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FISHFORUM 20 18

BOOK OF ABSTRACTS

FISH FORUM BOOK OF ABSTRACTS

Preparation of this document

This document has been prepared and edited by the Secretariat of the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO). It includes the abstracts of the keynotes, oral contributions and posters presented by participants on the occasion of the Forum on Fisheries Science in the Mediterranean and the Black Sea (Fish Forum 2018). Organized by the GFCM at FAO headquarters, Rome, Italy, from 10 to 14 December 2018, the Fish Forum 2018 gathered more than 400 participants from around the world, including scientists, researchers, engineers, academics, practitioners, managers and decision makers.

The material contained in this book of abstracts stems from the contributions received from participants and selected by an international scientific committee based on their technical quality and relevance. The abstracts are subdivided according to the three main themes of the Fish Forum 2018: 1) Better science for better advice; 2) Healthy seas and sustainable fisheries; and 3) Economic analysis and technology for societal benefit. Each theme is introduced by a keynote presentation.

All the presentations are reproduced in their original language as submitted by the authors. The Fish Forum 2018 material is available at the following webpage: http://www.fao.org/gfcm/fishforum2018/en/

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THEME 2 – HEALTHY SEAS AND SUSTAINABLE FISHERIES

THEME 3 – ECONOMIC ANALYSIS AND TECHNOLOGY FOR SOCIETAL BENEFIT

Acknowledgements

Abbreviations and acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
ACPCR	Association du Cantonnement de Pêche du Cap Roux
ADDEC	Association Développement Durable Ecologie Camargue
AER	Annual Economic Report
AIS	Automatic Identification System
AMOP	Association Méditerranéenne Organisation Producteurs
APAM	Association pour la pêche et les activités maritimes durables
BBN	Bayesian belief networks
BMS	Blu Marine Service
BRD	Bycatch Reducer Device
CCMAR	Centre for Marine Sciences
CEFE	Centre for Functional and Evolutionary Ecology
CESTMed	Center for Research and Conservation of Mediterranean Sea Turtles / Centre d'étude et de sauvegarde des tortues marines de Méditerranée
CFP	Common Fisheries Policy
CGPM	Commission générale des pêches pour la Méditerranée
CIBM	Consorzio per il Centro Interuniversitario di Biologia Marina ed Ecologia Applicata
CIESM	International Commission for the Scientific Exploration of the Mediterranean Sea
CIMAS	Cooperative Institute for Marine and Atmospheric Studies
CL	carapace length
CL	cephalothoracic length
CLS	Collecte Localisation Satellites
CNR	National Research Council of Italy
CNRS	Centre national de la recherche scientifique (France)
COISPA	Coispa Tecnologia e Ricerca
CoNISMa	National Inter-University Consortium for Marine Sciences
CPUE	catch per unit effort / Capture par unité d'effort
CREA	Council for Agricultural Research and Economics
CSIRO	Commonwealth Scientific and Industrial Research Organization
CW	carapace width
DCF	Data Collection Framework
DCM	deep chlorophyll maximum
DCRF	Data Collection Reference Framework

DEB	Dynamic Energy Budget
DEL	Diode électroluminescente
DTU Aqua	National Institute of Aquatic Resources
EADA	Escuela de Alta Dirección y Administración
EAF	ecosystem approach to fisheries
EastMed	Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean
EBILTEM	Science and Technology Centre of Ege University
EBM	ecosystem-based management
EDC	endocrine disrupting chemical
EEZ	exclusive economic zone
EFH	essential fish habitat
EII	Ecopath International Initiative
ELS	early-life stages
EMFF	European Maritime and Fisheries Fund
EMSO	European Multidisciplinary Seafloor and water column Observatory
ENM	Ecological Niche Model
EPS	expanded polystyrene
ESADE	Escola Superior d'Administració i Direcció d'Empreses
ESFRI	European Strategy Forum on Research Infrastructures
EwE	Ecopath with Ecosim
FAD	fish aggregating device
FAO	Food and Agricultural Organization of the United Nations
FFL	Fishing For Litter
FIP	Fishery Improvement Project
Fmsy	fishing mortality consistent with achieving maximum sustainable yield
FPA	Fully Protected Area
FRA	fisheries restricted area
FTIR	Fourier-transform infrared spectroscopy
GAM	general additive model
GF/A	glass microfiber filter
GFCM	General Fisheries Commission for the Mediterranean
GIS	geographic information system
GPS	global positioning system
GRSF	Global Record of Stocks and Fisheries
GSI	gonadosomatic index
HCMR	Hellenic Centre for Marine Research
IAMC-CNR	Institute for coastal marine environment – National Research Council of Italy
IAS	invasive alien species
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea

ICM-CSIC	Institute of Marine Sciences – Spanish National Research Council
ICT	information and communication technology
iDiv	German Center for Integrative Biodiversity Research
IEO	Spanish Institute of Oceanography
IFREMER	Institut français de recherche pour l'exploitation de la mer
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
IMBRIW	Institute of Marine Biological Resources and Inland Waters
INAT	Institut National Agronomique de Tunisie
INSTM	Institut National des Sciences et Technologies de la Mer (Tunisie)
IOE	Institute of Environment
IPCC	Intergovernmental Panel on Climate Change
IPMA	Portuguese Institute for the Ocean and Atmosphere
IRD	Institut de recherche pour le développement
ISAC-CNR	Institute of Atmospheric Sciences and Climate – National Research Council of Italy
ISMAR-CNR	Institute of Marine Sciences – National Research Council of Italy
ISPRA	Italian National Institute for Environmental Protection and Research
IUCN	International Union for Conservation of Nature
IUU fishing	illegal, unreported and unregulated fishing
IWRS	Institute for water of the Republic of Slovenia
IZOR	Institute of Oceanography and Fisheries
JRC	Joint Research Center
KMO	Kaiser-Meyer-Olkin Test
KOH	potassium hydroxide
LEK	local ecological knowledge
LFC	larval fish community
LFDA	length frequency distribution analysis
LOA	length overall
LOCEAN	Laboratoire d'Océanographie et du Climat : Expérimentations et Approches Numériques
MARBEC	MARine Biodiversity Exploitation and Conservation
MCRS	minimum conservation reference size
MCS	monitoring, control and surveillance
MEDISEH	Mediterranean Sensitive Habitats
MEDITS	Mediterranean International Trawl Survey
MEDLEM	Mediterranean Large Elasmobranchs Monitoring
MEY	maximum economic yield
MITgcm	MIT General Circulation Model
ML	mantle length
MLE	maximum likelihood estimation
MLS	minimum landing size

MMA	marine managed area
MMF	Marine Modelling Framework
MNHN	Muséum National d'Histoire Naturelle (France)
MOCNESS	Multiple Opening/Closing Net and Environmental Sensing System
MPA	marine protected area
MP	microplastic
MSC	Marine Stewardship Council
MSE	management strategy evaluation
MSFD	Marine Strategy Framework Directive
MSP	marine spatial planning
MSY	maximum sustainable yield
mtDNA	mitochondrial DNA
NESIA	Non-Economical Social Impact Analysis
NGO	non-governmental organization
NIS	non-indigenous species
NOAA	National Oceanic and Atmospheric Administration (United States)
NTZ	no-take zone
OBSEA	Expandable Seafloor Observatory
OGS	National Institute of Oceanography and Applied Geophysics
ONU Environnement/ PAM-CAR/ASP	Centre d'Activités Régionales pour les Aires Spécialement Protégées du Programme des Nations Unies pour l'Environnement/Plan d'action pour la Méditerranée
PLA	polylactic acid
PPA	Partially Protected Area
PSMA	Port State Measures Agreement
RBF	Risk-Based Framework
RCP	Representative Concentration Pathway
RFB	regional fishery body
RFMO	regional fisheries management organization
RFMO/As	regional fisheries management organization or arrangements
ROV	remotely operated vehicle
RPUE	revenue per unit of effort
SDG	Sustainable Development Goal
SEAPODYM	Spatial Ecosystem And Population Dynamics Model
SIBM	Società Italiana di Biologia Marina
SOCIB	Balearic Islands Coastal Observing and Forecasting System
SPR	spawning potential ratio
SS	size spectra
SSF Guidelines	Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries
SSF	small-scale fisheries
SST	sea surface temperature

STECF	Scientific Technical and Economic Committee for Fisheries (European Commission)
SWAN	Simulating WAves Nearshore
SWOT	strengths, weaknesses, opportunities and threats
TAC	total allowable catch
TED	Turtle Excluder Device
TRL	technology readiness level
TTX	tetrodotoxin
TÜBITAK	The Scientific and Technological Research Council of Turkey
CNRS-L	Lebanese National Council of Research
UN Environment	United Nations Environment Programme
UNGA	United Nations General Assembly
UOB	University of Balamand
UPA	Unprotected Area
UUID	universally unique identifier
UV	ultraviolet
VME	vulnerable marine ecosystem
VMS	vessel monitoring system
WGSA	Working Group on Stock Assessment
WGSAD	Working Group on Stock Assessment of Demersal Species

FISH FORUM OVERVIEW

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- – Organization
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Background

The Fish Forum is a first-of-the-kind initiative gathering scientists, researchers, engineers, academics, practitioners, managers and decision-makers from around the world to discuss and share knowledge on the latest developments in oceanographic, social and economic science and fisheries research. The aim is to build a lasting scientific network in order to discuss research trends, identify priorities and integrate scientific knowledge in decision-making with a view to better shaping the future of Mediterranean and Black Sea fisheries.

To revert the alarming trends in the status of Mediterranean and Black Sea fish stocks, in which roughly 90 percent of the scientifically assessed stocks are currently considered to be fished outside biologically sustainable levels, the need for scientific and technical advice on fisheries management is more than ever crucial. At the same time, advancements in fisheries science are occurring with unprecedented speed, in particular thanks to new technologies. Against this backdrop, it is important that the scientific community, policy-makers, practitioners and other stakeholders keep abreast of these developments so that capacity and synergies can meet the main challenges for the region.

The 2018 edition of the Fish Forum, organized by the General Fisheries Commission for the Mediterranean (GFCM) at the Food and Agriculture Organization of the United Nations (FAO) headquarters, Rome, Italy, from 10 to 14 December 2018, aimed at reviewing the leading work that has been carried out in the field, while addressing the pillars for the development of fisheries science in the Mediterranean and the Black Sea. The aim was also to take stock of progress made mainly towards achieving the United Nations Sustainable Development Goal (SDG) 14 on the conservation and sustainable use of oceans, seas and marine resources, as well as other intrinsically interrelated SDGs, such as SDG 5 on gender equality, SDG 8 on decent work and economic growth and SDG 13 on climate action. The Fish Forum can be seen as a powerful tool to share and exchange information and as a catalyst to invigorate and organize a community with common interests in fish and fisheries sciences in the Mediterranean and Black Sea. At the same time, this event offered an opportunity to strengthen the voice of scientists and managers wherever decisions shaping the future of the Mediterranean and Black Sea are being made.

Organization

The Fish Forum 2018 had an interdisciplinary focus, addressing three interrelated themes: 1) Better science for better advice; 2) Healthy seas and sustainable fisheries; and 3) Economic analysis and technology for societal benefit. It was structured around thematic sessions comprising keynote presentations, expert roundtables and poster sessions. In parallel, workshops and side events focusing on specific issues were organized in collaboration with technical partners, who were also offered the opportunity to be present with a stand at the Fish Forum venue. Contributions were received through a call for abstracts to ensure select experts had an opportunity to present their latest research findings. In this respect, the participation of early career scientists was actively promoted.

International scientific committee

An international scientific committee was established and tasked with the overall scientific supervision of the event as well as with the selection of abstracts, based on the technical quality of the documents and on the relevance to the topics.

It was composed of the following members:

– Michel Bariche, American University of Beirut, Lebanon
– Trond Bjørndal, Norwegian School of Economics, Norway
– Antonio Cervantes, European Commission, DG MARE
– Marta Coll, Institute of Marine Sciences (ICM-CSIC), Ecopath International Initiative (EII), Spain
– Ali Cemal Gücü, Institute of Marine Science, Middle East Technical University, Turkey
– Paolo Guidetti, Research Unit CoNISMa-Nice, University of Nice Sophia Antipolis, France
– Malouli Idrissi, Institut National de Recherche Halieutique (INRH), Morocco
– Toshihide Kitakado, Tokyo University of Marine Science and Technology, Japan
– Patrick Lehodey, Collecte Localisation Satellites (CLS), France
– Snejana Moncheva, Institute of Oceanology, Bulgaria
– Beatriz Morales-Nin, Mediterranean Institute for Advanced Studies (IMEDEA), Spain
– Chedly Rais, Okeanos Foundation, Tunisia

- Evelina Sabatella, Fisheries and Aquaculture Economic Research (NISEA), Italy
- Tamara Shiganova, Shirshov Institute of Oceanology, Russian Federation
- Olivier Thébaud, Institut français de recherche pour l'exploitation de la Mer (IFREMER), France

Partners

The Fish Forum 2018 was organized with the financial support of the European Union and in collaboration with the following technical partners:
- African Union – Interafrican Bureau for Animal Resources (AU-IBAR)
- Agreement on the Conservation of Cetacean of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS)
- Association of National Organizations of Fishing Enterprises in the European Union (Europêche)
- Black Sea Commission
- Centre Scientifique de Monaco (CSM)
- Collecte Localisation Satellites (CLS)
- Convention on Biological Diversity (CBD)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS)
- Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO)
- International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM)
- International Council for the Exploration of the Sea (ICES)
- International Ocean Institute (IOI)
- International Union for Conservation of Nature (IUCN)
- Low Impact Fishers of Europe (LIFE)
- Marine Stewardship Council (MSC)
- MAVA Foundation
- Mediterranean Advisory Council (MEDAC)
- New Economic Foundation (NEF)
- Oceana
- OceanCare
- Organisation for Economic Co-operation and Development (OECD)

– Pelagic Data Systems
– Prince Albert II of Monaco Foundation
– SRT Marine Systems
– Trackwell
– Union for the Mediterranean (UfM)
– United Nations Environment/Mediterranean Action Plan (UN Environment/MAP)
– World Wide Fund for Nature (WWF)

Structure and contents

The Fish Forum 2018 was structured around three thematic sessions:
1. Better science for better advice
2. Healthy seas and sustainable fisheries
3. Economic analysis and technology for societal benefit

Each thematic session was introduced by keynotes speakers who spotlighted cross-cutting topics and comprised three parallel sessions highlighting leading research in the field based in particular on contributions received. Three expert roundtables on prominent issues of specific interest to each theme also enabled dynamic discussions. Each thematic session then concluded with a wrap-up session drawing the main outcomes and defining priorities for the coming decade as well as with a poster session providing insights on specific aspects in relation to each theme tackled. All abstracts of keynote presentations, oral contributions and poster presentations for each thematic session are included in this book of abstracts.

The Fish Forum was structured as follows:

- **Theme 1 – Better science for better advice**
    o Keynote presentations
    o Parallel session 1 – Improving knowledge on stock status
    o Parallel session 2 – Innovative strategies for the provision of advice
    o Parallel session 3 – The effectiveness of area-based management
Expert Roundtable 1 – Promoting stakeholder dialogue toward harmonized fisheries management: boosting the science-policy-stakeholder interface

- **Theme 2 – Healthy seas and sustainable fisheries**
  - o Keynote presentations
  - o Parallel session 1 – Addressing climate change as a priority issue
  - o Parallel session 2 – Addressing pressing environmental challenges
  - o Parallel session 3 – Interactions between vulnerable species and human activities

Expert Roundtable 2 – Natural and anthropogenic impacts: effects of climate change, pollution and non-indigenous species on fish and fisheries

- **Theme 3 – Economic analysis and technology for societal benefit**
  - o Keynote presentations
  - o Parallel session 1 – Improving knowledge on the social and economic impact of fisheries
  - o Parallel session 2 – Mapping value chains
  - o Parallel session 3 – Marine technology promoting economic and environmental sustainability of fisheries

Expert Roundtable 3 – Technological future: High-tech advancements in fisheries research, management and fleet modernization

- **Final conclusions and priorities for the coming decade**

Technical workshops: The road to the Fish Forum 2018

- Essential Fish Habitats as key elements for the establishment of area-based management measures (Oceana)
- Future perspectives after the revolution: the rise of tracking devices for monitoring and modelling of fisheries (University of Tor Vergata and CSIRO)
- Promoting co-management as an innovative tool for the sustainable use of coastal and marine natural resources (Interreg Med PANACeA)
- Priority actions to prevent and reduce the generation of marine litter (UN Environment/MAP MED POL and OceanCare)
- Toward operational fisheries oceanography in the Mediterranean Sea: gaps, challenges, opportunities from open-access data and integrated tools (OGS and IEO)
- Complementarities between MPAs and fisheries spatial measures for area-based management (including SPAMIs, FRAs and national fishing reserves) (UN Environment/MAP)
- The MSC Project Pre-Assessments model: a multi-stakeholder collaborative approach to improve fisheries sustainability (MSC)

Side events

- Launch of The State of Mediterranean and Black Sea Fisheries 2018 (SoMFi 2018) (GFCM)
- Demonstration of ICES Transparent Assessment Framework (ICES)
- Results of the Horizon 2020 SponGES project (FAO)
- Implementation of the ecosystem approach at the regional level for the coordinated achievement of the SDG14 targets (UN Environment/MAP – SPA/RAC)
- Ocean noise impacts on fisheries in the context of SDG14 (OceanCare)
- ACCOBAMS Survey Initiative: preliminary results and identification of potential areas for cetaceans/fisheries interactions (ACCOBAMS)
- SOI Global Dialogue: Cooperation between CBD, FAO and GFCM (CBD, FAO and GFCM)
- Research and innovation initiative for blue jobs and growth in the Mediterranean area (European Commission [DG RTD] and UFM Secretariat)
- Best practices in co-management between fishers and scientists in the Mediterranean (MEDAC)

Fish Forum keynote speakers

Manuel Barange
Director of the Fisheries and Aquaculture Policy and Resources Division, FAO

Professor Manuel Barange is Director of the Fisheries and Aquaculture Policy and Resources Division at the Food and Agriculture Organization of the United Nations (FAO), and an Honorary Professor at the College of Life and Environmental Sciences, University of Exeter, United Kingdom. Until May 2016, he was Deputy Chief Executive and Director of Science at the Plymouth Marine Laboratory, United Kingdom. From 2010 to 2013, he was Chair of the Scientific Committee of the International Council for the Exploration of the Sea (ICES), and from 1999 to 2010, he was Director of the International Project Office of the IOC-SCOR-IGBP core project GLOBEC (Global Ocean Ecosystem Dynamics). Mr Barange's expertise includes a broad range of oceanography, marine biology and fisheries oceanography and management topics. In recent years, he has increasingly focused his research on the impacts of climate change and economic globalization on marine-based commodities, and on the interactions between natural and social sciences in fisheries, ecosystems and climate change, in the developed and developing world. He was awarded the 2010 IOC-UNESCO Roger Revelle Medal for his accomplishments and contributions to ocean science.

Anne Christine Brussendorff
General Secretary, International Council for the Exploration of the Sea (ICES)

Anne Christine Brusendorff has been working as the General Secretary of the International Council for the Exploration of the Sea (ICES) in Copenhagen, Denmark since 2012. She has been promoting integrated ecosystem understanding, with the aim to develop integrated ecosystem assessments in regional seas. This requires a strong connection between data and information, science and advice, and as the head of the Secretariat she has been working to facilitate communication within the organization, as well as engaging with external partners to fulfil the objectives of ICES Strategic Plan 2014–2018. She is currently contributing to the development of further linking ICES activities to relevant processes to ensure the data, science, and advisory outputs are contributing effectively to the knowledge base used for ocean governance. Before joining ICES Secretariat, Ms Brusendorff spent 14 years working for the Baltic Marine Environment Protection Commission (HELCOM) in Helsinki, Finland as Professional Secretary (in maritime matters), Deputy Executive Secretary and Executive Secretary. Before moving to Finland, she was the Head of Section at the Danish Ministry of Environment and Energy, Danish Environmental Protection Agency.

Lasse Gustavsson
Executive Director Europe, Oceana

Mr Gustavsson is passionate about the oceans and has a lifetime commitment to sustainable development and social change. With almost 3 decades of leadership experience in Greenpeace, WWF and Traffic, he now serves as Executive Director for Oceana in Europe. He has led international organisations, programmes and campaigns, developed partnerships with businesses, run constructive political lobbying efforts as well as led conservation programmes in the field. He always gives great priority to impact on the ground. Mr Gustavsson has his academic training in International Relations, Human Ecology and Development Science at the University of Gothenburg, Sweden. Oceana is the world's largest marine organization working exclusively to protect and restore the wold's oceans. With the motto "Save the Oceans, Feed the world", Oceana seeks to restore ocean abundance by winning policy victories in the countries that govern much of the world's marine life.

Keith Brander
Emeritus Scientist, Technical University of Denmark (DTU), contributed to the Nobel Peace Prize awarded to the IPCC in 2007

Keith Brander has worked on fisheries, marine ecosystems and climate impacts in the UK and Denmark as well as advising on marine policy at international level (including FAO, EU, IPCC and ICES). His recent work has been mainly on climate impacts on marine ecosystems and fisheries – how do we measure and monitor changes in fish stocks, marine biodiversity and distribution and how do we attribute the causes of change correctly in order to advise on appropriate management and adaptation? He strongly believes in taking a broad, interdisciplinary approach to management issues and in fully evaluating the risks and uncertainties when scientific models are used to project future expectations. Dr Brander has an emeritus position at DTU Aqua in Denmark and continues to research, write and teach in his spare time.

Ernesto Penas Lado
Former Senior adviser, DG MARE

Mr Penas Lado is originally from Spain where he obtained a diploma in Biological Sciences delivered by the University of Alcala in Madrid. Later, he did a PhD in marine ecosystem modelling in the United States of America. His career at the European Commission / Directorate-General for Fisheries began in 1986 but he took a three-year-break to complete his functions of Director General for Fisheries and Aquaculture for the Galician Regional Government in Spain. Back to the European Commission / Directorate-General from Maritime Affairs and Fisheries, he was responsible for different horizons like the negotiations in the Regional Fisheries Management Organisations, then he became Head of the Unit "Conservation Policy", and finally "Common fisheries policy and aquaculture". In 2009, he was appointed Director of the Directorate "Baltic Sea, North Sea and Landlocked Member States". From mid-2010 he has been Director in the Directorate MARE-A "Policy Development and Co-ordination" and was the initiator for the recent reform of the Common Fisheries Policy.

Vladimir Ryabinin

Executive Secretary, Intergovernmental Oceanographic Commission (IOC) of UNESCO

Dr Ryabinin is an oceanographer, climatologist, and marine engineer. Previously he worked as a scientist and head of a laboratory at the Hydrometcentre of Russia, a lecturer at the Moscow State University, the Executive Director of the International Ocean Institute, and senior officer of the World Climate Research Programme. His own scientific research has focused on turbulence, ocean thermocline and its variability, physical processes of relevance for weather prediction, numerical mathematics, ice processes, shelf engineering, marine prediction and wind-wave modelling. He contributed to international coordination of climate research related to polar matters, ocean, cryosphere, sea-level, stratospheric processes, atmospheric chemistry, and climate services. Dr Ryabinin has been part of the design teams for major research and development initiatives including the USSR numerical medium-range (weekly) weather prediction system, the Russian Federal Program "World Ocean", the Global Ocean Observing System and the UN Decade of Ocean Science for Sustainable Development (2021–2030).

