. In this study we assessed the effects of effluents from a gypsum quarry on fish assemblages in the Algibre temporary stream (Quarteira basin, southern Portugal). Fish assemblages monitoring was required by the environmental Portuguese authorities, following the Environmental Impact Assessment of the quarry expansion, to assess potential effects of seasonal discharge of effluents, due to the accumulation of rainwater and storm water runoff in the quarry, which could increase solids and sulfates in the stream. Accordingly, fish assemblages were monitored, between 2011 and 2013, in two stations downstream, and one upstream the effluent discharge point. Each year fish sampling was first carried out in spring, previously to discharge of the effluents, and afterwards in more three occasions. Effluent effects were assessed by modeling fish

species richness, relative abundance (CPUE) and assemblage composition in relation to site location (upstream vs downstream to the point of discharge), while accounting for habitat conditions and temporal dependence of observations. Early and extended drought conditions in 2012, only allowed sampling of fish assemblages once. Overall fish assemblages were composed by the common native species, with only one non-native species being captured in low numbers. Fish assemblage composition varied across the monitoring period, with species diversity and abundance decreasing after the dry-period in 2012, and recovering along 2013. Statistical analyses showed no differences in fish species richness, abundance and assemblage composition among upstream and downstream stations. These results suggest no persistent effects of effluent discharge in fish assemblages, even if short term fish responses to discharges may occur.

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COMPOSITION OF THE ICTHYOFAUNA OF ASSU RIVER, SEMIARID REGION OF BRAZIL

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The freshwater fish communities which occur in the Brazilian semi-arid region represent the results of anthropic, ecological and speciation processes. Studies relating to ichthyological surveys in the Brazilian semi-arid region are limited. The present study deals with the composition, species richness and endemism in fish species of River Assu, of the semi-arid Rio Grande do Norte. The composition, species richness and constancy of occurrence of fish species were determined on a temporal scale. A total of 163 individuals were captured which were distributed in 2 orders (Characiformes and Perciformes), 06 families (Characidae, Prochilodontidae, Anostomidae, Erythrinidae, Cichlidae and Sciaenidae) e and 09 species, of which, 06 were endemic, 2 introduced and one exotic. Among the families, Characidae was dominant followed by Anostomidae. Triporthus angulatus, an endemic species was most expressive followed by Prochilodus brevis. The results demonstrate an elevated number of endemic species, among them the rheophilic fish which migrate to the head river to spawn, and a reduced number of introduced species. The presence of endemic species increases the importance of conservation and adequate management practice of this natural semi-arid ecosystem.

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CHARACTERIZATION OF RIVER ECOSYSTEMS IN CASCAIS MUNICIPALITY

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Waterfronts have been intensively used by Mankind throughout the centuries, leading to the degradation of river ecosystems, and their biological communities.

In Cascais Municipality, with the development of populations, many of the watercourses have been changed, with its consequent artificialization and decrease in water quality, leading to the degradation of river ecosystems.

The Project “Ribeiras de Cascais”, arose from the need to value these ecosystems, detected by the Municipality, and aims to ensure the preservation, qualification and valorization of Cascais rivers, contributing to the sustainable development of the territory and to the improvement of life quality to residents and visitors. A team of Municipality technicians will develop and implement in a short/medium term, effective management plans, adapted to territorial requirements, directly involving the local population.

The first stage will consist in the biotic and abiotic characterization of 4 rivers: Foz do Guincho, Vinhas, Caparide e Sasseiros. These watercourses develop mainly along an urban matrix, being under different anthropogenic pressures, namely the introduction of non-indigenous species, modification and degradation of habitats and water quality. The knowledge that will come from this study will enable the development of management plans that promote the conservation and/or restoration of native riparian vegetation, removal of non-indigenous species and improving of water quality.

The municipality will also evaluate the possibility of introducing native fish species in these rivers, namely *Iberochondrostoma lusitanicum*. This species has already been identified in the area, and has been classified as “Critically endangered”, due to the decrease of the population to nearly 80% in the last 10 years, trend which will probably remain in the next years. The main threats to this species survival are the degradation of habitats, as well as water quality and the introduction of non-native species. Its endemic degree and high fragmentation of this population, increases the risk of local extinction in most of its distribution range. However, the species is able to reproduce in captivity, which is essential for its conservation.