Theme 1
Better science for better advice

KEYNOTE PRESENTATIONS

ORAL PRESENTATIONS

  Subtheme 1.1: Improving knowledge on stock status

  Subtheme 1.2: Innovative strategies for the provision of advice

  Subtheme 1.3: The effectiveness of area-based management

POSTER PRESENTATIONS

Science plays an important role in technical and social development and in many aspects of our lives, especially at a time when technological, health, environmental and sustainability challenges require science based solutions. In order to support sustainable fisheries and ecosystem services, it is crucial to improve the scientific understanding of marine ecosystems.

The objective of the theme "Better science for better advice" is to explore progress in ecosystem knowledge, and to analyze challenges and obstacles to implementing ecosystem based management, such as limited resources, illegal, unreported and unregulated (IUU) fishing, limited data, the need for interdisciplinary approaches, difficulties in translating science advice into management, as well as other limitations including those related to ocean governance.

Keynote presentations

Theme 1 - Better science for better advice

Anne Christine Brussendorff – General Secretary, International Council for the Exploration of the Sea (ICES)

Different seas and oceans, same scientific challenges – working together for the future seas and oceans that we want

Abstract

Societal expectations that the seas and oceans will meet our future needs have never been so high. But neither has the range and intensity of human pressures affecting them ever been so great. It is necessary to respond to these challenges by leading, fostering, and facilitating scientific collaborations, exploration and monitoring programmes that span national and political boundaries, and by developing and sharing scientific knowledge and evidence internationally. And through this work to provide decision-makers with impartial scientific advice on human activities affecting, and affected by marine ecosystems and to inform society about the state and use of the seas and oceans.

ICES works collaboratively, using its broad and active international network, to generate and share the data, knowledge, and scientific advice needed to meet current and emerging conservation, management, and sustainability goals. And in that same spirit GFCM and ICES have detailed their cooperation in a Memorandum of Understanding from 2012, pointing to areas of cooperation such as stock assessment and management plans, data collection, data bases, and data access, as well as ecosystem impacts of fisheries. The experience of GFCM and ICES will be an important ingredient for the achievement of many of the Sustainable Development Goals (SDGs), including SDGs 13 and 14.

Vladimir Ryabinin – Executive Secretary, Intergovernmental Oceanographic Commission (IOC) of UNESCO

The United Nations Decade of Ocean Science for Sustainable Development: A leapfrog approach to ocean science knowledge generation and its application for sustainable development

Abstract
In 2017 the United Nations General Assembly proclaimed a UN Decade of Ocean Science for Sustainable Development. The Decade will begin in 2021 and finish in 2030, in concomitance with the 2030 Agenda for Sustainable Development. This initiative aims at boosting the mobilization of ocean science as well as multistakeholder participation at all levels for generating actionable knowledge needed for a transformative agenda: the ocean we need for the future we want.

ORAL PRESENTATIONS

SUBTHEME 1.1: IMPROVING KNOWLEDGE ON STOCK STATUS

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Presentation title
Comparison of fisheries regulations applied to manage the Black Sea anchovy stock

Abstract
Black Sea anchovy is an important stock which constitutes 55 percent of the total catch in the Black Sea. However, over the years, the stock displayed sharp fluctuations and the consequences on the economy associated with this stock have been devastating. Both Turkey and Georgia, exploiting the majority of the stock, have set forth various management measures to ensure sustainable utilization of the stock. However, the regulations applied in these two neighboring countries are quite different. In this study, in an attempt towards the creation of a common management plan for this important stock, the management practices applied in these two countries are discussed in a comparative manner. In this context, pros and cons of daily catch quota, daily market quota, depth limitations, no-take zones (NTZ), annual fishing quota, number of days at sea, number of boats, and daily and seasonal catch per unit efforts (CPUE) were taken into consideration.

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Presentation title
Handbook on fish age determination: a Mediterranean experience

Abstract

Most of analytical methods used in stock assessment require knowledge on the demographic structure of the stocks based on age, as well as on other life history traits like recruitment, maturity and natural mortality, which are, in turn, linked to age. Literature on ageing analysis still shows some gaps, especially regarding ageing scheme, ageing criteria and methodology for the preparation of calcified structures. These aspects affect both the precision and the accuracy of the ageing process. One of the actions that could be taken to overcome this gap of standardization is to formalize and share common protocols in the scientific community, to decrease relative/absolute bias and to improve both precision and accuracy. The handbook here presented focuses on a wide range of species and taxa in the Mediterranean and thus represents a guideline to standardize the methods used for fish ageing analyses. The document focuses on the description of the principles upon which age analysis relies: assignment of theoretical birthdate, preparation methods of calcified structures, ageing scheme and identification of "true" rings. The volume is subdivided into five sections; for each section the main information on technical aspects and procedures, such as extraction and storage, preparation method, interpretation of age and ageing criteria, are provided by species. The handbook includes thirty fish species from different taxa or fish groups: small-pelagic, demersal, cartilaginous, large-pelagic and European eel, which represent the most important resources at the Mediterranean scale from both an economic and an ecosystem perspective.

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Presentation title

Population biology of the Lessepsian migrant puffer fish (*Lagocephalus sceleratus*) from the Gulf of Suez and the Mediterranean

Abstract

This study principally aims to assess the stock status of the most common Lessepsian migrant puffer fish species *Lagocephalus sceleratus* in two different habitats, the native one (Gulf of Suez) and the new one (Mediterranean Sea). The study revolves around three topics: the growth and population structure, the reproductive biology and the feeding behavior of the species in the studied sites. The results revealed that the maximum recorded age estimated by length-frequency distribution analysis was nine years old for the Gulf of Suez population compared to seven years old for the Mediterranean population. For the Gulf of Suez population, the fish length at first sexual maturity (L50) was 42.3 cm for males and 43.4 cm for females, while for the Mediterranean population the fish length (L50) were 36.5 cm and 38.4 cm for males and females respectively. Egyptian Mediterranean waters exhibit a relatively prolonged spawning season, extending from spring to summer for both sexes, while the spawning season of the species in the Gulf of Suez is restricted to spring. The average absolute fecundity of *L. sceleratus* from the Gulf of Suez was relatively lower than that from the Mediterranean. The analysis of diet composition showed that the *L. sceleratus* is mainly omnivore, feeding on a wide variety of items in both study sites. It may be crucial to establish a public agency that deals with the collection of these fish, monitoring their toxicity, and with their safe flesh either for local consumption or for exportation. On the other hand, the rest of the fish, especially gonads which contain higher levels of tetrodotoxin (TTX), can be used as a source of the toxin to be used pharmaceutically.

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Presentation title
Atlas of maturity stages of Mediterranean fisheries resources

Abstract
Knowledge on the length at maturity and the spawning period could improve best practices in the sustainable management of fisheries. The sustainable management of fish resources is linked to the stock reproductive potential concept that appears to be essential in stock assessment for several commercially important species. The Data Collection Reference Framework (DCRF) programme covers extensive samplings of maturity stages for different stocks within community waters, but often the achieved level of precision for their determination does not match the one required by DCRF. Hence, the need of an immediate improvement in the identification of the macroscopic maturity stage through a standardization of operational procedures and terminology has been stressed on several occasions. This atlas aims to develop sound approaches to maturity sampling based on accurate and precise determination of the different maturity stages. The atlas contains images of maturity stages of more than 50 species of economic interest in the Mediterranean. The macroscopic stage determination follows the Mediterranean International Trawl Suvery (MEDITS) macroscopic scales relative to *Osteichthyes*, *Chondrichthyes*, *Crustacea* and *Cephalopoda*. For each species, an introduction describes the species reproduction, most relevant references present in literature on spawning period and size at first maturity, descriptions of the maturity stages for both sexes and histological descriptions to validate the maturity staging when available. This document should represent a useful tool to be used on board during surveys or commercial samplings to define the maturity stages of species in order to reduce sources of error on maturity determination.

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Presentation title
A full life cycle multispecies IBM for North Aegean small pelagic fish

Abstract
Anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) are the most important small pelagic fish in the North Aegean Sea regarding biomass and economic importance for fisheries. They play a key role in the food web and respond rapidly to environmental changes, given their short life span and feeding on planktonic organisms. During the past decades, there has been a decrease in both anchovy and sardine biomasses, mean size and somatic condition in many Mediterranean subbasins. To study processes like dependence of somatic condition to food resources, reproduction, and species response to fishing effort, we developed a full life cycle, two-species population model that is one-way coupled with the POM-ERSEM hydrodynamic-biogeochemical model for the North Aegean Sea. The structure and characteristics of the two-species model that will be presented and which is stage-/age-specific and includes bioenergetics and reproduction modules, is based on the best available biological knowledge on anchovy and sardine in the North Aegean. Initially, a genetic algorithm is used for growth parameters estimation and then, a series of sensitivity experiments are performed to better understand the role of fishing effort, on the species population and biomasses.

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Presentation title

Lessepsian impact on the native fish stocks

Abstract

Connecting the Red Sea to the Mediterranean via the Suez Canal, and removing the fresh water barrier in front of the canal by building the Aswan reservoir pushed the Mediterranean to enter a new era. Since then, particularly the eastern basin has been experiencing major fauna and flora changes. Some of the marine species that have immigrated to the Mediterranean via the canal have attained a significant biomass level that can support commercial exploitation. Some stocks of these species are being assessed along with the native stocks, and managerial recommendations are being made for their sustainable exploitation. On the other hand, the effects of the faunal changes on the native stocks are completely neglected. This study evaluates two completely different stock diagnostics of GSA-24 red mullet stock assessed with the same methodology with 3-year intervals within the framework of the Working Group on Stock Assessment of Demersal Species (WGSAD). In order to determine the role of Lessepsian species in this complexity, the estimated total mortality (Z) was statistically modeled as a function of the biomass of the species (particularly rising species displaying sudden increases) and of the fishing effort. The various scenarios tested showed that empirically calculated natural mortality could be a biased estimator in the areas under the impact of Lessepsian immigrants. This finding underlines the immediate need for multispecies assessment models for the integrated management of the fish stocks in the eastern Mediterranean.

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Presentation title

The state of Mediterranean fisheries resources: a regional perspective

Abstract

Most of Mediterranean fisheries resources are currently considered outside biologically safe limits, and the indicators show a deteriorating trend in the last decades, with increasing exploitation rates and shrinking biomass, in contrast with recent improvements observed in the Northeast Atlantic and the North Sea. Insufficient fisheries management measures, a lack of compliance to existing regulations, and the inherent characteristics of the Mediterranean are believed to be behind the lack of improvement on the stocks, despite the efforts made to address the sustainability of fisheries. In this scenario, the Working Groups on Stock Assessment (WGSAs) of the GFCM play a key role in providing the best scientific advice for management. Constituted in the 1970s, their activities have been gathering pace in the recent past, with an increase in the number of stocks assessed and area coverage, as well as a methodological advancement. This contribution is aimed at providing a general overview of the work produced by the WGSAs (number of stocks, methods, scientific advice and information).

Secondly, it seeks to perform a regional and subregional appraisal of the current state of the stocks, as well as a historical retrospective of assessment outcomes. The work focuses on the main targeted demersal and small pelagic species, with a view of analyzing spatial and temporal trends in biomass and fishing mortality rates estimated by means of stock assessment using univariate and multivariate approaches. Ultimately, this work aims at providing a more general and wider view of the state of Mediterranean stocks.

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Presentation title
Ecological basis to embrace temporal assessment and spatial management of European hake in the western Mediterranean

Abstract
Beyond restrictions in fishing effort to reverse the current overexploitation of European hake in the Mediterranean Sea, the challenge according to the Mid-term strategy (2017–2020) is to improve the ecological basis of the assessment procedures in relation to: i) the critical ecological processes, ii) the information available and the capacity to annually retrieve it, and iii) the life stage/s that will frame the main management measures. However, one of the main limitations to respond to this challenge is that, for most geographic subareas, quantitative information is only available for recruits and juveniles, while considerably limited for adults. Here, we used two case studies of the Western Mediterranean (the Spanish Iberian coast and the

Alboran Sea) to synthesize the increasing available knowledge on capital ecological processes in recruits and juveniles susceptible to be implemented in the assessment and management procedures. Indeed, spatial management of hake juveniles is becoming an effective measure to be broadly implemented in the Mediterranean. However, it is currently unconnected with the population dynamics and the quantitative assessment. Here, we reviewed information on the structural complexity of populations, oceanic and demographic connectivity, hydroclimate and life history influence on survival, and drivers of the spatial-temporal distribution. These processes can help to improve the knowledge about the stock-recruitment relationships, natural mortality vectors, or habitat-based standardization of catch per unit efforts (CPUEs). We discuss that an effective implementation of ecological knowledge can help to embrace quantitative periodic assessment and spatial management in an operational way, providing a more holistic and ecosystem-based approach of hake.

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Presentation title
Knowledge gaps in marine fisheries in the southern Mediterranean

Abstract
Despite the societal and economic importance of marine fisheries within the southern Mediterranean countries, there is a considerable gap of knowledge regarding their state. This is mainly due to the unaffordability of classic stock assessment methods, political instabilities, and the artisanal nature of the dominant fisheries in the region. Since the 1950s, the FAO has made available to the public major marine fisheries catch data. Such data are available for most developing countries, and for some it is the only available data information on living resources in their Exclusive Economic Zones (EEZ). This data could be improved and applied to catch-based indicators for each data-poor country in the Mediterranean. These indicators combined with non-catch-based indicators represent an affordable, rapid, and relatively reliable method to assess the state of marine fisheries and ecosystems in the data-poor countries of the Mediterranean. Filling the gaps of knowledge regarding the state of marine fisheries would allow for better fisheries management, and thus, for more sustainable fisheries.

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Presentation title

A spatially explicit population dynamics and stock assessment model driven by environmental variables

Abstract

The Spatial Ecosystem And Population Dynamics Model (SEAPODYM) provides a spatially explicit representation of population dynamics integrating relationships between fish movement and the environmental variables, and includes a robust estimation approach of population dynamics and fisheries parameters. Several types of data can be included in the maximum likelihood estimation (MLE) approach: catch, fishing effort and size frequencies of catch from fisheries or research surveys as in standard stock assessment models, but also tagging data, acoustic biomass estimates, and eggs and larvae densities. These data can be assimilated at the resolution of the model, typically monthly 1 or 2-degree squares for basin scale configurations. The model has been used for several species of tuna, swordfish, and the South Pacific jack mackerel. Preliminary work was also conducted for sardine and anchovy. Since the population dynamics is driven by environmental mechanisms, the distribution of all cohorts from larvae to oldest adults are predicted everywhere based on a global parameterization. Classical metrics for stock assessment can be provided from the simulations, and fishing impacts discriminated from environmental variability. The impact of climate change on the population dynamics can be investigated using projections of environmental forcings generated by the Intergovernmental Panel on Climate Change (IPCC) Earth climate models. The interest of this new approach is illustrated with various applications and studies.

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Presentation title

The state of Black Sea anchovy resources in Georgia

Abstract

The anchovy stock assessment was carried out using the VIT package in 2015–2018. The natural mortality rates for age groups from 0+ to 4+ were estimated by the Gislason method: 2.24, 1.09, 0.79, 0.66 and 0.59 accordingly. The stock was also assessed using the surplus production models ASPIC and CMSY. The most part of the landing – 56 percent of the amount – consisted of the 0+ group over the past three fishing seasons, the share of the 1+ group was in average 26 percent of the amount. The proportion of the landing in relation to the total stock biomass was estimated at 20–25 percent for the 0+ group and 40-50 percent for older groups. The mean exploitation rate has been rising from 0.36 in 2015–2016 to 0.42 in 2017–2018, which is approximately equal to the Patterson reference point. The relative biomass B/Bmsy has varied from 1.25 to 1.50. Thus, the anchovy stock might be considered sustainably exploited. Moreover, the catch per unit effort (CPUE) has been at a stable high level during the last five fishing seasons in Georgia: 3 000–4 000 tonnes per vessel. The mean anchovy landing was about 60 000 tonnes over those fishing seasons and reached 78 000 tons in 2017–2018. Predators have negatively affected the anchovy stock. The Pearson linear correlation coefficient between total anchovy and bonito landings was -0.55. The overall decline in the anchovy stock and landing in the Black Sea in recent decades is evidently the result of habitat conditions deterioration after the introduction of alien hydrobionts: *ctenophore Mnemiopsis leidyi*, mollusk *Rapana venosa*, and *algae Desmarestia viridis*.

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Presentation title
Twenty-five years of MEDITS trawl surveys in the north Mediterranean Sea: progress and challenges

Abstract
The Mediterranean International Trawl Survey (MEDITS) programme started in 1994 with the cooperation among research institutes from four Mediterranean countries (France, Greece, Italy, Spain) of the European Union. Over time, up to the advent of the European framework for the collection and management of fisheries data, new partners from Slovenia, Croatia, Albania, Montenegro, Malta and Cyprus joined the MEDITS programme, while the cooperation with non-European countries was facilitated by the FAO regional projects. The MEDITS programme conducts a common bottom trawl survey once a year, using the same gear, sampling protocol and methodology, from the data collection to the data storage, applying common checks to improve data quality (RoME routines). Before the Data collection Reference Framework (DCRF) implementation, the MEDITS programme represented the only data source to evaluate the fisheries resource status, using population and community indicators, total mortality estimates, assessment models based on fishery-independent data (e.g. SURBA) and simulation models (e.g. ALDYM). With DCRF consolidation, MEDITS data routinely support the stock assessment

of target species, providing relevant abundance indexes for model tuning. Over time, the survey objectives and data use broadened their scope from the population to the fish community and ecosystems, facing new challenges from their changes and drivers, the evaluation of vulnerable species and Essential Fish Habitats (EFH), the generation of new scientific insights linked to the Marine Strategy Framework Directive (MSFD) (e.g. biodiversity and marine macro-litter evaluations) and Marine Spatial Planning (MSP). The MEDITS project allows to develop a variety of national and international research projects by a large scientific community and widely contributes to the ecosystem approach to fisheries (EAF).

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Presentation title

The Global Record of Stocks and Fisheries (GRSF)

Abstract

The Global Record of Stocks and Fisheries (GRSF) is an inventory combining data from across world renowned institutes. The information is harmonized according to international standards and published with unique identifiers for stocks and fisheries records to improve usability. The GRSF is designed around stock monitoring data that are shared by countries or through the Regional Fishery Bodies (RFBs). The GRSF enhances the global monitoring by i) collating stocks and fisheries records from national and regional sources, ii) storing information according to specific standards/protocols, and iii) assigning unique identifiers for stock and fishery identification. Many stakeholders from industries, NGOs, technology companies, etc., believe the success of seafood traceability is based on standardized fishery identifiers, and the GRSF provides exactly that information base which can be used to develop a global standard in support of traceability. Potential users: RFBs and their member states, the seafood industry, seafood certifiers, national agencies of governments responsible for stocks and fisheries reporting, researchers and officers working on global analyses on state of fishery resources, NGOs promoting sustainable fisheries, and the general public. Benefits: 1) a global standard to identify stocks and fisheries based on a Universally Unique Identifier (UUID) and a Semantic Identifier; 2) support to achieve Sustainable Development Goal (SDG) indicator 14.4.1 "Proportion of fish stocks within biologically sustainable levels"; 3) support to seafood traceability and catch documentation, ecolabelling schemes, food safety, sustainable fisheries; and 4) boost stocks and fisheries status and trend monitoring and, by showing poor trends or limited monitoring, stimulate responsible consumer practices.

SUBTHEME 1.2: INNOVATIVE STRATEGIES FOR THE PROVISION OF ADVICE

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Presentation title
Bio-economic assessment and risk evaluation to move towards a change in the exploitation pattern

Abstract
The objectives of the European Union Common Fisheries Policy (CFP) and of the GFCM are converging to improve by 2020 the sustainability of Mediterranean and Black Sea fisheries (landing obligation EU Reg. 1380/2013 and Mid-term strategy 2017–2020) and to halt the declining trend in the status of commercially exploited stocks (only 9 percent fished below MSY). Thus, there is an increasing focus on monitoring and stock assessment, paying special attention to the risk evaluation of stock collapse and fleet unprofitability. The improvement of the exploitation pattern, to delay the size at first capture and to reduce discard, is a key point in balancing fishing pressure with the capacity of the stocks. Tools able to support managers for designing multi-annual management plans play a key role under an MSE framework, where there is even the need to integrate stock and fleet-based indicators. BEMTOOL3 is a multi-fleet and multi-species bio-economic simulation model to provide advice through a

wide range of indicators. A case study on the demersal fishery in Southern and Central Tyrrhenian Sea (GSA 10), where most part of the stocks are exploited above FMSY, is used to explore the potential effects of different management measures on biological and socio- economic indicators, under diverse sources of uncertainty. The landing obligation and the improvement of the trawlers' exploitation pattern is simulated, differentiating the measures by fleet according to the respective impact on the target fishery resources. The impact of different levels of additional costs on the fleets are assessed.

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Presentation title
Benefits of MPA networks in the western Mediterranean Sea: a geographically-nested ecosystem modelling approach

Abstract

We implemented a geographically-nested modelling approach to quantify the ecological and fisheries benefits of the establishment of marine protected areas (MPAs) networks in the western Mediterranean Sea. We used Ecopath with Ecosim (EwE) to develop spatial-temporal local, subregional and regional food-web models representing areas with different levels of protection. For three Mediterranean MPAs, Cerbere-Banyuls, Cap de Creus and Medes Islands, we developed nine models (three for each MPA) representing different management zones: Fully Protected Area (FPA), Partially Protected Area (PPA), and Unprotected Area (UPA). We then built three models representing each MPA zone integrating the different management schemes. Afterwards, we developed a subregional model including the three MPAs and their surroundings to describe the whole MPA network. Finally, a model covering the western Mediterranean included current general MPA dynamics. The nested modelling approach allowed us to: (1) characterize the structure and functioning of MPA zones and identify differences between zones and between MPAs, (2) assess the regional impacts of local MPAs, and (3) quantify temporal changes and explore alternative MPA spatial configurations to promote fisheries sustainability, accounting for stakeholders' suggestions. Results highlight the ecological importance of FPAs, although their benefits are local due to their small size. Current MPAs show small differences with each other in terms of ecosystem structure and functioning. A significant increase in the level of protection and enforcement is needed to achieve positive impacts on fisheries at the regional level. This study represents a baseline for the development of further management scenarios of MPA networks.

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Presentation title

A GADGET model to explore the management implications of prey-predator interactions in the Strait of Sicily trawl fishery

Abstract

The catch of Mediterranean trawl fisheries is composed by a mixture of high-prize invertebrates, such as shrimps, and several species of bony and cartilaginous fish. The poor selectivity of the fisheries led to a high amount of discards of both undersized specimens of commercial species and non-commercial fish and invertebrates. In several Mediterranean sectors, shared stocks are exploited by the trawl fleets of different countries. The target of some of these fisheries has moved in recent years from traditional fish species to highly-priced crustaceans raising new challenging management problems, i.e. how to maximize fisheries yield of crustaceans without impairing the productivity of the populations of their fish predators. This is the case of the multi-national trawl fishery in the Strait of Sicily targeting the deep-water rose shrimp (*Parapenaeus longirostris*). The fishery produces a consistent bycatch of commercial fish species such as European hake (*Merluccius merluccius*) and horse mackerel (*Trachurus trachurus*). A GADGET mutispecies model was designed to explore interactions between European Hake, horse mackerel, deep-water rose shrimp and the main

Italian, Tunisian and Maltese fleets. Fleets subtract biomass in different ways from the three populations and display differences in the exploitation pattern. European hake is the predator of horse mackerel, deep-water rose shrimp and itself (cannibalism). Bottom trawlers target mainly deep-water rose shrimp having European hake and horse mackerel as bycatch. Model projections were used to compare the impact of different levels of fishing effort on the modelled system and to reveal trade-offs between stocks and fleets that are relevant to making management decisions based on an ecosystem approach.

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Presentation title

Identifying essential habitats for a fish of high economic importance (*Sparus aurata L.*) in the northwestern Mediterranean

Abstract

In coastal fishes with complex life histories, who typically inhabit different habitats during their lifespan and experience multiple environments at certain life stages (e.g. juvenile), studying the link between habitat diversity and fish lifetime conditions and growth is essential. Indeed, carry-over effects (COEs) between life stages can play a key role in population maintenance by driving individual fitness, when the conditions experienced by one life stage (e.g. juvenile) influence the next and ultimately affect the offspring. Difficulty in linking life-history traits across life stages makes examples of COEs' importance for population maintenance quite rare. Here, we took advantage of the lifetime physiological and environmental information simultaneously stored in fish otoliths to investigate whether using alternative nursery habitats in the Gulf of Lion (northwestern Mediterranean) induced significant variation in physiological history and fitness in the seabream *Sparus aurata*, a sequential hermaphrodite of high commercial value. For 200 adults captured at sea, nursery origin was

reconstructed using otolith microchemistry and matched with corresponding juvenile growth rates. Then, this information was crossed with the final body size, weight, condition and sexual status of the same fish. This allowed investigating the consequences of juvenile life in varied types of nurseries (coastal lagoons and the sea) on survival and later size-at-age and reproductive history. The COEs identified by this approach (differences in growth and sexual history linked to nursery habitat choice) bring unprecedented information on the respective importance of lagoon and marine habitats for preserving the stocks of this valuable species in the Mediterranean.

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Presentation title
Biomass Escapement strategies as basis for management of small pelagics: how information is used and influences catch

Abstract
How advanced population modelling and Management Strategy Evaluation (MSE) simulation can be used to manage small pelagics in the Mediterranean. Small pelagic populations of sardine and anchovy sustain important fisheries around the Mediterranean. Classic fisheries management suggests management at MSY through a selected fishing mortality, which is a concept well suited to medium or long lived stocks. Short lived small pelagic species with varying annual recruitment are potentially better managed using biomass escapement strategies. This paper will explain the development of such strategyfor sardine and anchovy in GSA 17-18. The role of information and the influence of precision to magnitude of potential catches are discussed and the trade-off between information and potential catch is illustrated.

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Presentation title
Best practices for monitoring actions to achieve sustainability of small-scale fisheries

Abstract
Monitoring, control and surveillance (MCS) activities play a key role in the global fisheries management systems in order to assure, not only compliance with legal rules, but also the achievement of sustainability goals. Monitoring activities have been increasingly developed and improved in the recent decades following new fisheries management needs and supported by great technological advances. This technological progress has facilitated tools to extend monitoring activities to a broader dimension in geographical and fleets dimensions, allowing to cover activities in any place of the ocean, from coastal areas to high seas, and of any type of vessels, from large to small-scale. Nevertheless, the challenges that a proper MCS system implies for certain fleets and fisheries are well known, such as the small-scale fisheries, due to their specific particularities. This particular nature of the small-scale fisheries generates a need to define and implement different approaches, actions and tools to meet fisheries compliance and management objectives. This paper presents the monitoring actions considered at best practice level in MSC certified small-scale fisheries and analyses the activities developed by fishing operators and managers to improve the performance of particular MCS systems in order to achieve sustainability goals.

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Presentation title

GALION project – Alternative management of resources in the Gulf of Lion

Abstract

To date, about 60 French trawlers work on the Gulf of Lion. They fish between 8 000 and 12 000 tonnes of fish a year. Improving the management of marine resources is imperative to ensure the conservation of species and the maintenance of economic activities in the coastal zone. In the face of recent scientific assessments, several species caught in the Gulf of Lion are overexploited, such as the hake (*Merluccius merluccius*). In order to reverse this trends, professionals and scientists have joined forces to develop an innovative project (GALION) to define new management methods for the trawl fishery. The GALION project (alternative management of the resource in the Gulf of Lion) aims to acquire a better knowledge of the spatio-temporal dynamics of the distribution of the target species in order to propose a strategy of seasonal avoidance of the areas where the rejects are potentially important. In addition, this study tested the selectivity of modified fishing gear incorporating escape grids, and among an economic analysis of the losses generated by these devices. Several phases of data collection at sea were conducted as part of a partnership between scientists, fishermen and economists. In addition, various simulation scenarios have been tested to limit discards of undersized commercial species while allowing for more sustainable exploitation and maintaining the viability of the fishery.

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Presentation title
Modelling gear and fishers' size-selection in Mediterranean trawl fisheries for escapees, discards and landings

Abstract
Gear selectivity and discards are both important in fisheries management but separately modelled. This work examines for the first time the overall size-selection pattern on the total amount of individuals of a species entering the trawl codend by modelling the escapement through the codend in the sea and the subsequently selection process by the fisher on the deck of the fishing vessel resulting into the discards and landings. A dual sequential model accounting for both gear size-selectivity and the subsequent fisher size-selectivity was applied, under the hypothesis that a fish entering the codend can follow a multinomial distribution with three probabilities: the escape, the discard and the landing probability, respectively. Three different trawl codends and three species have been investigated. The model described the escape probability through the gear and the landing probability by the fisher as S-shaped curves leading to a bell-shaped curve for the discard probability affected by both gear and fisher selection. The model described well the experimental data in all cases. The model provides at the same time selectivity and discard parameters useful in fisheries management.

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Presentation title

A modelling framework for the Mediterranean Sea ecosystem in support of EU policies

Abstract

Already historically high levels of anthropogenic pressures are even further expanding in the Mediterranean Sea with consequences for marine biodiversity and the economies that depend on it, constraining marine ecosystem services available to future generations. In this context, the Marine Modelling Framework (MMF), an end-to-end conceptualization of the marine environment, has been developed at the Joint Research Centre, European Commission (JRC-EU) to support managers and stakeholders in better preparing and adapting to future changing conditions (e.g., changes in the environment and fishing pressure). Here, we use the Mediterranean Sea ecosystem as case study to explore how the basin is going to be affected in the future by changes in climate and fishing pressure. To do so, we have coupled a food web modelling approach (Ecopath with Ecosim) with a hydrodynamic-biogeochemical model (Med-GETM/ERGOM) to 1) quantify future spatial-temporal changes of species abundance in the Mediterranean Sea under the impact of fisheries and climate change,

2) explore management options for mitigation of cumulative impacts to Mediterranean ecosystems based on scenario analysis. The MMF is designed to quantify and better understand the ecological status of European Seas and, overall, to help provide the best possible support to EU-level policies (e.g., Marine Strategy Framework Directive [MSFD], Common Fisheries Policy [CFP]) implementation.

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Presentation title

New approaches to bottom trawl codend selectivity studies in the Mediterranean Sea

Abstract

Mediterranean bottom trawl fisheries are generally operated in fishing grounds were many species with very different morphological characteristics are found together. This has a negative impact on size selectivity which is important to be ensured in bottom trawl nets. Recommendations and arrangements on mesh size and shape which will be used in bottom trawl codend have an important role among technical measures taken for ensuring sustainable bottom trawl fisheries. The effect on size selectivity of these technical measures are generally estimated through experimental sea trial or by sampling from the commercial fishery. These classic ways are quite expensive and there is a need to spend much more time in the sea. Recently some theoretical work exists which tries to understand and explain the size selectivity for Mediterranean species in trawl codends. For this aim, the most advanced simulations models in FISHSELECT (Herrmann *et al.*, 2009), which can simulate the basic size selective properties for nettings with arbitrary mesh shape and size for different species, have been successfully applied to some of the northeast Atlantic and Mediterranean species. The results of these studies have also been used to provide international advice to the EU and ICES. Therefore this new approach has a great potential for sustainable multi-species fisheries management in the Mediterranean. It may also be possible to use FISHSELECT to develop predictive techniques for selection of major species for use in economic and management models. The research given in this presentation was conducted as part of the Project Number TOVAG-112O492 supported by TUBiTAK.

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Presentation title

Modelling spatiotemporal ecosystem effects of the landing obligation in the North Aegean Sea (Greece)

Abstract

The EU Common Fisheries Policy initiates a landing obligation (discard ban) in EU waters, which in the Mediterranean applies to species with Minimum Conservation Reference Size (MCRS). As discards constitute food source for several species, it is necessary to examine the possible effects of this policy under the Ecosystem Approach to Fisheries Management. An "Ecopath with Ecosim" (EwE) ecosystem model representing the North Aegean Sea (Thracian Sea and Strymonikos gulf, Greece) was used, in order to explore food-web changes as a result of the application of the landing obligation. Temporal scenarios with a calibrated Ecosim model simulated landing of all MCRS discards after 2019 for a period of ten years. In addition, a spatial model (Ecospace) was developed addressing the knowledge on the species habitat use, incorporating satellite remote sensing environmental variables along with functional responses of

species or groups to these variables. Results showed only limited effects of the landing obligation on the majority of groups, however some possible impacts were revealed for species of conservation concern. Specifically, the main scavengers of discards, i.e. seabirds, showed a substantial decreasing population trend, while negative effects were also revealed for the loggerhead sea turtle. These changes were more pronounced at the end of the ten-year period compared to the middle (five years) of the forecast period. Spatial effects of the discard ban were also limited, still scenarios of fisheries closures regarding discard hot-spot areas were examined towards the improvement of the spatial component of fisheries management.

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Presentation title

Scientific challenges and ways forward for fishing effort management regimes

Abstract

In Mediterranean countries, fisheries management regimes are mainly based on controlling fishing effort levels, technical measures, as well as area and seasonal closures to protect nursery or spawning areas. Since fishing mortality levels have remained very high for most Mediterranean stocks, the effectiveness of most of the measures currently implemented to reduce fishing pressure is not evident. Overall reductions in fishing capacity have taken place through decommissioning programs, but such reductions have seldom resulted in an actual reduction in fishing activity and fishing pressure. In 2018, the EU Commission adopted a proposal introducing a fishing effort regime for trawl fisheries exploiting the demersal stocks in the western Mediterranean. An efficient fishing effort management regime starts from the estimation of a desirable level of fishing effort consistent with the management objectives typically based on fishing mortality rates (FMSY). However, even when reliable formal assessments are carried out, the relationship between fishing effort (e.g. in fishing days) with FMSY is not linear. Moreover limits based on fishing mortality rates are difficult to assess and predict in mixed fisheries, where a single adequate effort level for all stocks does not exist due to large differences in catchability and stock status across target species. This paper addresses the scientific and monitoring challenges linked to its successful design and implementation, as analysed during an Expert Working Group of the STECF in June 2018. Starting from previous worldwide experiences with effort regimes, we then discuss these challenges and ways forward for the northwestern Mediterranean fisheries.

SUBTHEME 1.3: THE EFFECTIVENESS OF AREA-BASED MANAGEMENT

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Presentation title

Age-structured metapopulation models to assess fisheries sustainability in the northwestern Mediterranean Sea

Abstract

Marine biologists are increasingly using the metapopulation concept to understand and describe the dynamics of spatially structured fish populations across heterogeneous environments. As part of the SAFENET project, we developed an age-structured, spatially explicit metapopulation model to describe the spatio-temporal dynamics of three highly relevant coastal species (*Diplodus sargus*, *Diplodus vulgaris* and *Epinephelus marginatus*) in the northwestern Mediterranean Sea. The model combines a description of larval dispersal with that of key life-cycle processes of juvenile and adult individuals, such as reproduction, body growth, natural and fishing mortality, settlement, and recruitment. Larval connectivity among sub-populations within the study area was assessed using Lagrangian simulations carried out over the period 2004–2015, taking into account the available knowledge regarding the main biological traits affecting the dispersal of early life-history stages (e.g. spawning schedule, pelagic larval duration). Marine Protected Areas (MPAs) currently established in the Mediterranean Sea are included in the spatial configuration of the model, allowing the assessment of their contribution to biological conservation and fisheries viability. The model represents the basis for the exploration of alternative spatially-explicit management policies aimed at improving fisheries sustainability (like the establishment of coherent networks of MPAs and other area-based fisheries management rules) and the assessment of their performances in the long run.

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Presentation title

Protection effects on fishes and small-scale fisheries in eleven MPAs of the Mediterranean Sea

Abstract

A large body of evidence exists globally about the effect of Marine Protected Areas (MPAs) in recovering fish assemblages (i.e. reserve effect). On the other hand, the role of MPAs in enhancing small-scale fishery (SSF) communities is still largely debated and poorly investigated. We evaluated the effects of eleven Mediterranean MPAs in ensuring both conservation and fishery goals. Ecological effects were investigated by comparing descriptors of

fish assemblages between MPAs (including no-take and buffer zones) and unprotected control locations. We combined multiple techniques to collect data about a large spectrum of fish species and descriptors. Specifically, underwater visual census and baited underwater videos were used to characterize fish species diversity, density, size distribution and biomass. Squidpops were set up to estimate predation intensity at different protection levels. Effects on SSF were assessed by comparing catch per unit of effort (CPUE) and fishers' revenues per unit of effort (RPUE) obtained by fishers within partially protected areas, and those obtained in open fishing areas outside each studied MPA. Although a certain level of variability, results showed that in most of the MPAs both no-take zones and, to a minor extent, buffer zones were associated to higher values of fish density, biomass and predation rates, compared to external unprotected zones. No clear effects on SSF were highlighted with CPUE and RPUE, showing inconsistent patterns between MPAs. These findings provide an important base for assessing the factors that determine the ecological and economic protection benefits of MPAs.

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Presentation title

Co-management Focus Group. Reflecting on how successful local co-management initiatives can be scaled up

Abstract

Top-down command and control fisheries management as applied in the Mediterranean (and elsewhere) is dysfunctional and not fit for purpose. The majority of the stakeholders and the small-scale fishers have been alienated from management decision-taking processes, and, due to a lack of capacity and political will at national level to enforce regulations, overfishing, habitat destruction and IUU fishery activities have become prevalent. In such a context, new forms of governance are required to build trust and cooperation between national authorities and fishery stakeholders, promote co-responsibility, and through collective action unite them in the common purpose of sustainable fisheries. This requires a paradigm shift to bottom-up, community-led approaches that recognise the role of the fishers as key players. Around Europe, there are examples where co-management projects often relatively small and localised, have successfully facilitated collaboration between stakeholders, establishing a basis for co-responsibility and improved acceptance of legally binding regulations, which in turn is contributing to addressing overfishing, IUU activity and social conflicts. Co-management has also produced more reliable data, and enabled management to be more flexible, adaptive and efficient. A Focus Group composed of fishers, academics and administrations, with direct experience of co-management initiatives, was created to reflect on the key factors leading to success and on the most important elements to include in co-management models to scale up to the wider national and regional levels. This paper provides an overview of some of these best practices examples and reflects the discussions held, with some conclusions and recommendations.

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Presentation title
SafeNet: Sustainable fisheries in EU Mediterranean waters through network of Marine Protected Areas

Abstract
SafeNet, an EU DG MARE funded research project, aims at identifying coherent networks of Marine Protected Areas (MPAs) whose emergent properties (i.e. the interactive effect of scaling-up MPAs in networks) can help achieve fisheries maximum sustainable yield and maximize over the long-term socio-economic benefits for the stakeholders in the northwestern Mediterranean Sea. After assessing the current system of MPAs, we tested the capacity of normative and target-seeking scenarios in improving fisheries sustainability at local, subregional and regional scales, using ecosystem, fisheries, and socioeconomic outputs. The robustness of the scenarios was validated by including direct and indirect drivers in the scenarios. Scenarios were built using a mix of ecosystem-based, meta-population and bio-economic modelling approaches. Overall, 30 local qualitative food web models were developed, in addition to one for the whole western Mediterranean. Quantitative, temporal and spatial food web models were obtained at regional, sub-regional and local scales. A set of habitat suitability models for keystone species was used in Lagrangian and meta-population simulations. A bioeconomic model with the Bemtool platform was also developed. To complement existing data on biological, fisheries, legal and economic aspects of the professional fisheries, field surveys were done in 163 sites inside and outside 11 MPAs and 117 small scale fisheries landings were sampled. In addition, data on recreational fishing from 20 coastal areas were collected and the impact of these activities on vulnerable species was studied. So far, the project activities already reached key stakeholders with significant impact, for instance in the MEDAC final advice on spatial-temporal closures.

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Presentation title

Deep-sea sensitive habitats identification: two examples from the Ligurian Sea (northwestern Mediterranean Sea)

Abstract

Deep-sea sensitive habitats host peculiar biological assemblages which require special conservation actions. In the Mediterranean Sea, the GFCM has adopted Fishing Restricted Areas (FRAs) as practical tools to protect these ecosystems (GFCM, 2006), often represented by animal forests (Rossi *et al.*, 2017). Finding parameters for their identification is of primary interest for fisheries management organizations and requires documentation on the biological features and the quantification of the fishing effort. Here, two cases of sensitive habitats identification are presented, targeting deep and shallow waters. The Maledetti Shoal (western Riviera) is a vertical wall (55-90m depth) known to host dense gorgonian aggregations (Enrichetti *et al.*, 2017). By combining the data obtained from the Remotely Operated Vehicle (ROV)-Imaging protocol with the analysis of the invertebrate discard of the spiny lobster trammel net, we quantified the impact of this *métier,* accounting for seven living gorgonian colonies/fragments and 4 kg of coralligenous substratum every 200m of net.The red shrimp trawling ground of Santa Margherita Ligure (eastern Riviera) is one of the most exploited and studied since 1960 (Relini-Orsi, 1974). The recent finding of *Placogorgia coronata* Carpine & Grasshoff, 1975 in the trawling discard highlighted the high biological value of this area, characterised also by a white coral's thanatocoenosis. The long-term monitoring of the catches stressed a high impact, with a removal rate of one colony every two trawling operations (Enrichetti *et al.*, in press). Due to their high biodiversity, precious commercial stocks and low sea floor integrity, these two areas are valuable candidates for FRAs.

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Presentation title
2008–2018 Vulnerable Marine Ecosystems a decade later

Abstract
In 2008 the United Nations General Assembly (UNGA) resolution turned the spotlight on seabed areas considered vulnerable to impacts from fishing activities in particular Vulnerable Marine Ecosystems (VMEs). UNGA called on the States and Regional Fisheries Management Organizations or Arrangements (RFMO/As) to pay particular attention to the sustainability of deep sea fisheries. The resolution resulted in the production of the FAO Deep-Sea Fisheries Guidelines aimed to provide an internationally agreed-upon set of criteria for identifying a VME and detailed management actions suggestion. Over the last decade, VMEs species have been identified, described and reported (in FAO and ICES databases and tools). In this paper, we present a systematic review and evidence-based mapping exercise to summarize the available baseline knowledge on VMEs. New or potential VMEs are being identified, reported and protected from commercial vessels activities; existing closures have been implemented and reviewed periodically, new management measures taken where circumstances have changed. Some VMEs are more studied and protected than others, a knowledge needs analysis based on an extensive scientific literature coupled with an inventory of VMEs and fisheries measures adopted to prevent significant adverse impacts of bottom fisheries, will inform where critical evidence gaps exist and will inform best practice in relation to management of fishing activities in relation to VMEs.

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Presentation title
Addressing the spatial dimension of fisheries sustainability: a case study in the western Mediterranean Sea

Abstract
Sustainable fisheries management must trade-off between long-term conservation and socioeconomic viability. Achieving sustainability goals is further complicated by the spatial interaction between biological resources and fishing effort dynamics. We developed a spatially explicit approach to describe the spatiotemporal dynamics of the European hake in GSA 9 (Ligurian and North Tyrrhenian Sea) and 10 (South and Central Tyrrhenian Sea), and support the identification of candidate areas for protection. First, spawning grounds in both GSAs were reconstructed by Lagrangian backtracking from nurseries identified by the Mediterranean Sensitive Habitats (MEDISEH) project. Forward Lagrangian simulations were then used to characterize larval connectivity across the area. Second, a bio-economic model was used to describe the spatiotemporal dynamics of the stock in GSA 9 under the present levels of fishing pressure. The model incorporates current knowledge about biological traits, the results of the connectivity analysis and spatially explicit information about fishing pressure exerted by different fishing métiers. It was calibrated against the results of the stock assessment carried out by the GFCM Working Group on the Stock Assessment of Demersal species (WGSAD 2017). The model provides a tool to forecast the effects of spatial closures on recruitment, spawning stock biomass and fishery productivity. Results obtained by simulating the closure of different areas to fishing suggest that the benefits of protection may extend well beyond the area subject to closure, with benefits (in terms of both spawning biomass and fishing yield) also on the surroundings. This study provides a starting point for the assessment of protection networks in the Mediterranean.

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Presentation title

Modelling early-life stages connectivity to better understand marine population structure and inform fisheries management

Abstract

There is growing evidence that the spatial and demographic structures of marine populations are often more complex than currently accounted for in management frameworks. Large fish stocks are usually assessed independently within each sub-area defined by the GFCM while overlooking demographical dynamics within and across transnational boundaries and neighboring stocks. Due to the highly dispersive abilities of early-life stages (ELS) for many marine organisms, a good description of ELS large-scale connectivity is of paramount importance to better understand the dynamical structure of marine populations. We present a novel modelling approach to assess the ELS connectivity of our target-species, the European hake, which is one of the most commercially and ecologically important demersal species in the Mediterranean Sea. By combining estimated spawning areas, ensembles of realistic connectivity matrices (current-driven larval dispersal) and predicted settlement grounds of juveniles, it provides insights into the basin-scale structure of hake population that is compare against the current delimitation of fisheries assessment units. A clustering algorithm provides a scientifically-based separation of the seascape

that does not necessarily match the established spatialized units nor the most accepted eco-regions. Identified communities illustrate how bio-physical constraints control ELS connectivity which in turn shapes hake's subpopulations in the entire Mediterranean basin. Merging concepts and tools from fishery sciences, oceanography, population dynamics and network-theory, our modeling framework allows comparing putative large-scale population structure and management areas, thus providing relevant information to reevaluate stocks boundaries and establish future protected areas, both of which aiming at a better effectiveness of area-based management.

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Presentation title

Spatial planning of trawlers' fisheries in the Gulf of Lion: Which strategies to reduce discards?

Abstract

Bottom trawlers in the Gulf of Lion are multi-specific and little selective. Most target species are subjected to a minimum landing size (MLS) under which it was forbidden to land the catch, which resulted in high discard rates. Since 2016, the implementation of the landing obligation regulation pushed fishermen to limit their undersize catches and develop strategies for a more sustainable exploitation of these species. In order to define spatial strategies to avoid discards, catches and discards of this fishery fleet were mapped over the 2005–2015 period. Observations at sea during fishing operations as well as scientific surveys were used to obtain interpolated layers of distribution of fish individuals under MLS. These were then used to devise spatial planning of the fishery activity using the systematic conservation planning software MARXAN. This decision-helping tool aims to identify areas to be protected in order to meet set protection targets at a minimum cost using an optimization algorithm. A large number of avoidance scenarios were produced to identify areas that should be closed in order to protect undersize individuals. For each scenario, three degrees of fishery protection were considered to insure the viability of this activity. This study highlighted the importance of the coastal areas both for bottom trawl fisheries and for small individuals, highlighting the need to find a management compromise in this area. Seasonal planning scenarios should serve as a basis of discussion between managers and fishermen to elaborate future management plans.