Finally, the project intends to raise public awareness, by involving the population in regular environmental conservation actions.

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LIST OF FRESHWATER FISHES OF THE BANHINE NATIONAL PARK (MOZAMBIQUE)

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The Banhine National Park is approximately 7,000km² and is located north-east of the Limpopo River in Gaza Province, Mozambique. The BNP lies in an arid zone (<400mm annual rainfall), and its vegetation is dominated by Mopane and sandveld woodland. The BNP conserves important freshwater wetlands in the form of extensive swamps and lakes in the north-eastern sector and scattered pans of varying sizes all over the park.

Since BNP wetlands are fed by rivers draining from the Gonarezhou area (Zimbabwe) and from low gradient swamps along the Limpopo-Save (Mozambique), and that there have been historical connections between the upper Zambezi and Save Rivers (51 species) with the lower Limpopo River (69 species), one would expect the BNP fauna to be dominated by Limpopo species, despite its isolation from its ‘founding’ river systems, with presence of some species from the Save system.

However, despite its close location to Maputo (about 350km), there is still a lack of taxonomic and distribution knowledge of BNP freshwater fishes. Furthermore, because BNP will be added to the Great Limpopo Transfrontier Park to create a larger transfrontier conservation area measuring almost 100,000km², it is essential to collect all fauna information to elaborate the most complete list for conservation purposes.

Therefore, a first list of freshwater fishes from the Banhine National Park (BNP) wetlands is provided.

During fish survey (May-June 2005), a total of 116 sites were visited: three sites were outside of the park boundaries, 79 were dry pans or river channels, 34 sites had water and of these fish were present at 27 sites. Several techniques were used to collect fish specimens: D-net, seine-net, traps, gill-net, etc. A total of 17 species and 2919 fishes were collected during the survey. From these species, the most charismatic are killifishes (two species) and lungfishes (one species) which are interesting by their patterns or behaviour.

In order to better understand the conservation status of temporary water species like lungfishes and killifishes it would be worthwhile trying to estimate the number of pans and map these wetlands. Additional overall biodiversity surveys during wet season should target some of these more inaccessible pans to examine their biodiversity, their water retention and any human impacts. These isolated pans are a unique feature for the region and BNP is an important conservation area for this habitat type.

LIST OF FRESHWATER FISHES OF THE KWANZA RIVER (ANGOLA)

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There is still a lack of taxonomic and distribution knowledge of Angolan freshwater fishes. A current list of freshwater fishes collected in the Upper and Middle Kwanza River system (Angola) is provided. Few historical collections have been made being the Kwanza River poorly known. In a historical context Poll's (1967) list is presented and compared to recent collecting projects (2007, 2008, and 2011) by including several sites sampled along the main channel and its affluent tributaries. Combining historic and recent collections, a total of 86 species distributed in 20 families are reported. However, due to the ongoing investigation process, 2 species are recognised as new records for the Kwanza River drainage and several specimens considered as putatively undescribed taxa. Furthermore, due to some difficult access localities along the stretch of river and the expected high species diversity, the list is likely to be incomplete. With its expected higher number of new records and undescribed species, the present incomplete list will provide an excellent starting point and foundation for further systematic and conservation projects by highlighting and documenting the ichthyofaunal composition of the Kwanza River system.

THE FIRST DESCRIPTION OF A COMPLETE ALBINO LOACHES, *COBITIS PALUDICA* (DE BUEN, 1930) COBITIDAE, FROM IBERIAN PENINSULA

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The albinism, or absence of the melanin pigment in the skin and eyes, is a rare disease in the Vertebrates and is provoked by a mutation; being related with one recessive allele autosomic. Bondari (1981) showed that in the fish *Ictalurus punctatus* (Ictaluridae) the albinism is also due to one recessive allele autosomic. The albinism is quite common in the trade of pets which are born in captivity; however, it is rare in the natural fish populations (Rutherford et. 1990; Dingerkus et al. 1991), probably due to a lack of protective coloration (camouflage) that increases the susceptibility to predation (Rutherford et al. 1990). Also the deficient vision can increase the probability of predation and decrease the feeding capacity. According to Rutherford et al. (1990) the relative albino frequency in nature can also result their reserved behavior (e. g., few interactions with predators).