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Presentation title

Reassessment of changing fisheries for data-poor stocks in the eastern Mediterranean

Abstract

The aim of ecosystem-based fisheries management is to provide the maximum sustainable take of target organisms with the minimum impact on other ecosystem components. The challenge of the approach is that in the developing countries, including Turkey, stock assessments have been made only for a tiny minority of stocks with the rest of these being categorized as "data-poor stocks". The main problem for data-poor stocks is to provide proper data to present the stock conditions and make any recommendation to fisheries managers, stakeholders and fishers. Based on this motivation, we focus on this question: Can we successfully develop an ecosystem-based management scheme for the data-poor fish stocks in the eastern Mediterranean? CMSY method based on surplus production modeling was used to estimate fisheries reference points in a maximum sustainable yield (MSY) framework for the stocks. Results showed that 60 percent of the stocks were subject to ongoing overfishing and 30 percent of them were outside of safe biological limits, potentially suffering from impaired reproduction. Only 8 percent of the stocks fulfilled the requirement of the Common Fisheries Policy (CFP) as not being subject to overfishing and having a biomass above the level that can produce MSY.

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Presentation title
Fisheries governance in the Black Sea

Abstract
General approach to fisheries management in riparian countries has already been changed according to the recent political, scientific and economic reasons and initiatives. On the other hand all countries intend to include the Blue Growth concept together with sustainable resource use, development and employment. In this paper, administrative, institutional and legislative changes specific to each country will be explained and analyzed.

POSTER PRESENTATIONS

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Poster title
Behavioral changes observed in Black Sea anchovy and its possible causes

Abstract
The Black Sea anchovy (*Engraulis encrasicolus ponticus*) is a migratory species spawning and overwintering at two opposite ends of the Black Sea. It has been reported that the species may display significant alteration in their migration routes and in their spawning grounds. That, in turn, affects the stock and the fishery on this species noticeably. This study focuses on these alterations by comparing the age, length and egg-size distributions of the anchovies sampled within the Turkish Exclusive Economic Zone (EEZ). The results showed that all the variables examined decreases along the longitudinal axis extending from the overwintering areas towards the spawning grounds. This indicated that the youngest anchovies, which are smaller than the old ones and lay smaller eggs, spawns in the areas near to the overwintering ground, and that the part of the population returning to the main spawning grounds (continental shelf of the northwestern Black Sea) were composed of older fish. These results may also indicate that the high fishing pressure on this species could possibly increase the proportion of small size fish in the stock by removing the large individuals and lessening the size of the population returning to the main spawning grounds. And this situation is a very important factor that needs to be considered in fisheries assessment in the Black Sea.

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Poster title

Changes in life history parameters and landings trend of sardine in the Catalan coast

Abstract

In the last decade, sardine landings have markedly decreased in the Catalan coast, especially in the northern part. Sardine (*Sardina pilchardus*) was monitored, aiming at updating population parameters to detect changes over time and exploring possible causes driving the observed species decrease. Sardine landings were monitored in two fishing ports, Roses and Arenys de Mar, located 115 km apart in the northern Catalan coast (northwestern Mediterranean), from October 2016 to March 2018. Differences were observed between localities regarding population parameters. The size range of the monthly length-frequency distributions was smaller in the northern port (Roses), located south of the Gulf of Lion. The larger sizes observed were 16.9 cm TL in Roses and 18.1 cm in Arenys. The individuals fished during the reproductive period were always mature (sizes from 10.4 cm). Based on the condition factor (size range 10.4-15.5 cm), the individuals from Arenys were in better condition than those from Roses. In both zones, the duration

of the reproductive period changed between years (more extended in autumn 2017-winter 2018). In addition, the duration was always longer in the northern zone. These interannual and spatial variations in the duration of the reproductive period would be explained by the temperature, lower in the second year and in the northern zone. However, temperature by itself would not explain the smaller sizes and worse condition of sardine in the northern zone, and other physical (e.g. vertical mixing) and biological (e.g. plankton composition and condition) factors would play a role.

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Poster title

Artisanal small-scale fisheries in the future MPA of "Taza" (southwestern Mediterranean): A multispecies multigear fishery

Abstract

Artisanal small-scale fisheries are a primordial but very variable activity in the Mediterranean Marine Protected Areas (MPAs). This variability is explained by a diversity of target species, gears, and fishing tactics which represent a major difficulty in terms of management of stocks in a context of multispecies multigear fishery. In the mid-2000s, scarcity of fish in Algeria and particularly in the Gulf of Béjaia, one of the most productive areas of the country, triggered a crisis insmall-scale fisheries and revived the discussion of the creation of an MPA in this zone as a solution against the depletion of stocks and their sustainable management. The main objective of this work was to identify the *métiers* practiced by artisanal fishermen of the future MPA of "Taza" (Gulf of Béjaia, southwestern Mediterranean) through direct observation method of daily landings. These *métiers* could be considered as homogeneous units that can be studied and interpreted individually in terms of pressures and impacts on fishery resources. Apprehending the fishing effort at the *métier* level is therefore a relevant approach to the study of small-scale fisheries because it limits the biases related to the evaluation and the management of the fishing pressure of this latter. Thus, the results of this study will define the state-of-art of small-scale fisheries in a candidate area to be classified as an MPA and contribute in the establishment of a conservation reference point in a data-poor situation.

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Poster title

Oceanographic and biological connectivity of *Nephrops norvegicus* and of *Solea solea* in the Adriatic Sea

Abstract

We explored oceanographic and biological connectivity in the Adraitic Sea, with reference to a *Nephrops norvegicus,* and Solea solea, two important commercial resources whose recruitment is strongly related to larval dispersal from spawning to nursery areas. In both cases the knowledge of the biological connectivity among subpopulations is a fundamental parameter for a sustainable fisheries management plan, the identification of the appropriate geographical management scale, and the assessment of the potential effects of selective spatial fishery closures. In this study, the connection between spawning, nurseries and harvesting grounds and between species subpopulations has been assessed by post processing two ensembles of simulation, one for each species, and covering a large and representative ensemble of oceanographic conditions. A Lagrangian particle tracking model have been used to track the trajectories of particles released from specific

areas, and driven by ocean currents in the GSA17 and GSA18 management areas. The numerical particles represented larvae of a target specie and were released from species spawning grounds, close to the seabed, and according to the biology of each specie. Larvae grew in size with a rate depending on water temperature and their floating and sinking dynamic were superimposed to the vertical hydrodynamic transport, also based on the larval stage. In the first life stage larvae have positive buoyancy and drift to surface waters, where they remain until they reach a critical size allowing them to sink down to the bottom. During the larval stage, diel migration has been simulated, according to species-specific literature information. At the end of the larval stage organisms starts searching for a seabed substrate suitable for settlement. These features are, again, species-dependent. Various scenarios have been analysed by evaluating parameters such as the lifetime of the larvae and the critical survival temperatures. The larval dispersal is modelled using the LTRANS-v.Zlev, three- dimensional, Lagrangian model coupled with the flow fields obtained from the MIT General Circulation Model (MITgcm) hydrodynamic model run for the 2006–2012 period, with 1/64° horizontal resolution. Postprocessing of model results highlighted the existence of isolated subpopulations of *N. norvegicus*, and suggested that this species should be managed accordingly. Results also evidenced that the set up of the marine restricted area known as *Solea* sanctuary might not guarantee *Solea* presence all over the Italian coasts. This work were developed in the frame of the MANTIS EU project, which aims at providing tools and information to improve the Common Fisheries Policy (CFP), by applying a spatial-based approach to the management of fishing effort, minimizing the impact of trawlers on areas where juveniles of commercial species concentrate.

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Poster title

Decapod crustacean larvae and hydrodynamic processes in the northwestern Mediterranean Sea

Abstract

Geomorphology and hydrodynamic processes shape the aggregation and dispersion of planktonic communities. In this study, we analyzed the community of decapod crustacean larvae in the frame of three different hydrodynamic processes in the northwestern Mediterranean: the retention caused by three submarine canyons, a mesoscale seasonal eddy and the hydrographic barrier of the Ibiza Channel. Zooplankton samples were collected during July and August 2016 with two different gears: a) a 1 m-diameter bongo net towed obliquely from 250 m depth to the surface and b) a 1 m-wide Multiple Opening/ Closing Net and Environmental Sensing System (MOCNESS) towed obliquely from 100 to 50 m depth. Mesh size was 300 µm in all gears. Samples were

preserved in 5 percent formaldehyde and all decapod crustacean larvae were sorted under a stereomicroscope. Species richness and diversity indexes were calculated for each station. Submarine canyons showed high values of species richness although the communities were largely dominated by Brachyuran crabs. Significantly higher values of general larval density were observed in the northern part of the mesoscale eddy. Dendrobranchiate shrimps were the most abundant group in the deep chlorophyll maximum (DCM) zone in the Ibiza Channel. Identifying the relationship between water mass circulation, environmental variables and the characteristics of zooplanktonic communities can help understand the dispersion and connectivity patterns of many crustacean species of economical and ecological interest.

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Poster title
Larval drift of deep-sea shrimp *Aristeus antennatus* from limited areas of trawling

Abstract
The individual-based model can explore the connectivity of subpopulation of the deep-sea red shrimp *Aristeus antennatus* in the northwestern Mediterranean Sea through larval drifts. The species is under a unique local management plan which limits the trawling activities of fishers. We used a Lagrangian framework with a three-dimensional hydrodynamic model to evaluate the retention capacity of the shrimp stock under fishing restriction, and therefore, the effectiveness of the local plan to expand the stock abundance. Modelled as passive particles, the larvae were retained for 44 percent of them in the fishery area under restriction. This zone also received 27 percent and 99 percent larvae from another submarine canyon and the intercanyons area from higher latitude, respectively. When particles had the properties to ascend to the surface, through egg buoyancy, the larvae connected with a submarine

canyon at lower latitude with 39.4 percent of particles; and the Balearic Islands grounds with 40 percent. The two drift paths were characterized by a drift in the superficial layer (0-5 m) and a drift in the subepilagic layer (5 200 m), respectively. Connectivity intensity with Balearic Islands has slightly increased when spawning occurred at the end of summer. The retention or dispersion of larvae from the restrictive area of fishery depended mostly on the larval ecology. Above all, the vertical behaviour of the species larvae could influence the recruitment and determine the effectiveness of the management plan.

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Poster title

The multidisciplinary approach to stock identification and state: case studies from the Mediterranean Sea

Abstract

To improve stock assessment, efficiency is essential to facilitate fishery sustainability and profitability. To achieve this goal, it is necessary not only to enhance assessment methodologies but also to fill the biological knowledge gaps, including stock boundaries identification and connectivity estimates. Although the validity of a multidisciplinary, "holistic" approach to fish stock assessment is widely recognised, the case studies in the Mediterranean Sea are still limited in number. Here we focus on the synergistic results obtained by the joint application of molecular approaches with different and complementary techniques to infer the biological boundaries of fish stocks and their connectivity. As relevant case studies will be presented those concerning fish species highly relevant for Mediterranean fisheries and characterized by different biology and fishing pressure, as the demersal European hake (*Merluccius merluccius*) and the small pelagic horse mackerel (*Trachurus trachurus*). The results obtained will show how different approaches do reflect processes encompassing different temporal (not only geographical) scales: the genetic structure revealed by molecular data results from processes involving a temporal scale over multiple generations, while the use of biological data (from parasites, otolith chemistry, biological characters, etc.) may track individual movements through the identification of their feeding grounds. The analysis of congruence and incongruence of such kind of multiple datasets may provide insights into stock boundaries, connectivity and state, and thus contributing to better management advice.

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Poster title
New wrecks in the Adriatic, the beginning of a successful story on artificial reefs?

Abstract
Submerged wrecks are the most common form of artificial reefs. Whether they were submerged intentionally or accidentally, they enhance the habitat for a large number of organisms such as corals, invertebrates and fish, many of which are commercially exploited. The first research of fish community structure associated with two shipwrecks on the east coast of the Adriatic was conducted in 2017 and 2018; the shipwrecks Ledenik and Vis. Ledenik sank in the Middle Adriatic in 2008 due to a malfunction, while Vis is the first ship in Croatia that was sunk for the purpose of a diving attraction in 2016 in the North Adriatic. Both wrecks are located at 20-30 m of depth and are about 60 m long. The research was conducted by visual census using scuba diving, recording observed species, abundance and fish size. On both wrecks, the assemblages are similar in terms of recorded species, but the abundance and average size of individual fish is larger on the wrecks than on the corresponding control stations. The aim was to provide a baseline data of fish community structure for a long-term monitoring that would confirm artificial reefs as hotspots. Similar trends of increased abundance and size on the wrecks represent the basis for a successful monitoring of the changes and expected growth of ichthyofauna biomass on artificial reefs. Such locations are rare in the Adriatic and have a potential to provide the locals with economic benefits by attracting fish and thus becoming attraction for divers and fishermen.

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Poster title
An operative tool to evaluate the environmental status of epimegabenthic communities subject to trawl activities

Abstract
The European Marine Strategy Framework Directive (MSFD) indicates a series of descriptors to evaluate the environmental status of marine communities, including sea floor integrity and biodiversity as crucial indicators. One MSFD operative protocol is dedicated to the assessment of the status of epimegabenthic communities in trawling fishing grounds. In this context, operative tools, such as ecological indicators, represent fundamental elements to obtain information on the conservation status of the ecosystems and to carry out ecosystem-based management strategies. To be useful for management purposes, indicators must be rapid and simple in characterizing the composition, structure, and functioning of the communities and their modification in time (Greenstreet and Rogers, 2004), and should highlight the occurrence of sensitive species or

habitat used as bioindicators (GFCM, 2006). We used a modified version of the Traders Dynamic Index (TDI) (de Juan and Demestre, 2012) to evaluate the conservation status of the epimegabenthic communities including demersal fish populations. Five ecological categories reflecting the vulnerability or potential response of the species to trawling impact have been utilized (mobility, fragility, position on substrata, size and feeding mode). A revised version of the scores attributed to sessile and mobile invertebrates, as well as demersal fish, was created using a comprehensive list of species obtained from literature and the EU MEDITS database. The scores were used to assign each taxon to a functional group and the index reflected the percentage composition of these groups in each evaluated community. This new index was applied and tested in different areas of the Italian seas.

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Poster title
Parasitism in *Anguillicola crassus* and its impact on the fitness of *Anguilla anguilla* in Tonga Lake (Algeria)

Abstract
This study is a contribution to the knowledge of parasitism in *Anguillicola crassus* and its impact on the fitness of the European eel (*Anguilla Anguilla*) who live temporarily in Lake Tonga, a continental hydrosystem located in the extreme east of Algeria. The parasites were sampled in the swim bladders of the eels during an annual cycle. A total of 473 individuals (26 < TL < 73.3 cm, 30 < TW < 710 g) were analyzed and various classical epidemiological indices were determined (prevalence, intensity and abundance) according of the seasons, sex, silver stages (silver eels, yellow eels and intermediate eels). The impact of the nematode parasite on fitness was investigated by comparing the condition coefficient of two groups of healthy and parasitized eels. The study of the evolutionary dynamics of parasitism showed that *A. crassus* was present throughout the year in Lake Tonga. The prevalence values range from 10.7 to 56.2 percent and the total abundance of parasites per infected fish varies between 2 and 7. This nematode targets mainly silver eels and large eels. However, statistical analysis revealed no significant variation in time and sex. In both groups, growth patterns ($Kc = 0.17$ g/cm^3) are similar ($t = 0.44$, $P = 0.65$), which means that the growth of healthy and infected eels is similar.

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Poster title

Exploitation status and stock assessment by pseudo-cohort analysis of the *Lepidopus caudatus* in Tunisian waters

Abstract

The silver scabbardfish, *Lepidopus caudatus*, is quite abundant in Tunisian waters, off the eastern coast of Tunisia. It is commercially exploited by trawlers all year round. Catches of silver scabbardfish, in the period 2000–2014, fluctuated between 479.67 t and 226 t with an annual average of 362.35 t. The analysis of the virtual population of silver scabbard fish in Tunisian waters showed that, in 2014, the stock was subject to a fishing effort (226 t) which does not exceed its capacity ($E = 0.42 < 0.5$). The biomass (B) estimated to be 2371.43 t only tolerated the extraction of 418.32 t. The actual stock of silver scabbardfish in Tunisian waters was characterized by individuals having a mean total length of 73.88 cm, a size which is much lower than the one at first sexual maturity (100.23 cm). The turnover (D/B) being of 48.03 percent, it did not allow the reconstitution of the stock. The total removals (913 t) due to both natural mortality ($M = 0.385$) and fishing mortality ($F = 0.288$) had to be compensated especially by individual growth (1127.05.3 t, 98.95 percent) because of the low weight of the recruits (1.05 percent).

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Poster title
Modelling the food web of Thermaikos Gulf (northeastern Mediterranean Sea, Greece)

Abstract

Ecosystem modelling is an integral part of the ecosystem approach to fisheries management, which requires shifting from single-species assessments to more complex models that include multi-species trophic interactions, environmental and anthropogenic driving factors. Ecopath with Ecosim (EwE) has been widely used to describe the energy fluxes and food web structure of marine ecosystems and assess the impact of fishing. In the Mediterranean Sea, most Ecopath models have been constructed in the western and central parts of the basin. Thermaikos Gulf is a shallow gulf in northwestern Aegean Sea (Greece) that constitutes one of the major fishing grounds of the northeastern Mediterranean concentrating high fishing effort of trawlers and purse-seiners and producing more than 20 percent of the total Greek catches. In the present work, we developed an Ecopath base model, with 33 functional groups, aiming to depict the food web structure of Thermaikos Gulf. According to the summary statistics that describe Thermaikos ecosystem as a whole, the output parameters were within those of previous models in the Adriatic and northeastern Aegean Seas. These values indicate a medium sized system in terms of flows, with a total system throughput of about 3 200 t/km^2/year, and also an immature ecosystem, probably as a result of intense fishing pressure by small-scale coastal vessels, with high system production exceeding respiration. Overall, squids had a high relative total impact meaning that they play an important role in the food web with relatively low biomass, and out of fishes, other gadiforms had the highest overall impact and keystoneness.

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Poster title
Shaping natural mortality and stock productivity bythe fish condition index in the stock assessment

Abstract
Strengthening scientific advice in support of management is a priority of the GFCM mid-term strategy, to reverse the declining trend of Mediterranean and Black Sea fish stocks. In parallel, the complexity of the stock assessment models used during the dedicated GFCM working groups in the Mediterranean has rapidly increased, like the availability and quality of the fisheries data. In particular, the integrated models were indicated as the possible solution to supplement the information from additional regional indicators of stock status. Several studies demonstrated that fish condition, or the magnitude of stored energy reserves, is a key attribute of fish, as the condition affects other life-history traits such as growth, reproduction and natural mortality and, consequently, it may have important influence in terms of stock productivity and fishery success. The purpose of the present study is to integrate the fish condition factor in the stock assessment. *Mullus barbatus* from Southern Adriatic Sea (GSA18), a stock recently assessed as sustainably exploited, has been selected as a case study. The use of Le Creen index (Kn) was selected as the

simplest and reliable indicator of body condition for species allocating energy reserves mostly in muscle, as red mullet. The annual proportion of "starving" individuals by length intervals, defined as having a Kn below a set threshold, was used to adjust the annual natural mortality by age used in the integrated assessment. Then the impact resulting from the integration of the fish condition index in the assessment is evaluated.

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Poster title

Création d'une réserve marine avec les pêcheurs professionnels petits métiers dans une AMP (Agde, France)

Abstract

Afin de répondre à une diminution des ressources marines et à une dégradation des milieux naturels, en particulier de l'habitat récifs de coralligène dans le périmètre des 6 200 hectares de l'Aire marine protégée (AMP) de la côte agathoise (Agde, côte méditerranéenne française), Site Natura 2000 Posidonies du Cap d'Agde, les pêcheurs professionnels petits métiers et leur prud'homie se sont associés à la ville d'Agde, gestionnaire de l'Aire marine protégée, pour développer un projet de création de réserve marine sous forme de cantonnement de pêche. La démarche a été engagée de manière collaborative et dans une étroite concertation avec les pêcheurs et les autres acteurs (pêcheurs de loisirs, plongeurs sous- marins, et plaisanciers notamment), sur la base d'entretiens individuels et collectifs. Une méthodologie scientifique a été adoptée pour conduire à une proposition de réserve marine d'environ 300 hectares permettant de protéger 45 pour cent du coralligène de l'AMP. La réglementation adoptée par consensus prévoit que toutes les activités seront interdites (pêche, plongée, mouillage) à l'exception de la navigation. Ce projet est développé par la ville d'Agde dans le cadre du LIFE intégré MarHa piloté par l'Agence Française pour la Biodiversité de 2018 à 2025.

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Poster title
Turbot stock management in the Turkish Black Sea coasts

Abstract

Turbot population is the most valuable target species in the Black Sea littoral. The state of turbot fishery has been analyzed with all components of fishery dynamics since the 1980s. The results indicate that the stocks have been seriously overexploited for several decades. Analyses showed that recovery of the exploited stocks and establishing sustainable fisheries need some urgent provisions primarily through basic fisheries management measures. Some urgent actions towards rehabilitation of the Black Sea turbot stocks have been commented. There is some insufficient information which is not enough to stocks assessments and population parameters. Recently, some management measures for the exploitation of turbot stocks and monitoring programs were initiated, but they are poorly implemented. Management measures should include: (1) social aspects (training and education together with capacity building at grass-roots level) in order to be prepared to accept governance of fishery regulations; (2) economic and technical aspects (fisheries regulations). In order to control illegal and unreported catches, the following issues should be tightly monitored by legal authorities: (1) to stop illegal catches and landings, (2) to minimize the amount of illegal fishing, discard and bycatch by a) reducing fishing effort, b) precluding vessels without licence from fishing operations, c) applying prohibitions of locality-period-depth to provide stock recovery, (d) setting up regulations for total allowable catches (TACs), (e) using more selective fishing gears for sustainable fishery (modifications to minimize bycatch and discards, increasing mesh size selectivity), and (f) training the artisanal and recreational fishermen.

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Poster title
Fisheries biology of blue swimmer crab (*Portunus pelagicus*) in the Mediterranean waterfront of Egypt

Abstract
More than 5 000 MT of crabs are annually produced from the Egyptian fisheries. Most of them are blue swimmer crab (*Portunus pelagicus*), about 45 percent are caught in the Mediterranean Sea. To assess their fisheries biology, monthly samples were collected from the commercial crab catch during the period from November 2016 to October 2017. A number of 1 632 *P. pelagicus* specimens were measured for morphometric relationships, sex ratio, and age determination using carapace width frequency, population structure, mortalities rates and exploitation ratio. *P. plagicus* is targeted by multifilament trammel nets. Carapace width-weight relationship showed isometric growth (b-value =3). The carapace width at first capture (CW50%) was 83 mm. The mortalities rates were estimated at 1.840, 0.753 and 1.087 year-1 for total, natural and fishing mortalities respectively. The blue swimmer crab fisheries in the Mediterranean waterfront of Egypt is overexploited (E= 0.59) by trammel net. Some management measures were suggested to maintain its stock for sustainability.

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Poster title

Assessment of *Sepia officinalis* population in the Egyptian Mediterranean coast

Abstract

The common cuttlefish (*Sepia officinalis*) has a significant commercial value in Egyptian fishery. The population parameters of this species in the Egyptian Mediterranean coast were investigated using landed trawl catch from six ports along the coast during the period from 2011 to 2015. A total of 4 601 specimens were examined. Mantle length (ML) ranged between 20 and 203 mm for male and between 20 and 210 mm for female. The sex ratio was 1:3 in favor of males. There was a significant difference in growth between both sexes. The reproduction season of *S. officinalis* covers the whole year. The estimated growth parameters were $L\infty$ = 298 mm and K = 0.39 y-1. The instantaneous rates of total (Z), natural (M) and fishing (F) mortalities were 4.81, 0.45 and 4.36 y-1 respectively with an exploitation rate (E) of 0.91. Trawl fishery targeting demersal species in the Egyptian coastal waters is in a critical situation, which needs requires a management plan for the sustainability of the resources.

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Poster title

Stock assessment of the red mullet (*Mullus barbatus*) in the Egyptian Mediterranean waters

Abstract

The red mullet (*Mullus barbatus*) is one of the most important commercial species in the Mediterranean waters of Egypt (GSA 26). The landings of *Mullus barbatus* came mainly from the trawl vessels and constituted about 33 percent of the goatfishes in GSA 26. The sampling process was within a fisheries data collection system supported by the FAO EastMed project. Monthly samples were collected from landings during the period from January to December 2016. The monthly length-frequency distributions were raised to the monthly landings and analyzed by ELEFAN program incorporated in length frequency distribution analysis (LFDA) software for the estimation of growth parameters for the sexes combined. The length-weight relationship, the length at first maturity (L50) and the sex ratio were also studied. ProdBiom was used to estimate natural mortalities. VIT software was used for pseudocohort analysis. In addition, the Y/R analysis implemented in the VIT was applied for the calculation of the reference point F0.1. Sex ratio (% females/total) was 0.52 during study period. Age composition analysis indicates that the majority of the catch of this species was represented by Age groups 0 and 1. The Y/R analysis indicated a level of fishing mortality of 0.756, the target reference point F0.1 amounted to 0.265 during 2016, while the ratio Fcur/F0.1 2.857. In conclusion, the stock revealed a status of high overfishing. As a recommendation, the reduction of fishing mortality towards the resulted F0.1, taking into account the gear selectivity, will help in the implementation of a sustainable fishery management of the species.

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Poster title

Lagrangian backtracking of small pelagic larvae: assessment of spawning and connectivity

Abstract

The reconstruction of spawning areas starting from ichtyoplancktonic dataset regarding small pelagic species larvae is a fundamental issue for developing any indicator for fishery sustainability. We propose a backward Lagrangian that accounts for the relative dispersion that is not resolved by large-scale Eulerian models. Lagrangian trajectories are constrained by biological chlorophyll satellite measurements to eliminate spurious trajectories originated

by Lagrangian chaos and model imperfection. The actual ages of the larvae are determined by means of otholites measurements and give reliable ending conditions for back trajectories. We focus on the European anchovy in the Sicily Channel (Mediterranean Sea), whose ichtyoplancktonic data were continuously collected from 2004 to 2011. We obtain a direct assessment of previously hypothesized spawning areas together with evidence of Lagrangian connectivity between North Africa and the recruitment Capo Passero region. Results are then validated by means of *in situ* data and compared with spawning areas reconstructed from bioenergetics modelling.

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Poster title

Otolith shape analysis as a tool for stock identification of *Pagellus erythrinus* in Tunisian coasts

Abstract

Pagellus erythrinus is a common fish species, which represents in Tunisia an appreciated and valuable fishery resource since it plays an important role in local microeconomics through its capture volume and its high commercial value. The shape of the otolith has long been considered to be an ideal natural marker for fisheries management. We used otolith shape to confirm the existing stock structure of *Pagellus erythrinus* based on applications of basic size descriptors (curve area, perimeter and maximum otolith size), shape indices (circularity, ellipticity, rectangularity, roundness and form factor), and normalized elliptical Fourier descriptors. Two geographic areas representing the eastern and western Mediterranean Sea off Tunisia coasts were sampled. In all, 197 sagittal otolith pairs of *Pagellus erythrinus* ranging from 120 to 221 mm in standard length were collected from commercial fishing of each area at the beginning of each season over the course of the year 2007. Multivariate analysis of variance performed on each descriptor separately revealed significant otolith shape differences between both areas when sex and age are taken as cofactors. However, when ages, male and female were combined, no difference was detected among regions. The results of the discriminant analysis showed that a quite low misclassification occurred among areas with an overall of 68.52 percent of fish correctly classified for both sexes combined. These results are in agreement with the previous *Pagellus erythrinus* genetic studies in Tunisian coasts, which support the slight separation of these stocks.

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Poster title
Study about the effectivity of the artificial substrates for cuttlefish and squid lays

Abstract
Catches by fisheries of cephalopods have been increasing in the last years. The artisanal fishermen from Gandía take average of a *métier* which is suitable with catches of cuttlefish throughout driftnet. Catches by these fisheries have fluctuated so high from one year to another and decrease in catches has been perceived in the last period. Fisheries management of cephalopods is considering increasing the habitats which favour spawning because the majority of catches by artisanal fisheries are associated to the habitats and the reproduction period of these species. On this work, it is evaluated the effects of artificial substrates for increasing the cuttlefish (*Sepia officinalis*) and squid (*Loligo vulgaris* and *Loligo forbesii*) spawning's on sand bottom, influence of bathymetry and the possibilities of recovering the spawning's which have been fixed on driftnets and it would be thrown out. The results show that is possible to recover the eggs fixed on driftnets and to increase the success of reproduction. The squids prefer substrates on major depths, among ten meters and so deep zones. The cuttlefishes prefer superficial depths, ten meters maximum. The substrates which cuttlefishes prefer are more complex, and squids prefer substrates more simples like deep buoys.

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Poster title
Searching for patterns in *Octopus vulgaris* locations on pot fishing lines

Abstract

The common octopus (*Octopus vulgaris* Cuvier, 1797) is a commonly exploited species with high commercial value. This study focuses on the catches of coastal population near Gandía, on the northwestern Mediterranean, and analyses data obtained by octopus pot fishing during nine days distributed between may and july of 2017 on board one of the local fishermen's guild vessel. Female ratio was higher than expected, although average mass per sex matched data already available. Significant biometric changes were found on females over this study duration. Dorsal mantle length to body weight ratio is analysed, and no recognizable pattern in the position of the catches is found. Other biometric measures like ventral mantle length is discarded by redundancy, and the age determination procedure was not precise enough to provide any valuable data.

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Poster title

AIS as a useful system to support the identification of fisheries restricted areas

Abstract

Fisheries restricted areas (FRAs) are marine areas where fishing activities are regulated or totally impeded to increase biodiversity and/or biomass of commercially important species. Usually the establishment of these areas is based on scientific and technical studies which take into account ecological features and biological aspects. However, the relevance of such areas for different fishing activities represents an additional parameter that has to be taken into account in the identification process. In this context, Automatic Identification System (AIS) data opportunely processed can provide high spatial and time resolution key information on the current use of potential FRAs by fisheries, so allowing to hypothesize the eventual spatial redistribution after the ban and hence further supporting the decision process.

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Poster title
Environmental influence on the population dynamics of European hake in the western Mediterranean

Abstract
European hake (*Merluccius merluccius*) is one of the most important demersal commercial species in the Mediterranean, but also the species in the most critical situation due to the high levels of overexploitation. In the western Mediterranean, different methodologies have been used to assess its state of exploitation along the years, from initial pseudo-cohort analysis to the current age-structured models. However, none of these models take into account the effect of the environment on its population dynamics. Previous studies have identified the influence of oceanographic conditions, reflected in a mesoscale hydroclimatic index, on the recruitment of hake in the Balearic Islands (Geographical Subarea GSA 5). In fact, this index improved the stock-recruitment models of the species in this area. The objectives of this document are to analyse if this influence is scalable to adjacent waters of the western Mediterranean (GSA 6: Northern Spain and GSA 7: Gulf of Lion) and, when adequate, to carry out a model in which the role of the environment is

included. For that, firstly, the outputs of the stock assessment models carried out in these three GSAs will be analysed in relation to the IDEA index, with additional analyses using survey indices. Secondly, the incorporation of the effects of the IDEA index in the stock assessment models will be explored. The inclusion of the environmental factors on the analysis of the population dynamics of European hake will help to better understand these stocks and may be a useful tool to improve their assessment and management.

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Poster title

Discard trends in bottom trawl fishery in the Turkish Black Sea littoral

Abstract

Trawl fishery is the major fishing method in the Turkish Black Sea. One of the most important problems with bottom trawl fishery is by-catch and discard. A large proportion of the catch on board is sent back into the sea after the removal of the target species. The rate of discard for two target species of bottom trawl fishery was estimated at 17.3 %, 27.8 %, 27.7 % and 26.5 % for red mullet in 2010, 2011, 2012 and 2013, respectively. The rates were at 33.4 %, 39.3 %, 40 % and 29.8 % for whiting in these four successive years, respectively. The reasons for the heavy pressure on red mullet and whiting populations were the low selectivity of meshes and the long operation durations. The high exploitation rate generally causes the catch of relatively small and immature individuals. Though the rate of discard in weight is lower than the market rate, by means of number of individuals the discarded portion is larger than the market. The age composition of discarded red mullet was determined at 0 and 1 age groups and of whiting at 1 and 2. The high discard rates can be considered as an indicator of the exploitation level of the demersal species.

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Poster title
A multidisciplinary approach to assess the transboundary nature of Mediterranean fish stocks: the TRANSBORAN project

Abstract
Historically, stock delimitation has followed a top-down approach, in which management stewardships decide stock boundaries attending mainly to political reasons and, fisheries assessment consequently adapts. However, there are currently vast research evidences showing that stock delimitation should be bottom-up based in scientific evidences. This inherently requires multidisciplinary and holistic approaches to deal with stock structure and inter and intra stock connectivity. However, this is often a challenge because different approaches provide information at contrasting spatial (from local to regional) and temporal (from daily to evolutionary) scales. Here, we present the research project TRANSBORAN ("Transboundary population structure of Sardine, European hake and blackspot seabream in the Alboran Sea and adjacent waters: a multidisciplinary approach"), carried out under the framework of the FAO Mediterranean Regional Project "CopeMed-Phase II" and in collaboration with the GFCM. The main objective of the project is to describe the spatial structure of populations of sardine, European hake and blackspot seabream in the most precise way to identify the most plausible stock units, as well as potential intrastock structural complexity (e.g. metapopulation), that lets improve regular assessments and inform management advice in the western Mediterranean. The project will sample 17 sites within the Alboran Sea and adjacent waters to combine information of: hydrodynamic modelling; genetics; muscle and otolith stable isotopes; otoliths microchemistry and shape; parasites composition; meristic description of body and fish bone; and, fishery patterns, demography and life history traits. This presentation describes the rationale for the multidisciplinary approach and the preliminary findings obtained in the first year of the project.

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Poster title

Reproductive biology of turbot (*Scophthalmus maximus*), from the northwestern coasts of the Black Sea, Bulgaria

Abstract

The turbot, *Scophthalmus maximus* (Linnaeus, 1758), is of great economic importance for the fishing sector in Bulgaria. The purpose of this study was to determine the age, length and weight of the matured individuals, sex ratio, sex ratio at length and age, condition factor, gonadosomatic index (GSI, %), total fecundity, seasonal development of the ovary and testis of mature turbot inthe northwestern Black Sea coast of Bulgaria. The fish samples were obtained between May 2015 and December 2017. Turbots were collected using bottom trawl and from wholesale trade. A total of over 300 turbots were sampled and ordered in age groups. Total lengths were between 45.0 and 65.0 cm, while weights varied from 1 600 to 5 000 g. The gonads were investigated by histology and macroscopic analysis. The results, together with the gonadosomatic index (GSI) values, suggest that the spawning activity extends from 15 April to middle June. Total fecundity depends on female size and age and is around 2 300×103 eggs/female. A significant positive correlation was observed between body length and weight and the total and absolute fecundity.

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Poster title
"Smart fish scale (SFS)" development project

Abstract
The main study consists in measuring the length and weight of the samples accurately in order to determine the amount of stock or population and create a basis for future strategy in fisheries management. The total length is closely related to many factors such as age, weight and maturity. As many fish as possible should be measured for this relationship to be accurately determined. It aims at reducing the standard error while increasing the number of measurements to represent all length classes. When the measurements are recorded on frequency tables, forms, or computers, errors can occur from researchers. Digital-based measurements and weighing systems are developed to remove these errors. Error sources are eliminated while data is assessed thanks to these systems and a more correct and faster analysis is obtained. This product developed within the scope of the project measures fish length, weight and width, and data can be stored and reported in digital media and be sent to the desired place via network. Linux-based software is used in the product and can be improved with "Deep Learning" technology. Future versions of the system will have central back-office software and data from different locations or devices will be analysed at the centre to generate reports and graphical results. Consequently, the image processing-based software aims at minimizing the errors caused by researchers, saving time and manpower and creating a common data network at the same time.

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Poster title
Fisheries monitoring indicators – stock status

Abstract
The implementation of the Common Fisheries Policy (CFP) requires all stocks of interest to the fleets belonging to European Union Member States to be in line with the international agreements about the exploitation of fish stocks, namely fishing mortality to be at FMSY levels and biomass to be above BMSY levels. These objectives are also laid down in the United Nations Convention on the Law of the Sea and Sustainable Development Goals (14 – life below water). Recent results on monitoring exploitation and conservation levels in the Mediterranean are presented.

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Poster title

Growth characteristics and distributions of cartilaginous species in the Black Sea

Abstract

The cartilaginous species contains sharks, rays, skates and chimaeras. Three species are relatively common in the Black Sea. These are: thornback ray (*Raja clavata*), common stingray (*Dasyatis pastinaca*) and spiny dogfish (*Squalus acanthias*). All cartilaginous species are caught accidentally as bycatch or discard in the fishing gears, mainly bottom trawl and gillnet. They have no commercial value in the Turkish fisheries sector and two of them (*R. clavata* and *S. acanthias*) were protected by legislation according to the Turkish Fisheries Circular by the Ministry of Food, Agriculture and Livestock. In this research, some growth characteristics and distribution of the cartilaginous species from the experimental bottom trawl survey in the central Black Sea were examined. The length-weight relationships were calculated as W= 0.0044 L 3.093 (R2=0.98) for *R. clavata*, W= 0.0004 L 3.745 (R2=0.97) for *D. pastinaca*, W= 0.0071 L 2.857 (R2=0.97) for *S. acanthias*. *R. clavata* specimens distribute between 10–90 m, *D. pastinaca* between 10–50 m, *S. acanthias* between 10–75 m. All specimens are mostly found in 0–25 m (46 percent for *R. clavata*, 72 percent for *D. pastinaca* and 52 percent for *S. acanthias).*

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Poster title

Operating a Network of Integrated Observatory Systems in the Mediterranean Sea (ODYSSEA): The role of Gökova Observatory

Abstract

ODYSSEA is a project supported by the EU under the Horizon 2020 Programme for Research and Innovation, which is based on an integrated network of Mediterranean observational and forecasting systems. ODYSSEA focuses on biological data integration, fosters the ecosystem assessments, forecasts scenarios and provides a deeper understanding of vulnerabilities, risks and interventions at local and regional levels. The project is a user-centred project, aiming to make Mediterranean marine data easily accessible to multiple end-users by harmonizing the existing Earth Observing Systems, upgrading operational oceanographic capacities, improving interoperability in monitoring and fostering Blue Growth jobs creation. Nine Regional ODYSSEA Observatory Prototypes will be established in the Mediterranean Sea in order to fill-in existing data gaps and to increase the temporal and spatial resolution through observational and marine forecasting data. A network of observatories, which will consist of monitoring and modelling teams, will be established to support environmental management, planning and protection activities. Being one of these observatories, Gökova Bay Observatory is a Marine Protected Area (MPA) (with 6 No Take Zones) in the South Aegean Sea. Regional economy relies on small scale fishery, tourism and agriculture.

Gökova Bay with its vulnerable habitats, is important for commercial species as it serves as a nursery area. Overfishing and invasive species are the main threats of the region. Gökova Observatory will provide data for the fishery sector, non-governmental organizations (NGOs) and ministries by considering these factors to support ecosystem-based management plans.

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Poster title

Biological characteristics and stock assessment of *Lithognathus mormyrus* along the Lebanese coast, Levantine basin

Abstract

Lithognathus mormyrus is common in the Mediterranean Sea. It is a demersal species that inhabits rocky and sandy bottoms down to 80 m of depth (in the Mediterranean). In the latter sea, it is highly appreciated and constitutes a good catch for coastal fisheries, especially along the Lebanese coast (28.25 tonnes caught in 2016). Basic biological information is required to aid in the sustainable management of this exploited fish stock. Monthly biological *Lithognathus mormyrus* data has been collected since 2015 by the National Center for Marine Sciences – National Council for Scientific Research in the framework of the FAO-Eastmed project. Data from 2015, 2016, and 2017 will be used to assess the growth and biology of the latter species along the Lebanese coast. These data will be essential to understand the growth rate, population structure and other biological aspects of population dynamics that will be beneficial for the future management of this fish stock.

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Poster title
Biological, economic and technical vessel use indicators: a tool for fishing capacity management?

Abstract
Overcapacity of fishing fleets has been an important cause of historic overexploitation of fisheries resources. The calculation of biological, economic and technical vessel use indicators at fleet segment level, can offer fisheries managers a novel perspective on relationships between the fishing capacity, the status of biological resources at sea and the economic performance of fishing fleets, assisting them in the decision-making process. Indicators can for instance be used to assess the extent to which fishing fleets rely on stocks which are fished at levels exceeding FMSY, to assess which fleet segments catch sensitive species, to flag unprofitable fleet segments, and to identify fleet segments with underused fishing vessels. The experience of the Scientific, Technical and Economic Committee for Fisheries (STECF) working groups calculating and evaluating such indicators to assess the balance between fishing fleets operating in the Mediterranean Sea and the resources they exploit is described. Challenges related to data gaps, the integration of biological, economic and transversal datasets, the interpretation of indicator results, and to achieving an overall assessment for each fleet segment are discussed.

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Poster title
Trawl Surveys to support demersal stocks assessment in the Adriatic

Abstract
According to most recent stock assessments performed in Adriatic, a further reduction of fishing mortality and fishing effort is desirable, since almost all species assessed result overexploited. Conventional approach of stock assessments uses catch data which, however, are questionable; the majority of models assumes strong correlation between catch and biomass in the sea, considering a decrease in the landings as a decrease in biomass. Catches do not necessarily represent the real amount of fish in the sea, as it depends on several factors such as, market and laws. Alternative tools exist that use fishery-independent data coming from scientific survey. In this document SURBA, a fishery-independent assessment model, has been used with data coming from MEDITS trawl survey performed in GSA17. Analyses were performed for some commercial species already assessed using fishery-dependent models in the Adriatic (e.g. *Mullus barbatus* and *Merluccius merluccius*). Results have been compared with the stock assessment regularly performed for the same species and they suggest that the health of stocks varies depending on the species.

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Poster title
Parasites as biological tags for Mediterranean fish stock characterization

Abstract
Stock identification of Mediterranean fisheries has been based mostly on data on biology, morphometrics, artificial tags, otolith shape and fish genetics, and, more recently, on the use of parasites as biomarkers. Here are some case studies comparing Mediterranean and Atlantic fish stocks in a multidisciplinary framework will be presented. Differential distribution of parasite species of the genus Anisakis on demersal (hake) and pelagic (horse mackerel, swordfish) species, were useful in providing support for their fish stock characterization, in a holistic approach. The generalized Procrustes rotation was used to assess the association between parasite data and fish host genetics. While fish population genetics can detect changes over an evolutionary timescale, providing indications on the cohesive action of gene flow, parasites are more suitable biomarkers when considering fish stocks over smaller temporal and spatial scales, hence giving information of fish movements over their lifespan. Further, population genetic studies, inferred on both mitochondrial genes and nuclear (DNA microsatellites) markers, performed on target species of Anisakis, parasites of distinct fish stocks, would represent a further tool to be included in multidisciplinary studies on fish stock structure.

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Poster title
An environment friendly structure for enhancing economy and sustainable utilization of Mediterranean and Black Sea

Abstract
The Mediterranean and the Black sea are a vast source of fish and fisheries resources. At present, Mediterranean and Black Sea are facing a decline in their fish stocks and also facing lots of problems such as lack of proper fisheries management plans, overexploitation, lack of bio-economic analyses, significant loss of revenue, climate change effects, extinction of fish species and unsustainable development. To minimize these problems we bring a floating structure named "Floating Terrain". The structure can make by using locally available low cost materials. This structure can be used for both small-scale and large-scale commercial purposes. It is a movable and environment-friendly structure with integrated use. It can minimize the effect of climate change thanks to its rotational uses according to season. It will provide a year-round income source for the community who depends on the Mediterranean and the Black Sea for their livelihood. During the rainy season it can be used for cage culture of fish in a place where minimum shark influence occurs. In times of huge fish catch, it can be used for drying the fish with minimum insect infestation and better quality. Besides it can be used for solar energy production, hook and line fishing, vegetable culture around the structure, conservation of endangered fishes, source of tourism etc. with no environmental pollution. The people who are involved in exploitation of resources there, will get a structure with multiple income opportunities and thus will reduce overexploitation. Hence, it will lead to a sustainable management of the Mediterranean and Black Sea.

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Poster title
What should be the Minimum Landing Size (MLS) and Minimum Mesh Size (MMS) in the whiting fisheries with gillnets on Black Sea?

Abstract
Whiting is one of the most important fish species in the Black Sea fisheries and generally caught by gillnets. However, in the last period, indicators to deal with the overfishing of this stock have been observed. For this reason, it is necessary to take some precautions about the fishing activities of this species. In this study, it was aimed to determine the selectivity parameters of gillnets used in the whiting fisheries. Also the first sexual maturity length, the optimum length range and the megaspawner length were determined. With the help of the obtained data, length range to be catched and the minimum mesh size that should be used for that length range were calculated. According to data; the first sexual maturity of the whiting was 13.42 cm, the optimum length ranges between 17-21 cm, and the lower limit of the magaspawner length was 23 cm.

Accordingly, the minimum landing size for the whiting should be 17 cm. It was determined that if fishing is done with a 28 mm mesh size, only 8 percent of the captured individuals will be in the optimum length range and 65 percent will be smaller than the first sexual maturity length. By contrast, when a 36 mm mesh size is used, it was determined that about 50 percent of the individuals caught would be in the optimum length range and 80 percent would be longer than the first sexual maturity length. When all the results are evaluated together, it can be said that the minimum mesh size that should be used in the whiting fisheries is 36 mm.