From November of 1990 to December of 1992, there was a study on population of *Cobitis paludica*, present in the small stream of the Samarra, with monthly samplings, using a electric device for capture specimens. Throughout the study 874 fish had been captured, being 3 of them were completely albino (2 females and 1 juvenile) belonging to distinct generations with the difference of one year. The first albino loach was captured in March of 1992 (female 6,3 cm T.L.); the second in May of 1992 (female 6,0 cm T.L.) and the last one in July of 1992 (juvenile 3,5 cm T.L.).

Description of the specimens: the 3 fish are morphologically normal, except for its white color (albino phenotype). They are completely albino and they share the same coloration: with red iris eyes, completely white skin and some parts of the body are almost transparent (mouth, caudal region).

In spite of the great number of studies done in this big group of freshwater fish, this work, as far as I know, is the first description of albinism in the Cobitidae family and in *Cobitis paludica* (endemic species of the Iberian Peninsula).

The main hypotheses for the capture of these albino fish in the Samarra stream are:

- Small populations with high taxes of inbreeding.
- Reserved behavior (e.g. few interaction with predators).

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THE GEOGRAPHICAL DISTRIBUTION OF *COBITIS CALDERONI* BACESCU, 1961 (COBITIDAE) IN PORTUGAL

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In the present poster the geographic distribution of *Cobitis calderoni* in Portugal is analyzed and their limits traced. *C. calderoni* is an endemic species from the North of the Iberian Peninsula and its distribution is confined to Ebro, Douro basins and is found locally in a few areas in the Tagus basin higher altitude reach of the Jarama, Lozoya, and Manzanares streams (Bacescu, 1961; Doadrio, 1981; Lobon-Cervia, Elvira & Rincon, 1989; Doadrio (ed), 2001; Rogado (coord.), 2005).

In Portugal, this species was completely unknown until 1990. The first prospection carried out to find this loach in Portuguese waters was done during the years of 1989-1994 in the basins of Minho, Lima, Neiva and Douro. For the first time, in 1990, the presence of this species in our country, has confirmed, only for the Douro basin (Madeira, 1994). The second prospection was done in July and August of 2002 in Douro basin (Madeira, 2002); in August in the Neiva, Cávado, Ave, Leça and Barrinha de Esmoriz basins (Alcobia, 2002), in the scope of the Red Book of the Vertebrates of Portugal (Fish) (Rogado (coord.), 2005). The results of the samplings carried out during the years of 1989-1994 and 2002 using electrofishing, show that in Portugal *C. calderoni* only was found in Douro hydrographic basin, presenting a fragmented distribution.

Other important works were done in the North basins of Portugal given information on *Cobitis* geographic distribution (Cortes, 1989; INAG, 1999 a, b, c; INAG, 2000 a, b; Oliveira (coord.), 2007). In spite of the studies done in this group of freshwater fish, the knowledge on the geographical distribution of *C. calderoni* is scarce, in some localities its validity is questionable and needs confirmation.

These results will be discussed and some explanation will be advanced to clarify the geographical distribution of this Iberian loach.

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THE FISH IN THE MUHNAC'S COLLECTIONS

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The Museu Nacional de História Natural e da Ciência (MUHNAC)'s Fish Collection is one of three internationally recognized ichthyological collections in Portugal (<http://research.calacademy.org/research/ichthyology/catalog/collections.asp>). This collection was restarted in 1984, after a fire completely destroyed the zoological collections in 1978. Today, there are nearly 9,000 cataloged lots containing roughly 60,000 specimens, with some thousands of backlogged specimens still to be processed.

There are representatives of 191 fish families. The strengths of our holdings lie principally in the freshwater and marine fishes of Portugal, but we also hold important collections of Africa, namely of the Portuguese-speaking countries collected in the 40s-60s during the scientific expeditions promoted by the Portuguese government. A Fish Larvae Collection has been initiated in 2008 and totals nearly 700 lots with almost 17,000 specimens with representatives of about 40 different fish families. The collection includes developmental series of several endemic fishes to Iberian Peninsula. We also maintain, since 2002, a Fish Tissue & DNA Collection, containing nearly 24,000 samples from freshwater and marine fishes, mainly from Portugal. The MUHNAC has been engaged in the International Barcode of Life Project, incorporating voucher-specimens in the Fish collection and associated genetic resources in the Fish Tissue & DNA Collection, constituting an international reference for fish species biodiversity in Portugal.

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