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Poster title

How small-scale fisheries (SSF) Traditional Ecological Knowledge (TEK) is used in the Marine Stewardship Council (MSC) certification program and tools

Abstract

The MSC is the most recognized global fisheries certification program worldwide, coherent with the FAO Code of Conduct and the FAO Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries. The MSC certification program is based on its standard for sustainable fisheries which provides a global framework of fisheries management best practices. The MSC third-party assessment process therefore allows to recognize those best practices actions and to identify and analyse challenges within specific fisheries management system, including those related to the requirements on the collection and monitoring of ecological information, both scientific and empirical, needed to inform and define measures to achieve and maintain sustainable management. The MSC program integrates the TEK concept from two complementary dimensions emanating from its vision and mission. Firstly, from a philosophical vision considering that the MSC program is a global tool which can be accessible to any kind of fishery regardless of its dimension. And secondly, from an operational approach embedded within the Fisheries Standard where specific performance indicators can be assessed using informal and traditional management uses applying specific tools such as the risk-based framework and following specific guidelines provided to interpret those approaches in a homogenized way.This paper presents how TEK has been considered to assess and certify small-scale fisheries against the MSC Sustainable Fisheries Standard, analysing the rationales produced by the evaluation teams of the independent third party certification bodies applying the risk-based framework tool and the informal and traditional approaches in order to score specific performance indicators.

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Poster title

The implementation of a pilot case study on the Ecosystem Approach to Fisheries in Lebanon

Abstract

The FAO and the University of Balamand (UOB) – Institute of Environment (IOE) have agreed to support the implementation of a pilot case study on the Ecosystem Approach to Fisheries (EAF) in Lebanon. The project entitled "Implementation of a pilot case study on the Ecosystem Approach to Fisheries in Lebanon" focuses on the purse seine sardine fishery that harvests pelagics, specifically sardines. The action is funded by the FAO-EastMed project "Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean" (GCP/INT/250/EC Year 6) and implemented in collaboration with the EastMed project, the Ministry of Agriculture and FAO Lebanon. The project started on 1 December 2015 and ended on 31 December 2016; activities were officially launched two weeks after the signing of the contract. Introducing the EAF as the management tool for the Sardine Fishery in Lebanon was therefore accomplished through three main phases: i) initial process planning and stakeholder support, ii) risk assessment, and iii) development of the fishery management plan and action plan for capacity development. The main achievements of the project are the elaboration of the EAF-Baseline Report summarizing the purse seine sardine fishery in Lebanon and establishing of the "Purse Seine Sardine Fisheries Management Plan" based on the EAF basics. The project was a great opportunity for fostering relationships amongst fishers, the EAF team and other stakeholders. The project offered a platform permitting a bottom-up approach to share concerns and to elaborate the purse seine sardine fishery management plan based on the EAF basics.

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Poster title
Trawl surveys to support fisheries management in the Adriatic Sea

Abstract
The Scientific, Technical and Economic Committee for Fisheries (STECF, PLEN-18-01) states a general overfishing state for Mediterranean stocks with only six stocks not overfished, out of 47 assessed. Official Italian statistical data show, in the last two decades, a reduction of fleet (- 45 percent), fishing days (- 40 percent) and crew (>- 40 percent). Following this trend, catch declined from more than 400 000 tons, in the period 1970-1995, to lower than 200 000 tons in 2015, with a loss of one million euros per year of catch value. Despite this socio-economic destructive policy, STECF stated that Mediterranean stocks remain in a poor situation, without signals of change in terms of fishing pressure or stock biomass. A doubt exists on the reliability of stock assessment for the Mediterranean fishery situation, since model results from different sources contain biases and uncertainties. Some biases may be overcome giving greater emphasis to fishery-independent data collected from scientific surveys (e.g. MEDITS for demersal species). Scientific surveys are less subject to the uncertainties of commercial catches, since collection protocols are scientifically designed and standardized, and samplings cover not only fishing area but the whole distribution area for almost all species; biological data collected provide information on age and size of several species, estimation of recruitment and spawning stock biomass, nursery or spawning area. The reliability of data also depends on occurrence of species and it is possible to calculate it. An example of possible management advices independent from fishery is here discussed for a group of species by means of MEDITS data of the last 20 years in GSA 17.

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Poster title

European hake assessment based on size frequencies and basic biological parameters in the southwestern Mediterranean

Abstract

Assessments of small-scale, coastal fisheries are often hindered by the lack of complete data sets fulfilling the requirements of conventional stock assessment methods. In contrast, existing information from the regular monitoring of fisheries coupled with data-limited assessment methods can help provide the information needed for an effective management of fisheries. We investigated the year-to-year length-based estimates of the spawning potential ratio (SPR) of European hake, a species with moderate data availability. We explore the effects of considering fast- vs. slow-growth hypotheses and the uncertainties of input parameters on the annual estimates of the SPR (1998–2010) in a bottom trawl fishery in the SW Mediterranean. The SPR estimates under four life-history scenarios were sensitive to the quality (sample size) of the length frequencies. Consequently, comparable and more accurate SPR estimates were often found for annual samples larger than 2 000 individuals. The F/M ratio varied less when size compositions were grouped by period, suggesting there are transitory-population size structures. The SPR estimates were insensitive to the underlying growth hypothesis since similar M/k ratios> 2.3 were derived from the four sets of von Bertalanffy growth parameters. The assessment indicated

an overexploitation of hake (F/M > 2, SPR < 10%) that is comparable with that derived from conventional assessments for this species elsewhere in the Mediterranean Sea. According to our findings, the LB-SPR method can provide reliable stock assessments and allows population trends to be calculated for data-limited species. However, this method requires a good understanding of the input data and their possible sources of bias.

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Poster title

Spatial modeling of trawling in the Mediterranean Sea: predicting the effects of Fisheries restricted areas

Abstract

Within the framework of the DG MARE MANTIS project two modelling approaches were applied to assess the expected effects of spatial-based management scenarios of trawl fisheries in the central Mediterranean. The cases of study of the project include the Strait of Sicily (GSA12-16) in which the fishing effort in different grounds is regulated to create and optimize a network of marine managed areas (MMAs). The two approaches being applied are: the SMART platform (Russo *et al.*, 2014), representing an innovative approach, and the ISIS-Fish platform (Mahevas and Pelletier, 2004), an acknowledged model in this field. Both approaches are based on the identification of the fishing grounds and the definition of some critical areas (i.e. spawning and nursery areas), as well as the modelling of the physical connectivity among subareas. In parallel, the spatial pattern of catches for the main target stocks (*A. foliacea, P. longirostris, M. merluccius* and *M. barbatus*) and the economic costs associated to the pattern of the trawling effort are modelled. In this way, the effort displacement determined by the establishment of closed area is estimated according to the bio-economic processes underpinning the fishers' behaviour. Finally, the effectiveness of spatial-based management approaches is evaluated in terms of the simulated exploitation patterns determined by different choices of areas closed to trawling. Results in terms of stock status and fisheries performances are compared with the "classical" non-spatial approaches of reduction of fishing effort in fishery management.

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Poster title
Discards and IUU fishing in rapa whelk fisheries in the Black Sea, Turkey

Abstract
Since rapa whelk fisheries started in 1985, it was accepted as an alternative species for the benefit of fishers just in the period of collapse in anchovy fisheries followed by other species fed on anchovy. At the beginning, harvesting started with diving; either with scuba or pipe connected with the air compressor on board. In the first years, when the large-sized individuals were abundant, collection by hand was profitable. But when their abundance reduced, fishers were obliged to spend more time underwater to look for and collect big individuals with high market value. In that period, some accidents also happened due to diving failures of amateur divers. So the government gave permit to dredge for the benefit of *Rapana* fishers and a new period started damaging the ecosystem due to the peculiarities of the dredges such as its destructive pattern on the bottom habitat and high impact on bottom flora and fauna. Untargeted species in the dredge operations contain mainly crustaceans and fish, and rarely algae. Although it is illegal, most of the vessels use two dredges simultaneously and often operate at night. They prefer to use the two dredges per boat to catch whelk illegally in the spawning season. During these months, factories intensively process Rapa whelk. The active processing period of factories and illegal whelk fishery always overlap. In this presentation, discards and IUU fishing of rapa whelk fisheries with dredge in the Black Sea of Turkey will be summarized.

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Poster title

Characterization of fisheries of *Squilla mantis* (L., 1758) in Tunisian waters: implications for management

Abstract

The spottail mantis shrimp, *Squilla mantis* (L., 1758), is found in the Tunisian coasts especially in the Gulfs of Gabes, Hammamet and Tunis. S. mantis is considered as a bycatch, but its abundance in this area makes it an important species for fisheries. The analyses of the trawl surveys and the effect of spatiotemporal and environmental factors on the abundance of *S. mantis* have been made. The cartography of mantis shrimp biomass shows that the distribution of *S. mantis* in the Gulfs of Hammamet and Tunis is significantly lower than the one in the Gulf of Gabes. The life cycle has an important influence on the catchability of this species. The bathymetric distribution of the mantis shrimp ranged from 6 to 60 m in the Tunisian waters. The study of reproductive biology shows that the sizes at first sexual maturity (Lm50) for females ranged between 145.64, 150.63, and 155.25 mm for the mantis shrimp, respectively captured from the Gulf of Tunis, Hammamet and Gabes. The sexual cycle of this species can be split into three phases (maturation: December-April, spawning: April-August, retrieval and sexual rest: September-November). Von Bertalanffy function demonstrated that in Tunisia, female growth is lower than that of male. The growth rate is higher for mantis shrimp captured in the Gulf of Gabes. The population is composed of three size classes (one class per year) with a maximum life expectancy of three years. However, the significant difference between the morphometric characteristics of the three regions studied allows deducing the presence of three populations of *S. mantis*.

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Poster title

Review of the state of Gulf of Gabes fisheries management

Abstract

Dans ce travail, nous avons étudié l'état des pêcheries du golfe de Gabès afin d'identifier et d'analyser les changements survenus et de proposer un scénario pour une meilleure gestion des ressources halieutiques dans le golfe de Gabès. La méthode adoptée est celle de l'observateur embarqué à bord des navires de pêche professionnelle pratiquant la pêche au chalut benthique. Au total, 430 traits de chalut ont été réalisés en deux ans totalisant 507 heures de pêche effective. Durant les différents coups de chalut effectués, les captures en espèces commerciales ont été accompagnées par la pêche de quantités relativement importantes de rejets. Ces analyses ont permit d'évaluer l'aire de répartition des ressources halieutiques dans le golfe de Gabès et de quantifier les déplacements des espèces par rapport à la côte et d'évaluer ainsi leur abondance pour voir s'il y a fragmentation de l'aire de distribution. Les résultats ont montré que la production du golfe de Gabès a chuté chez certains groupes d'espèces entraînant des variations de la composition spécifique. En effet, les biomasses des espèces à longévité courte ont augmenté aux dépends de celles à longévité longue (accessibles à des profondeurs assez importantes). Les rejets en petits poissons et en benthos ont montré une tendance à l'augmentation accompagnée d'une diminution de la taille moyenne des espèces capturées. La production de la pêche a fluctué en fonction de plusieurs facteurs tel que l'impact de la surpêche, des mauvaises pratiques de pêche, de la pollution et du réchauffement climatique.

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Poster title
Modelling the dispersion of early life stages of Blackspot seabream in the Strait of Gibraltar

Abstract

The blackspot seabream (Pagellus bogaraveo) is a commercially appreciated demersal fish, widespread in the North-eastern Atlantic and middle-western Mediterranean. The Strait of Gibraltar is an important fishing area where artisanal fleets from Spain and Morocco target this species using special longline gears known as "voracera". Different assessments of the state of health of this species point to the same result: a clear overexploitation of the resource with no specific/joint management implemented yet. There is some agreement in literature in considering the Strait of Gibraltar as a specially energetic and dispersive spawning zone for this species. After the spawning, eggs and larvae (early life stages [ELS]) would be scattered to both sides of the Strait of Gibraltar, mostly to the breeding area close to Estepona, where high concentrations of juveniles occur. A high resolution hydrodynamic model coupled to a 3D Lagrangian particle tracking system is employed to assess the potential dispersal pathways of blackspot seabream ELS spawned in the Strait of Gibraltar. Recursive releases of passive tracers in virtual spawning spots in this zone are tracked under different conditions of tidal current, including fortnightly modulation, in order to obtain the spatial dispersion patterns of the studied species. Semidiurnal variability appears as a fundamental factor for horizontal dispersion and vertical displacement of the spawning products, determining the trajectories of the ripening ELS of the species.

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Poster title

Can data mining on YouTube reliably inform about patterns of fish catch in recreational fisheries?

Abstract

Data on recreational fisheries are scarce in many areas of the world, limiting both science and management. In the absence of field monitoring data, alternative data sources such as digital applications and social media platforms have the potential to produce valuable insights but have rarely been used to collect data from recreational fishers. Here, we present a case study aiming at exploring the harvesting patterns of common dentex (*Dentex dentex*) in Italy using videos posted on YouTube between 2010 and 2016. We automatically collected video information (e.g., title, description, number of likes and comments) and then filtered and subdivided the videos according to specific keywords into two categories representing anglers (N = 692) and spearfishers (N = 1051). The comparison of fish weights declared in the videos indicated that anglers shared catches of heavier fish (mean = 6.43 kg; N = 214) than spearfishers (mean = 4.50 kg; N = 326). The analysis also revealed a different effect of the weight of the fish caught on public engagement with videos from both groups; only in spearfishing videos the weight of the fish predicted the number of views and likes. Despite the possible biases associated with using social media data to infer patterns of fish catch and harvest, it allows inferring quantitative data that, once calibrated, can be useful for understanding and monitoring recreational fisheries.

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Poster title

MEDLEM archive to evaluate the bycatch of elasmobranchs in the Mediterranean basin

Abstract

The Mediterranean Large Elasmobranchs Monitoring (MEDLEM) database contains over 3 000 records and more than 4 000 individuals of large elasmobranch species from 20 countries of the Mediterranean and Black Sea. It covers the period from 1850 to 2018, with some records coming from the seventeenth century. The most numerous species shown in the archive are the devil fish (1 388 individuals), the basking shark (939 individuals), the blue shark (585 individuals) and the great white shark (337 individuals). In the last decades, other species such as the shortfin mako (166 individuals), the spiny butterfly ray (138) and the thresher shark (174 individuals) were reported with an increasing frequency. MEDLEM is an important source of information in the evaluation of bycatch. Indeed, 67 percent of the events recorded are due to bycatch, 6 percent are sighting events, 1 percent stranding, and 26 percent are unknown occurrences extracted from bibliographies. Regarding the gears responsible to retain the largest quantities of bycatch, longlines represent 33 percent of records, followed by purse seines (27 percent) and trawls (18 percent). The records in MEDLEM do not cover the Mediterranean and Black Sea homogeneously, thus it should only be considered a database of observed species presence. Scientific monitoring effort in the south-eastern Mediterranean is generally lower than in the northern sectors, thus the absence of some species in this database does not imply their actual absence in these regions. Under the GFCM research program to improve the knowledge and assess the status of elasmobranchs in the region, the adoption and the further development of the MEDLEM as common archive is foreseen in view of sharing its historical value.

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Poster title
Bycatch in rapa whelk fishery in the Black Sea, Turkey

Abstract
The veined rapa whelk (*Rapana venosa* Valenciennes, 1846) is an important invasive species in the Black Sea. Being a large predatory marine gastropod, it is refered to be the most unwelcome invaders worldwide due to its ecological impact in the ecosystem. However, in Turkey it is also one of the most important income sources for dredge fishery. However there has been serious conflicts between dredge fishermen and the fishery authority since recommended fishing methods of pot and diving are not considered to be profitable whereas dredging is most welcome regardless taking into consideration its ecological impact on the demersal ecosystem. However, the outcome of the GFCM meeting held in Batumi in 2017 was that rapa whelk fishery was about to reach the maximum sustainable yield (MSY). For a possible re-assessment of some management strategies in force we aimed to have a look at the bycatch rates of the dredges in use in the mid-Black Sea (Samsun and Sinop), where the majority of trawlers locate and hence most whelk catch comes from. We, therefore, have recently performed an intensive sampling in two *Rapana* fishing zones. The dredge used in the fishing zone is maximum 3 m of mouth opening and 40 cm of depth, and the maximum hull is 1 m in length with 70 cm mesh size. The duration of the haul was 30 min at each. The results are discussed, bearing in mind the fisheries economy, taking into consideration (a) ecosystem-wide overfishing, (b) bycatch and discards, and (c) habitat-destroying fishing methods.

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Poster title
Managing mass fish mortalities in Greece: The IMBER-adapt network approach

Abstract
Unusual fish kill extended for a four-week period within a semi-enclosed embayment (Maliakos Gulf), analyzed as a crisis management case study. The hazard identification was not an instant action since fish health diagnosis in relation to the detection of the environmental stressors takes 1-2 months to give a clear answer about the causal aetiologia (*Chatonella sp*) of the mass mortalities. Fish kill losses affects directly the income of the fishermen. As dead fish gradually appeared in different places along the coastline on different time, it has a tremendous effect on the local residents, the consumers of local seafood products and on tourism for several years. The importance of the social trust in the public administrators is given including the effects of the crisis communication on the social behavior. The crisis management of another mass mortality event, in a fjord-like gulf (Amvrakikos) with several fish kills reports in the past, due to the upwelling of anoxic water masses. The few-hour phenomenon had a tremendous disaster effect (900 tons of dead farmed fish). The technical aspects, communication and governance of the exploitation of "a mountain of dead biomass" are demonstrated. This crisis lasted for about a month and the relevant socioeconomic effects were also discussed. Both cases used as inputs templates to the Integrated Marine Biogeochemistry and Ecosystems (IMBER) decision support framework (I- ADApT) / expert system in order to investigate the societal and governing responses to global change in marine systems. Lessons learned from this effort are presented for risk management improvements.

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Poster title

Fish gut content analysis: gilthead seabream (*Sparus aurata Linnaeus*, 1758) from the Orbetello Lagoon (Central Italy)

Abstract

Gilthead seabream (*Sparus aurata* Linnaeus, 1758) is an important commercial species in the Orbetello Lagoon (Tuscany, Italy) which reaches 60 percent of the total catch. In order to assess diet composition and niche breadth of this species, the gut content of 35 specimens were collected at Orbetello Lagoon at each summer and autumn between May 2016 and October 2017. Fish sampling was performed by purse net, early morning of each day by Sig. M. Giudici (expert fisherman "La Peschereccia Srl"). After their capture, fishes were quickly transferred to the laboratory, weighed and measured. They were dissected and their stomachs were removed and preserved in 10 percent buffered formaldehyde. For dietary analysis, each stomach content was washed out and sorted under a dissecting microscope. Identification of prey was carried out to species level, whenever possible. To evaluate the rate of feeding activity, the vacuity index was calculated. The result of gastrointestinal tract content analysis index revealed that the highest feeding activity of *S. aurata* was during autumn. The highest level of vacuity index was observed in summer and the lowest in autumn indicating that the highest number of empty stomachs was in summer. Fifteen prey taxa, belonging to five major groups (algae, mollusca, crustaceans, polychaetes), were totally identified in the stomachs of *S. aurata*. The diet of *S. aurata* was mainly composed of benthic or epibenthic molluscs and crustaceans, whereas gastropods and polychaetes were only occasionally ingested. The most frequent prey was the mollusca *Cerastoderma glaucum*.

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Poster title
Commercial fish population in the Romanian Black Sea area – Stock changes generated by certain diseases

Abstract
Fishing, a traditional activity that over the years has played an essential role in the economy of Black Sea riparian countries, is industrial and handcraft. Marine living resources are not inexhaustible, even if they are restored, therefore, fishing must be done under certain conditions and depending on the state of fish stocks to minimize the risks. To ensure the sustainable exploitation of fish resources in the Romanian Black Sea coast, researches for assessing the effects of fishing gears and technologies used in Romanian fisheries on fishery resources and their specific habitats were made. The action of mechanical factors on fish populations can cause major trauma, triggering bacterial or fungal diseases. Stress caused to fish populations while fishing gear are used can also have a negative impact, reducing the resistance of organisms and favoring the release of infectious, parasitic, or other diseases. The fish species have revealed the following diseases: cutaneous fibroma, infections caused by bacteria of the *genera Aeromonas* and *Vibrio* and parasitic diseases trichodinosis, botriocephalosis, nematodosis. The most notable diseases were the parasitic ones – botriocephalosis and nematodosis – that affected turbot, sprat, anchovy and horse mackerel, the degree of parasite infestation being very high for a large number of specimens. Fish stocks can be affected and can reduce their number due to these diseases, with the risk of spreading it to other populations.

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Poster title

Hake trawlers spatial management in the Gulf of Lion: science-fishermen modeling efforts for realistic scenarios

Abstract

In the Gulf of Lion, demersal trawlers are confronted with overcapacity and the over-exploitation of one of their main target species: hake. The regulatory constraints consequently evolved with the implementation of the landing obligation and the upcoming multi-annual management plan for demersal fish enforcing effort reduction, spatial and temporal closures and technical measures. The main objective is to bring down hake fishing mortality to that ensuring maximum sustainable yield (MSY) by 2020. In this context, trawlers, one of the fleet with the highest fishing pressure on hake, have to limit catches of undersized individuals and consider other management strategies in order to promptly reach the hake MSY objective. Within the GALION and DISCARDLESS projects, scientists and fishers collaborate in order to reconcile these ecological emergencies and the upholding of sustainable fishing activities in the Gulf of Lion. To do so, all available knowledge on hake spatial dynamics and exploitation was integrated within the modeling plateform ISIS-Fish, which was then used to simulate alternative management strategies for the fishery.

In a first step, information from various sources were gathered and combined with evidence and model spatio-temporal patterns in hake distribution and exploitation. Results were discussed with fishers to ensure that the model reflects a shared vision of the system functioning. In a second step, fishers were consulted to build alternative management scenarios combining effort reduction and displacement and to identify the outputs of interest. The scenarios were simulated with the model and the trade-offs between ecological and economic objectives were quantified for the different scenarios.

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Poster title
Contributions of coastal MPAs to marine ecosystem recovery and fisheries sustainability in the northwestern Mediterranean

Abstract

The overexploitation of many marine stocks in the Mediterranean Sea calls for the development and assessment of tools to support the recovery, rebuilding and conservation of marine resources while contributing to fisheries sustainability. In this study, we assessed the beneficial impacts of three Marine Protected Areas (MPAs) in the northwestern Mediterranean Sea and their potential contributions to fisheries sustainability at the local and subregional level. To do so, we first built twelve food-web models for three MPAs in the northwestern Mediterranean Sea (Cerbere-Banyuls MPA, Medes Islands MPA and Cap de Creus Natural Park) using the Ecopath with Ecosim (EwE) approach. For each MPA, we constructed four Ecopath models representing the three different management areas (Fully Protected Area – FPA; Partial Protected Area – PPA; Unprotected Area – UPA) in each site, and another model representing the whole MPA. We followed the same mass-balance procedure and a similar food-web structure in order to facilitate the comparison of each management zone within and between MPAs. Results of the models were used to (1) characterize and compare the structure and functioning of each MPA management area; (2) assess differences/ similarities between MPA management areas and among the three MPAs; and (3) assess if no-take management areas have noticeable impacts in the three areas and can be related to history, traits and compliance of protection. Our comparative approach shows small differences between management areas in terms of ecosystem structure and functioning, while similarities are found between Cerbere-Banyuls and Medes Islands due to their similar configuration, enforcement and establishment.

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Poster title

An investigation of age, growth and mortality of the red mullet (*Mullus barbatus*, Linnaeus, 1758) in the western Black Sea

Abstract

The red mullet is an important component of the Black Sea demersal resources exploited by bottom trawl and small-scale fisheries. This study was the first directed to determine the age-growth and fishing mortality rates of the red mullet off the western Black Sea coast of Turkey. Age, growth and mortality parameters were estimated for *M. barbatus*, sampled from commercial landings of the demersal trawl fishery in the western Black Sea between October 2012 and April 2014. The age of 1 426 individuals was determined using the sagittal otolith reading technique. The total length ranged from 6.3 to 18.9 cm, while weight varied between 3.62 and 62.42 g for 4 928 red mullet individuals (1 829 males, 1 986 females and 1 113 unidentified). 3 815 individuals were found mature compared with 1 113 immature. The length-weight relationship for all individuals was calculated as $W = 0.0109 \times L^{2.9886}$. It has a life-span of four years, but over 60 percent of fish were less than three years old. The growth parameters were $k = 0.17$ yr-1, $L\infty = 24.1$ cm, and $t_0 = -1.98$ years for pooled data. According to age-structured analysis, the total, natural and fishing mortality were $Z = 1.32$ year-1, $M = 0.45$ year-1 and $F = 0.86$ year-1, respectively. Due to its high commercial value, *M. barbatus* appears to be under high fishing pressure ($E = 0.65$) that is not sufficiently managed. The results of this study can serve as a component of management plans and stock assessment of red mullet.

Theme 2
Healthy seas and sustainable fisheries

KEYNOTE PRESENTATIONS

ORAL PRESENTATIONS

Subtheme 2.1: Addressing climate change as a priority issue

Subtheme 2.2: Addressing pressing environmental challenges

Subtheme 2.3: Interactions between vulnerable species and human activities

POSTER PRESENTATIONS

Oceans and the ecosystem services they provide are an important source of economic and social wealth. Accelerating climate change and the degradation of coastal ecosystems lead to substantial socio economic impacts and threaten citizen livelihoods, health and well being.

The theme "Healthy seas and sustainable fisheries" aims to take stock of the latest developments in understanding the likely effects of climate change on fish and marine biota in the Mediterranean and the Black Sea, as well as the effects of other human stressors and their likely impacts on ecosystem goods and services as well as on social ecological systems.

Keynote presentations

Theme 2 – Healthy seas and sustainable fisheries

Manuel Barange – Director of the Fisheries and Aquaculture Policy and Resources Division, FAO

Climate change in fisheries and aquaculture: evidence and adaptation options

Abstract

The 2015 Paris Climate Agreement recognizes the need for effective and progressive adaptation measures, while considering the particular vulnerabilities of food production systems. However, the inclusion of adaptation measures in the fisheries and aquaculture sector requires targeted analyses of the sector's vulnerabilities to climate change, as well as the opportunities and responses available. In 2018 the FAO produced a significant report[1] on the disaggregated impacts of climate change for marine and inland fisheries, and aquaculture, to facilitate the development of targeted adaptation strategies. The report concludes that the sustainability of the fisheries and aquaculture sectors will be determined by their ability to adapt to climate change, highlighting the multi-faceted and inter-connected complexity of fisheries and aquaculture, through which direct and indirect impacts of climate change will materialize. The report also provides information on the tools available to inform decisionmakers of particular adaptation investments, to ensure adaptations are effective and efficient. Adaptation tools are presented within three primary

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[1] **Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F., eds**. 2018. *Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options*. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp.

adaptation entries: institutional and management, those addressing livelihoods and, thirdly, measures intended to manage and mitigate risks and thereby strengthen resilience. In this presentation we will synthesize the main results presented in the report, with particular emphasis on how to best minimize the impacts and maximise the opportunities that the sector has in terms of adaptation to climate change, with a view of facilitating the achievement of the 2030 Sustainable Development Goals. Finally, the report is a reminder of the critical importance of fisheries and aquaculture for millions of people struggling to maintain reasonable livelihoods through the sector. These are the people who are most vulnerable to the impacts of climate change, and particular attention needs to be given to them while designing adaptation measures if the sector is to continue to contribute to meeting global goals of poverty reduction and food security.

Keith Brander – Emeritus Scientist, Technical University of Denmark (DTU), contributed to the Nobel Peace Prize awarded to the IPCC in 2007

Healthy seas & sustainable fisheries are attainable

Abstract

The goal of healthy seas and sustainable fisheries is universally accepted, so what holds us back from reaching it? A reasonable level of agreement is needed on what we mean by "healthy seas and sustainable fisheries" and from this we can define specific targets and measure progress. The next step is to design and implement actions that will move us towards the targets. We can identify and prioritise "environmental challenges", which, in addition to climate change, include non-indigenous species and marine litter. Considerable progress has already been made with these steps and there are clear examples of improvements in health and sustainable production in some areas. However, progress may be slow due to the level of complexity and knowledge of the marine system; the degree of international cooperation and shared management and whether the costs and benefits of improving ecosystem health and sustainability are apparent, acceptable and equitably distributed.

I will review goals, targets and actions from an ecosystem perspective and point out trade-offs that require political and societal choices as they are not resolved by scientific and technical analysis. Although progress towards the goal of healthy seas and sustainable fisheries is slow and may go backwards as well as forwards, my title expresses optimism, because our goal can be reached by small steps and by learning and adjusting our actions along the way. We can identify some strategies that provide win-win outcomes and we have examples of progress towards specific targets that provide insight and encouragement.

ORAL PRESENTATIONS

SUBTHEME 2.1: ADDRESSING CLIMATE CHANGE AS A PRIORITY ISSUE

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Presentation title
Plausible pressures on small pelagic fish populations changes in the northwestern Mediterranean Sea

Abstract
Important changes have been observed in recent decades in small pelagic fish (SPF) populations of the northwestern Mediterranean Sea: declines in biomass and landings of European anchovy and sardine, and a geographical expansion of round sardinella. These changes have been linked to environmental factors directly influencing annual recruitment and growth. The role of climate change

in affecting the composition of plankton was also suggested to explain declines in SPF, while other causes could be the recovery of predators, competition with other pelagic organisms that prey on early life phases of SPF (i.e., gelatinous zooplankton), interspecific competition for food, or impacts from fisheries harvest. To test the role of these potential pressures, we developed qualitative mathematical models of the northwestern Mediterranean pelagic food web. We used analyses of signed directed graphs and Bayesian Belief Networks (BBN) to compare alternative hypotheses about how SPF species may have responded to combinations of different pressures. Data documenting changes in SPF populations were used to test predicted directions of change from signed diagraph models. An increase of the sea surface temperature (SST) that had a positive impact on round sardinella or on gelatinous zooplankton abundance were the two pressures that alone provided the most plausible insights into observed changes. A combination of various pressures, including an increase of SST and exploitation, and changes of zooplankton, also delivered results matching current observations. Predators of SPF were identified as the most informative monitoring variable to discern between likely causes of perturbations to populations of SPF.

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Presentation title
Larval fish communities and increased thermal stratification of the water column with future climate change

Abstract

Temperatures are expected to significantly increase in the Mediterranean Sea, resulting in more stratified water columns. Little is known about the effect of thermocline intensity in the larval fish community (LFC) distributions. The Mediterranean Sea and the Gulf of Mexico are key areas for the reproduction of large pelagic fish, including Altlantic Bluefin tuna (*Thunnus thynnus*). Both areas are characterized by warm temperatures, with a very different thermocline structure (deeper in the Gulf of Mexico), a low chlorophyll production and a strong mesoscale activity. Therefore, comparing LFCs in terms of abundance, distribution and diversity between spawning grounds can help us to understand how similar species use the water column differently depending on the thermocline structure and the biotic and abiotic variables associated. In the summer 2012, LFCs were sampled in the Mediterranean Sea and the Gulf of Mexico with standard methods (Multiple Opening/Closing Net Environment Sensing System [MOCNESS] net). The Gulf of Mexico mean abundances were higher than the Mediterranean Sea ones (629.4 against 47.56 larvae 1 000 m-3). *Thunnus thynnus* larvae comprised 23.31 percent of the total abundance in the Mediterranean Sea and 1.88 percent in the Gulf of Mexico waters. Eighteen families define the Mediterranean Sea LFC and 110 the Gulf of Mexico one. Our statistical analyses revealed that the strong thermocline was the main factor affecting LFC in the Mediterranean Sea whereas for the Gulf of Mexico such effect was not so clear. In both scenarios, the most sensible taxa to this factor are those strictly inhabiting surface waters such as larvae from the Scombridae (Mediterranean Sea and Gulf of Mexico), Engraulidae (Mediterranean Sea) and Carangidae (Gulf of Mexico) families. Higher temperatures in the actual Gulf of Mexico scenario will allow to predict the consequences of future warmer scenarios on the Mediterranean Sea summer LFC.

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Presentation title
Successful monitoring tools for non-indigenous species (NIS) and climate-related impacts on Mediterranean resources: the LEK protocols

Abstract
Fishery resources of the Mediterranean Sea are rapidly changing under the pressure of climate change and invasive species, and novel strategies are requested to track the evolution of this phenomenon. Here we present the experience and some recent developments in the use of Local Ecological Knowledge (LEK) as a novel and cost-effective monitoring tool. Standard LEK protocols were made available to access the knowledge that local fishers have on major biodiversity changes occurring in their fishing areas. The method was implemented within the framework of various initiatives, carried out by the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM) Tropical Signals, FAO Adriamed, FAO MedSudMed, Interreg BALMAS, Interreg MED MPA-Adapt, and recently presented for endorsement to UN environment and GFCM bodies. Yet, through an extensive collaborative effort, these procedures were spontaneously adopted by researchers of eleven Mediterranean countries and applied in 79 different locations. A semi-structured questionnaire is used to identify changes in species abundance and distribution and to reconstruct yearly catches. Fishers' perceptions on historical catches are coded in ranks and used to build species-specific time series, which are analyzed using breakpoint analysis to highlight years of significant structural changes. Both indigenous and non-indigenous thermophilic species showed significant breaks (i.e. sharp changes in perceived abundance), revealing the spatio-temporal dynamic of the ongoing tropicalization. These results highlight how LEK can be successfully applied beyond the local scale, consolidating a standard methodology for effective data collection across different countries and varying socio-economical settings. Further discussion within the forum is expected to enrich the use of these tools to provide support to advice for management within the GFCM area.

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Presentation title

Indications of a climatic-driven shift in the Aegean Sea demersal resources

Abstract

With over 90 percent of the energy gained by the Earth due to human activities accumulating in the oceans, oceans "feel" most of the impacts of climate change. Such changes in the marine environment alter primary production fields, which provide underlying resources for fisheries. In the present work, our goal was to investigate possible climatic-driven impacts on the Aegean Sea demersal resources. Historical, environmental and fisheries data, from the 1960s to date, were analyzed to derive trends and relationships of landings and environmental indices. A series of statistical approaches were applied in parallel: Principal component analysis, chronological clustering, sequential regime shift detection and threshold generalized additive models. Temporal cross-correlation was checked using Chelton correlation and Granger causality tests. All methods applied indicate a multivariate shift in the Aegean climatic system during the mid-1980s, in accordance with numerous studies around the globe identifying the mid-1980s as a "tipping" point in the oceans regime. Applying the same methods to the multivariate fisheries landings profiles, a concurrent regime shift in the Aegean Sea demersal biota is identified.

Temporal correlation tests revealed that the landings trend coincides with matching trends in climate. Our results suggest that exploitation by fishing should not be considered the exclusive driver of landings trends. Moreover, the results highlight the susceptibility of the Aegean marine biota to warming that may have important implications for the management of marine resources in the area, especially in the context of climate change and the expected continuation of sea warming.

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Presentation title

Climate-related impact on fish resources and sustainable solutions

Abstract

Sea level rise due to climate change affects the biophysical and socio-economic aspects of coastal environment. These effects include: coastal flooding and erosion, salinity intrusion, decline in fish resources and socio-cultural impacts. Therefore, the aim of the research is to investigate the impact of sea level rise on fisheries resources along the Nigerian coast and proffer sustainable solutions of resilience nature. We considered scenarios based on the Intergovernmental Panel on Climate Change (IPCC) for sea level rise, and other extreme scenarios. A geographic information system (GIS) model was also adopted to show the significant impact of sea level rise on the fish resources along the coast. A sustainable climate change resilient tool was utilized to proffer sustainable solutions. A decline in fish resources along the coast was recorded, due to sea level rise and other pressures, which also affected distribution of fish resources and habitat modification. We also present possible resilient-adaptive measures to the Nigeria coastline. In general, it is difficult to predict the level of biodiversity of fish resources and their distribution along the coast, caused by climate change and other pressures.

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Presentation title

Edible jellyfish in the EU: new opportunities for local fisheries

Abstract

Fishery, market and consumption of edible jellyfish are spread in Southeast Asia and currently established in America where they are still limited by the lack of market demand. Globalization of food markets and the recent upgrade of the European regulation on novel foods (EC 2015/2283) opened new possibilities for the introduction of edible jellyfish in the European's diet. Considering jellyfish as a new food resource instead of waste is in line with the principles of sustainable food systems. Although the tradition of eating jellyfish is still absent in Europe, our recent studies showed that several Mediterranean jellyfish species have biologic and nutritional features with a large potential as innovative novel food and bioactive compound source. New opportunities for expanding jellyfish uses in EU Countries depend on the development of new processing technologies and internal market demand, which is in turn influenced by the scientific studies on jellyfish raw material, and from its public acceptance and appeal as innovative food. With GOJELLY EU H2020 project n. 774499, we are exploring different approaches dealing with microbiological and food safety issues, sensory analysis as well as food design and functional food features of some Mediterranean jellyfish treated by western-style food processing as an alternative to the traditional Asiatic treatment. Jellyfish collagen and other proteinaceous and non-proteinaceous bioactive compounds are investigated for their putative health promoting features.

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Presentation title
"Size does matter!": Informing fisheries management under climate change scenarios

Abstract
The on-going climate change threats are deeply and rapidly growing and affecting the Mediterranean and the Black Sea at both global and local scales, affecting ecosystems, societies and economies by altering natural distribution and productivity of key commercial species. While the actual vision of ecosystem-based management (EBM) of fisheries relies on the response of communities to fishing pressure, the effects of environmental changes, compounded by evolutionary responses of wild populations, may translate into unexpected changes in the fish-sized structure. To inform a more effective EBM under changing climate conditions, scientists, stakeholders and policy makers must be able to foresee changes in size-based indicators (e.g. maximum total length) commonly supporting the management of commercially exploited wild fish populations. The influence of external environmental drivers (e.g. climate change) may push the ecological indicators far from the theoretical expectations. Mechanistic approaches are suggested as reliable solutions. Specifically, the Dynamic Energy Budget (DEB) application allows to analyze the link between environmental changes (e.g. crossed simulations of temperature increasing scenario [+2°C, COP 21, Paris climate conference Agreement] and food density increase) and life- history traits (e.g. maximum total length, length at first maturity). Our modelling exercise produced outcomes to inform climate-adaptive target setting for community-level size-based indicators, focusing explicitly on the European anchovy (*Engraulis encrasicolus*) along the Sicilian coasts as an example. A final spatial contextualization of DEB model outcomes produced source and sink risk maps of easy reading, allowing translating complex results into useful figurative representations for stakeholders, useful when informing the management of marine resources.

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Presentation title

Biodiversity breaks in bottom fish communities along the Moroccan coast and the perspective of a warm future

Abstract

The latitudinal distribution of fish species is predicted to shift towards the poles in the upcoming decades, with the rise of sea temperature. This may influence fish abundance and fish communities' composition and structure, and alter food webs. Morocco has a coastline of 450 km in the westernmost Mediterranean Sea, and 3 000 km in the Atlantic. These waters home contrasted ecosystems with specific identities and are at the front door of tropical waters southernly. Bottom fish communities from the shelf (0-200 m) of these three ecosystems are mainly subtropical (57 to 68 percent of the species). The Mediterranean and the North Atlantic have close numbers of temperate (17 percent) and tropical species (seven and five percent respectively). The three ecosystem share 31 percent of their fish species, and 23 percent of the species are shared by two of the three ecosystems. Nevertheless, the composition of these three communities appears clearly different, which is shown by the dissimilarity analyses (NMDS) of species occurrences in the bottom trawl surveys conducted by l'Institut National de Recherche Halieutique (INRH) during the period 2000 and 2012. Previous analyses on community structure of the Atlantic ecosystems have shown that the structuring of the bottom communities is constrained by fishing activities, mainly trawling. The structuring of the Mediterranean communities which resulted from the analyses of the eleven bottom trawl surveys conducted between 2000 and 2012 (STATIS-Coa), show more complex patterns with weak explained variances (GAMs). The change in fish communities in the Moroccan Atlantic is ineluctable and remain unpredictable, and the way that these changes may affect the Mediterranean depends on the permissiveness of the Strait of Gibraltar.

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Presentation title
Large pelagic fish in the Mediterranean: Different life strategies but the same need for management

Abstract

Large pelagic fish in the Mediterranean Sea compile a variety of species with different phenology, migratory behaviour, physiology and maturation size. From Atlantic bluefin tuna, the largest tuna and the most migratory species with the most constrained spawning season, to bullet tuna, one of the smallest species with a wider spawning season and less migratory behaviour, they all use the Mediterranean Sea as their major spawning ground and nursery area. Many species of large pelagic fish are targeted by fisheries in the Mediterranean Sea, mainly aiming at migratory spawning adults or resident juveniles. Including environmental variability or fisheries independent recruitment indices in stock assessment models are two ways to improve current stock assessment models for these species. Besides, understanding the effect that climate change may have on the distribution, abundance and phenology of these species is a major objective of scientists and management bodies. In this study, we show geographical and temporal variation in fitness of eggs in relation to temperature and spawning location in the Mediterranean Sea for two large pelagic tuna species with contrasting ecological characteristics based on experimental studies of the processes driving offspring growth and survival. Changes in the spatial distribution of suitable spawning areas and the optimal timing for reproduction across large pelagic species could explain their coexistence/segregation within the Mediterranean Sea. This is a step towards better assessment models and predictive abilities from the expected effects of climate change on these species.

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Presentation title
Climate changes involve shifts of the Mediterranean small pelagic fish distribution

Abstract
Climate change is affecting marine ecosystems worldwide, shaping species distribution and biological communities. Distribution and local abundance of exploited fish may be significantly redistributed in the next decades. Therefore, predicting climate-induced range shifts of marine species has become an important challenge for sustainable stock management and food security. However, only few studies on climate-induced changes in harvested fish species have been performed so far. Here, we investigated the changes in the potential distribution of the most harvested small pelagic fish (SPF) species in the Mediterranean Sea, yielding ca. 50 percent of the Mediterranean commercial landings. Using several Ecological Niche Models (ENM), a range of potential future distributions was modelled (for 2050 and 2100) using five of the latest generation of atmosphere-ocean general circulation models from the Intergovernmental Panel on Climate Change (IPCC) and four Representative Concentration Pathways (RCPs) scenarios. Our projections highlighted significant poleward distribution shifts for all studied SPF. Regardless of the RCP scenario, the models converged toward a decrease in climate suitability of most of the Mediterranean southeastern coast. Following a pessimistic scenario such as RCP8.5, models predicted local disappearance of several SPF in the southeastern Mediterranean basin. In this case, the Adriatic Sea and the Gulf of Lion would be the last suitable areas hosting these species. These issues highlight the potential impacts of climate change on SPF distribution, hence their harvesting capacity, which should be taken into account in future stock management.

Author

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Presentation title

The impacts of climate change on the biodiversity and fishery in Turkish marine waters

Abstract

The climate change effects on biodiversity and fishery in the eastern Mediterranean, Aegean, Marmara and Black Sea coasts of Turkey. The surface sea water temperatures, salinity, sea-level rise in the Turkish marine waters have gradually increased for the last decades, which changed the distribution and productivity of marine species. In parallel, the number of non-indigenous species has rapidly increased for the last decades, which caused increased invasion of the non-indigenous species and significant shift of biodiversity in the Mediterranean and Aegean Sea parts of Turkey. The impacts of non-indigenous species on their new environment include: restructuring established food webs, competing with native organisms for food and space, and altering the gene pool when the invading species replace native species. This settlement process of the non-indigenous species is probably accelerated and/or facilitated by global climate change, overfishing of native species and competition between native and non-indigenous species for food and space. Nowadays, the occurrence of the Atlantic-Mediterranean and Indo-Pacific originated species in the Marmara and Black Seas can also be an important indicator of the process of "Mediterranization" of the Marmara and Black Seas. There are high economic and social consequences of non-indigenous species in Turkish marine waters. Coral bleaching was also observed in the Mediterranean coast of Turkey with increased sea-water temperature in summer, which is one of the consequences of global warming.

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Presentation title
**Towards a strategy for the adaptation of fisheries to climate change in
the Mediterranean and the Black Sea**

Abstract
The Mediterranean and the Black Sea are considered among the areas of
the planet that could be most affected by climate change. Surface warming,
increasing heatwaves, decrease in precipitation, sea level rise, changes
in thermohaline structure and extreme weather events are expected in the
medium-term with different levels of uncertainty across the two basins. These changes
are expected to interact with other anthropogenic and ecosystem stressors, such
as overfishing and the entry of non-indigenous species, and altogether generate
impacts and opportunities to fisheries activities. Within this context, Mediterranean
and Black Sea countries, in the framework of the GFCM, decided to include the
development of an adaptation strategy to cope with the potential effects of invasive
species and climate change on fisheries as a priority within their Mid-term strategy
(2017–2020) towards the sustainability of the Mediterranean and the Black Sea
fisheries. This presentation will provide a brief summary of the initial steps taken
towards the goal set in the mid-term strategy, resulting from a collaborative effort
between the GFCM Secretariat, the FAO Fisheries and Aquaculture Department,
and WWF. The presentation will cover the outcomes of an Expert Meeting on
Climate Change Implications for Mediterranean and Black Sea Fisheries (Rome,
4–6 December 2017) and will discuss preliminary findings about the vulnerability
and adaptive capacity of fisheries to climate change obtained from vulnerability
assessment case studies in the region.

SUBTHEME 2.2: ADDRESSING PRESSING ENVIRONMENTAL CHALLENGES

Author

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Presentation title

Work under the Convention on Biological Diversity (CBD) to support mainstreaming of biodiversity considerations in fisheries management and the application of the ecosystem approach

Abstract

Parties to the Convention on Biological Diversity (CBD) have clearly acknowledged the central role of fisheries in achieving goals for healthy and productive biodiversity and ecosystems. This is embodied, in particular, by Aichi Biodiversity Target 6, adopted by CBD Parties in 2010, and its clear overlaps with other global goals, including Sustainable Development Goal 14. This presentation will outline various areas of work under the CBD that can support addressing biodiversity and environmental aspects of fisheries management. These include technical work and collaboration with FAO, GFCM, UN Environment and others on approaches to mainstreaming biodiversity in fisheries management, describing ecologically or biologically significant marine areas (EBSAs) and enhancing cross-sectoral coordination among regional seas organizations and regional fishery bodies. It will also highlight relevant outcomes of the 14th meeting of the CBD Conference of the Parties (COP 14), being held in November 2018.

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Presentation title

Remarkable stability of eastern Mediterranean size spectra in face of the ongoing Lessepsian migration

Abstract

Biological invasions are globally increasing and are considered a major cause of biodiversity loss. Most notable is the Mediterranean Sea, which is subject to an ongoing invasion of Red Sea species through the Suez Canal in one of modern history's most important biogeographical transitions. We used size spectra (SS), a reliable index of food web structure often used to evaluate the effect of fishing, in order to examine how the influx of Red Sea species into the Mediterranean Sea has impacted the local community's size structure. We used data on trawl catches along Israel's shoreline from two time periods spanning 20 years in order to obtain the community's SS using length-based size classes. This serves as the first attempt of using SS in order to examine the effect of biological invasions, one of today's most pressing ecological issues. We found that the biomass of non-indigenous species increased in 20 years, especially in small and large species. The biomass of indigenous species did not decrease accordingly, which suggests competition between indigenous and non-indigenous species in the Mediterranean may be weaker than previously assumed. However, as non-indigenous species biomass increases, competition for now-limiting resources may result in biomass loss.

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Presentation title

Forecasting dynamics of an eastern Mediterranean marine ecosystem under the impacts of multiple stressors

Abstract

An important challenge for the conservation and management of marine ecosystems is to advance our understanding of how multiple human stressors, environmental factors and marine resources interact and influence each other. The ecosystems of the Levantine Sea have undergone significant ecological changes caused by multiple stressors. This is a region highly invaded by Indo-Pacific species, subject to extreme environmental conditions and highly sensitive to climate change, and has experienced intense fishing pressure. Using a temporal-dynamic food web modelling approach, we analyzed the potential ecosystem effects of future conditions in the ecosystem off the Israeli Mediterranean continental shelf. Particularly, we assessed the effects of a new set of fishing regulations currently being implemented, changes in sea temperature following the Intergovernmental Panel on Climate Change (IPCC) projections and a continued increase in alien species biomass. We first

investigated the impacts of stressors separately, and then we combined them to evaluate their cumulative effects. Our results showed overall potential future benefits of fishing effort reductions, and detrimental impacts of increasing sea temperature and increasing biomass of alien species. Cumulative scenarios highlighted that the beneficial effects of fisheries reduction may be dampened by the combined impact of increasing sea temperature and alien species. These results illustrated the importance of integrating multiple stressors other than fisheries, such as climate change and biological invasions, in an ecosystem-based management approach. These results also supported different calls for reducing local and regional stressors such as fishing and biological invasions in order to promote resilience to sea warming.

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Presentation title

Fishing for litter in the Adriatic-Ionian region (Mediterranean Sea): strengths, weaknesses, opportunities and threats

Abstract

The fishing sector is viewed as a source of marine litter since marine litter is related to it in several ways. However, at a global level, most of the plastic litter is land-based, affecting the fishing sector itself (e.g. hazard to crews, tangled propellers, net cleaning, reduced or contaminated catches, etc.). The measures to reduce marine litter can be preventive, mitigating, removing and behaviour-changing, whereas prevention should be the priority. However, so far the effects of prevention policies have been insufficient, resulting in great amounts of litter at sea that recalls the need for removal actions. Between 2014 and 2016, 15 ports in five countries (Italy, Slovenia, Croatia, Montenegro and Greece) in the Adriatic-Ionian region (Mediterranean Sea) implemented Fishing for Litter (FFL) pilot projects. The FFL scheme is a clean-up activity that aims at reducing marine litter by physically removing it: fishing vessels collect and

properly dispose marine litter that is caught in their nets during normal fishing activities. We prioritized strengths, weaknesses, opportunities, and threats (SWOT) of FFL pilot projects in each country, and compared the Adriatic-Ionian experience with FFL initiatives running in Scotland since 2005. A lack of an overarching policy or legal framework for marine litter management and an ambiguous bureaucracy with an unclear subdivision of competences among authorities were the main factors that undermine FFL scheme implementation in the region. However, FFL initiatives demonstrated to be successful in terms of marine debris removal and raising awareness, giving fishers the possibility to become part of the solution.

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Presentation title
The role of Marine Protected Areas (MPAs) in mitigating the impact of invasive species

Abstract
"Biotic resistance" suggests that native species can hinder the establishment of invasive species by utilizing the majority of available resources. For example, with higher native species richness in a community, the amount of available niches are reduced, which may reduce invasive success. However, the generality of this pattern is not well established, and empirical support changes from one ecological system to another and with change of scale. This study inspects four Marine Protected Areas (MPAs) in the eastern Mediterranean Sea, with different levels of enforcement. In this invasive-infested marine system, fish communities compose a unique blend of indigenous and invasive species. In order to understand the role of MPAs in biotic resistance, we examined the association between native and invasive species for multiple facets of diversity such as species richness, abundance, biomass, diversity and functional diversity. We have tested how these associations differ within and outside four MPAs and across seasons. Our results show that the association between native and invasive species changes with enforcement level and season. The most protected area exhibits lower invasive species abundance compared to a non-protected area. However, this result is found only for the oldest and best protected MPA. Seasonality is noticeable, and, as temperatures increase in spring, invasive species abundance increases compared to native abundance in all of the study locations. These results emphasize that both MPAs and season affect abundance of invasive species relative to natives, which may stem from biotic resistance by the native community.

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Presentation title

An assessment on local ecosystem damages by the blue crab *Callinectes sapidus* in Valencia, Spain

Abstract

The blue crab *Callinectes sapidus* is considered an invasive species in different European and Asian territories. In the western Mediterranean, the number of sightings and captures has drastically increased in recent years, becoming very frequent in areas of high ecological value where protected species such as *Anguilla anguilla* or *Unio turtoni valentinus* are found. To determine the impact caused on the local ecosystem, specimens are captured in different points of the province of Valencia (Spain) and stomach contents are analyzed to determine the composition of the diet. To avoid altering stomach contents, the specimens are captured using traps without access to the bait, and are immediately sacrificed to stop the digestive process. Complementarily, a stable isotope analysis is carried out to determine its trophic level, and thus the competing species in the local fauna. The impacts caused on the local ecosystem are established through the combined evaluation of both indicators, both by direct depredation and by competition, and measures are proposed for the management of the local blue crab population.

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Presentation title
Impacts of some alien species in Egypt: crayfish as fresh water species and puffer fish as marine species

Abstract
Many of the invasive species have been introduced by humans, like introducing the fresh water crayfish into Nile River which impacts the whole ecosystem of the Nile, and by corridors, like introducing the puffer fish into the Mediterranean Sea through the Suez Canal. Fresh water crayfish *Procambarus clarkii* is considered to be one of the biggest invasive species in the Egyptian aquatic environment where they entered fresh water at the beginning of the 1980s. Puffer fish, *Lagocephalus sceleratus* and *Lagocephalus spadiceus* may be the worst invasive alien fish species throughout the eastern Mediterranean due to their impact on human health. They have rapidly extended to Egyptian Mediterranean waters and became abundant, with considerable amounts caught. It is worth mentioning that not all the impacts of invasion by alien species are negative. In Egypt, there are many successful experiments to use the puffer fish toxin for medical purposes and to use the exoskeleton of crayfish to produce chitin and chitosan. Crayfish is a cheap source of protein and seafood. Similar to the much more expensive shrimp and lobster, but much less in price compared to them. A number of factories could be established to process these species along with other species that are not edible in their fresh state, especially with the situation of over population and the growing need for food. This paper will discuss and demonstrate the fishery characteristics and the economic importance of crayfish and puffer fish and their contribution to the Egyptian economy and food security for the growing population in Egypt.

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Presentation title
Socio-economic implications of the impact of invasive species on artisanal fisheries within Marine Protected Areas (MPAs)

Abstract
Biological invasions are a major component of global change, particularly in the Mediterranean, and they cause numerous negative impacts on marine biodiversity, ecosystem services, and coastal communities. However, it is often difficult to justify the expenditure of resources to support the control of invasive non-native species because of a lack of evidence of impacts, the long-term commitment and, in many cases, differences of opinion regarding the magnitude of impacts (Katsanevakis *et al.*, 2014). For Marine Protected Areas (MPAs), despite their importance on biodiversity conservation, the impacts of the arrival and colonization of some of the most invasive species in coastal communities and its biodiversity are mostly unknown (Otero *et al.*, 2013). These impacts are strongly affecting artisanal fisheries within and around MPAs, particularly in the eastern and central Mediterranean. Observations in different Mediterranean sites highlight the environmental and economic impacts (benefits and losses) caused by some of these species (IUCN-ENALIA, 2018).The presentation will provide an overview of the findings out to date related to the socio-economic implications of the impact of invasive species on artisanal fisheries within MPAs. It will focus on describing the case study of Lebanon from a study work by the International Union for Conversation of Nature (IUCN) quantifying catches and socio-economic impacts on different fisheries *métiers* (longliners, gillnets, spear/traps, and trammel nets). In searching for long-term measures, it will conclude with the challenges found there and elsewhere together with main recommendations for successfully managing the most impacting species, involving a wider spatial and transboundary approach and the participation of public-private sector partnerships.

Author

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Presentation title

Effect of climate change and non-native ctenophores on fish stocks in the Black Sea

Abstract

The Black Sea is semi-enclosed, non-tidal and meromictic (i.e. permanently stratified by a pycno-halocline), with relatively low salinity (12-22) and a thin (60–200 m) oxygenated surface layer overlying waters dominated by hydrogen sulfide. The thinness of the oxygenated layer makes the ecosystem of the Black Sea very vulnerable to environmental changes. From the 1970s, anthropogenic effects turned the Black Sea into one of the most polluted and mismanaged water bodies. The severe environmental and ecosystem degradation with manmade eutrophication led to outbursts of native gelatinous plankton, i.e. scyphomedusa *Aurelia aurita* (L. 1758) and pyrrophyte alga *Noctiluca scintillans* (Macartney) Kofoid & Swezy. Due to the combination of adverse circumstances such as environmental disturbances, climate-driven changes and increasing propagule pressure from different sources in the early 1980s, many non-native species became established in the Black Sea, the most harmful being the carnivorous ctenophore *Mnemiopsis leidyi* A. Agassiz 1865. That species was transported into the Black Sea in ballast waters of ships from the Gulf of Mexico, spread around the sea, and reached high abundances that caused cascading effects on the most components of the ecosystem. Bottom-up effects included collapsing planktivorous fish stocks, and vanishing large pelagic fish species and dolphins. Top-down effects included decreased zooplankton diversity and stocks (maximum annual zooplankton biomasses declined almost two orders of magnitude lower than during the previous period), increased phytoplankton biomasses, because of the decreased grazing pressure from zooplankton, increased bacterioplankton, favored by the higher production of phytoplankton exudates, and increased heterotrophic flagellates and ciliates,

which fed on bacteria. By the late 1980s, the pelagic ecosystem had become dominated by gelatinous species. From the Black Sea, *M. leidyi* and many other invasive species expanded into the Sea of Azov, the Sea of Marmara, and the eastern and western Mediterranean, and were introduced into the Caspian Sea in ballast waters from the Black Sea. The Black Sea became the main region donor for the Sea of Azov and the Caspian Sea. Effect on these seas' ecosystems and fish stocks is even more tremendous. The sizes of *M. leidyi* populations were not controlled by any predator until 1997. In 1997, predator of *M. leidyi* another ctenophore *Beroe ovata* arrived in the Black Sea in ballast waters from the same North American coastal areas. After *B. ovata* arrival the Black Sea ecosystem began to recover progressively. An additional factor that favored the recovery of the ecosystem was the decreasing eutrophication, resulting from reduced anthropogenic nutrient inputs. This was accompanied by a decrease in total phytoplankton biomass, with harmful algae blooms becoming rarer and less intense. The combination of these factors in the late 1990s led to a general improvement of the ecosystem and fish stocks. However abundances of two ctenophores, time and duration of their development depend on environmental conditions. Although the same combined reproductive sequences of *M. leidyi* and *B. ovata* took place year after year from 1999 until 2017 but the value of abundances depends on temperature and zooplankton biomass of current year. Time of appearance and disappearance of *M. leidyi* in water column depends on the intensity of *B. ovata* development and consequently grazing rate on *M. leidyi* and its larvae. Therefore these two invasive ctenophores still act as the main drivers of the ecosystem state. In spite of the positive trend, *M. leidyi* still affects fish eggs and larvae survival during its intensive development while *B. ovata* is absent yet in the surface layer. But this period is lasting one or two months now and spawning and development of fish eggs and larvae continue afterward. Therefore, the study of the interannual variability of both invasive ctenophores is especially important in understanding the mechanisms that control *M. leidyi* population size in the Black Sea and its effect on the ecosystem and fish stocks.

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Presentation title

Barcoding the invasives

Abstract

Routine reports of newly discovered invasive species in the eastern Mediterranean are continuously proving that the magnitude of 'Lessepsian migration' is far from being exhausted, with more than a hundred documentations of alien fish species at present. The majority of these reports, however, rely mainly on traditional morphological identifications, providing at best distinguishing keys and voucher specimen in registered collections. Nevertheless, our confidence in pure traditional taxonomy is being occasionally challenged when documenting taxa with difficult distinguishing characters or in early life stages. Moreover, alien species with great morphological resemblance to the indigenous fauna may be erroneously overlooked in their newly invaded habitat. Adopting DNA-based tools, such as the global 'DNA barcoding campaign', frequently overcomes such limitations by providing accurate identifications where morphology fails. By using DNA barcodes in our recent reports of invasive fish species in the Israeli Mediterranean coast we managed to uncover overlooked invasive species and to confirm the Suez Canal as the pathway for the invasion of others. However, the use of barcodes to identify species should be carefully practiced as it does contain several drawbacks, e.g., when a reference sequences for the species is missing or when geographical comparisons reveal a shallow genetic divergence throughout the taxon's distribution. As such, traditional taxonomy of the studied taxon clearly remains crucial, and only by the integration of these methodologies we may minimize taxonomic errors while maximizing the available information that can be extracted from the investigated alien species.

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Presentation title

Blue Packaging project, reduction of plastic packaging (expanded polystyrene, EPS) in the fishing sector with the use of innovative material

Abstract

Blue Marine Service (BMS) is an Italian company working in the sector of applied marine research developing projects aiming at managing, improving and protecting the marine environment through concrete actions. The initiative "Blue Packaging" carried out by the BMS has considered a series of concrete actions with the objective of facilitating the use of a new bio- based material packaging in the fishing sector and at the same time has raised awareness of its strengths and opportunities. This new material has the important feature of being biodegradable and compostable, thus in substitution of the ordinary plastic fishing boxes (made of polystyrene EPS) - currently used- it gives a smart and sustainable added value to the sector. This initiative took place in Italy and in Spain and obtained important results, being the pioneer project in using biodegradable packaging to transform thousands of polylactic acid (PLA) boxes into compost. Millions of EPS boxes are currently used worldwide in the seafood sector and their environmental impact is rather critical, especially on the coastal and marine areas. The added value of this initiative lies in encouraging the use of new biodegradable packaging by involving the main stakeholders of the fishing sector. This new material made of PLA has the same technical characteristics of EPS and is already available on the market, but compared with the EPS that needs 1 000 years to decompose, the PLA is entirely compostable.

SUBTHEME 2.3: INTERACTIONS BETWEEN VULNERABLE SPECIES AND HUMAN ACTIVITIES

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Presentation title
Protecting the elasmobranch species from fishing by sharing the knowledge and involving the fishers as partners

Abstract
The Mediterranean Sea is a marine biodiversity hot spot, where approximately 17 000 marine species occurring in it. Biodiversity is also generally higher in coastal areas and continental shelves, and decreases with depth. Temporal trends indicate that overexploitation and habitat loss have been the main human drivers of historical changes in biodiversity. At present, habitat loss and degradation, followed by fishing impacts, pollution, climate change, eutrophication, and the establishment of alien species are the most important threats and affect the greatest number of taxonomic groups. All these impacts are expected to grow in importance in the future, especially climate change and habitat degradation. Many species are gradually becoming endangered or critically endangered (at risk of extinction), where some of the most threatened chondrichthyan (skates, rays and sharks) populations in the world are still present in it. For example, in the northern Ionian Sea, landings of blue shark declined by 74 percent in abundance and 83 percent in biomass over 20 years (Albania and Sicily). A Project entitled "Beginning of Sharks Conservation in

Albanian Territorial Waters by Performing Fisheries Survey and Sensitizing Communities" is still ongoing and its methodology will represent an example of the methodologies used in similar projects for doing practical research in order to propose and put into practice appropriate actions for their conservation.

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Presentation title
Endangered species bycatch in surface and bottom longlines fishery of the Gulf of Gabes (Tunisia)

Abstract
In the frame of ACCOBAMS-GFCM Project on mitigating interactions between endangered marine species and fishing activities, developed with the collaboration of the RAC/SPA and a substantial financial support from the MAVA foundation, a pilot action on mitigating bycatch and depredation of elasmobranchs, sea turtles, marine birds and cetaceans in surface and bottom longlines fisheries operating in the Gulf of Gabes was executed. The surface longline fishery targeting swordfish primarily but following collapse of stocks, the sandbar shark *Carcharhinus plumbeus* became the most landed species in the Gulf of Gabes. Bottom longline is targeting groupers. The two types of longline engender bycatch of endangered species listed in annex II of SPA/BD protocol of Barcelona convention. These species are involved in the GFCM Recommendations on reducing incidental bycatch of seabirds, cetaceans and marine turtles in fisheries in the GFCM competence area and on fisheries management measures for conservation of sharks and rays. In this work, we evaluate firstly the interactions and describe circumstances of interactions, and secondly we experiment the efficiency of some measures to reduce bycatch.

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Presentation title
Surface pelagic longline fisheries in southern Spain affecting air-breathing species

Abstract

The Alboran Sea is an important area for turtles, mammals and sea birds. The Gibraltar Strait is a passage used by those species during the migrations. Surface drifting longline affect non target species including mammals, birds and turtles in the Alboran Sea. Four cetaceans reobserved as bycatch in the western Mediterranean Sea: Risso's dolphin, striped dolphins, common dolphins and pilot whales bycatch. Three species of sea turtles are present in the Alboran Sea (loggerhead, leatherback and green turtle). The common loggerhead is captured by surface longlines as bycatch in the Alboran Sea, a migratory corridor for loggerhead turtles born in North America or the eastern Mediterranean. Nine sea birds species are caught in the western Mediterranean: Yellow-legged gull, Cory's shearwater, Northern gannet, cormorants, Balearic/Mediterranean shearwater, Audouin's gull and Great skua. After working with the Spanish fishing fleet on surface longline in the Alboran Sea, we suggest some measures proposed by fishers to reduce the bycatch of birds, including the use of streamer lines to scare seabirds, the use of scarecrows with success. For marine turtles, setting the longline deeper and as main bycatch occurs in summer, the use of semi-pelagic drifting longline instead of traditional drifting longline. Other suggested methods for turtles include knowing the surface temperature ranges in the fishing area or using plastic baits. For birds: fishing at night, when birds are generally less active, and leaving the hooks next to the water and avoid the flight of the bait. The use of plastic baits should also reduce the bycatch of cetaceans.

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Presentation title
Effects of ground gear rigging on catch composition of demersal trawls in the eastern Mediterranean

Abstract
This study investigates catch composition of trawl gears with two different commercial ground gear riggings. The first of them is a single rope rigging which is used on soft and smooth grounds. The other one is a double rope rigging which has a fishing line and a lead line rigged to each other with a distance of about 10 cm. This rigging is used on rougher grounds to avoid the intake of unwanted loads of shells and mud. Catch compositions of the two ground gear riggings of the same trawl were compared in 18 pairs of hauls: nine in soft and nine in rough grounds. The study was conducted between January and May 2017, in Mersin Bay. For eight commercial species (red mullet, brushtooth lizardfish, common pandora, common sole, bogue, striped piggy, Por's goatfish, green tiger prawn) and three bycatch species (guitarfish, stingray, spiny butterfly ray) individual length and weight data were collected.

Differences in mean catch rates of all species between two riggings were compared in terms of total numbers and weights with Mann–Whitney U tests. Additionally, for commercial species, multimodel inference was applied to describe paired catch comparison rate using SELNET. Confidence intervals were estimated using double bootstrap method. No significant difference was found between the two riggings for the commercial species except for common sole, for which double rope rigging captured significantly fewer individuals than the single rope rigging. Among the bycatch species the mean catch of guitarfish and stingray was significantly reduced in the double rigging while no significant difference was found for the butterflyfish. Double rigging was further modified in follow-up studies to reduce the bycatch of rays and skates. Potential of ground gear modifications in bycatch reduction in the Mediterranean bottom trawling is discussed. The study is funded by The Scientific and Technological Research Council of Turkey (TÜBiTAK, Project 115O647).

Author

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Presentation title

Shark and ray management in the Mediterranean: a critical analysis

Abstract

The international actions of Regional Fisheries Management Organisations (RFMOs) have the potential to swiftly safeguard species throughout their ranges. As a member of the Shark League for the Atlantic and Mediterranean, the Shark Trust is focused on securing management for sharks and rays through RFMOs, with particular engagement with the GFCM. As a region, the Mediterranean reports shark and ray declines of 97 percent in number & catch weight (Bradai 2012) with over 50 percent of native species at an increased risk of extinction (IUCN 2016). A global analysis of threat levels for sharks and rays reveals the Mediterranean as a hotspot of extinction risk (Dulvy *et al* 2014) and evidently vulnerable to human activities. This presentation explores the action to protect the 24 species of threatened sharks and rays listed on the Barcelona Convention's Annex II of the Protocol concerning specially protected areas and biological diversity in the Mediterranean through GFCM 36/2012/3. Domestic implementation across the 24 GFCM Contracting Parties will be assessed, and a critical analysis of compliance and possible instances of illegal, unreported and unregulated (IUU) fishing will be examined. In the context of the diverse socio-political landscape of the Mediterranean, barriers to compliance will be considered, research and policy priorities discussed, and the value of current Regional and National Plans of Action for the Conservation of Cartilaginous fishes reviewed. Significant and immediate action is required to secure healthy seas, support potential sustainable fisheries, and safeguard the future for Mediterranean sharks and rays.

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Presentation title
Évaluation des connaissances sur le statut d'une population de petits delphinidés dans le littoral algérien

Abstract
Les eaux algériennes sont l'une des régions de la Méditerranée où la présence des cétacés est des plus fréquentes autant du point de vue de la fréquence des individus que de celui de la diversité spécifique. Ce travail d'investigation a complété les lacunes concernant les connaissances de la population de ces deux petits delphinidés (*Tursiops truncatus* ; *Delphinus delphis*) résidant dans le littoral occidental algérien. Les contributions de cette étude abordent les échouages et les nécropsies de petits delphinidés sur le littoral occidental algérien ainsi que des observations en mer effectuées le long des zones continentales et insulaires. Les résultats obtenus confirment la présence des grands dauphins et des dauphins communs dans les eaux algériennes. Malheureusement, ces créatures marines fragiles, sensibles et magnifiques sont soumises quotidiennement à une lourde pression anthropogénique dans leur habitat naturel.

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Presentation title

Microplastics contamination of the Lebanese coast: Ingestion by commercial seafood species

Abstract

Microplastics (MPs) marine pollution is one of the biggest environmental preoccupations of this last decade. Due to their small size, MPs or plastics of a size below 5 mm, could represent significant risks for marine habitats and could affect marine species and top predators throughout marine trophic webs. The Mediterranean Sea, being semi-closed, is one of the most affected sea by this phenomenon. This is precisely the case of the Lebanese coast where the recent direct garbage discharge is polluting the sea. The objective of this study is to evaluate the contamination of microplastics in the marine organisms, surface water, and sediments in three different sites (Tripoli, Beirut, and Sidon). Water and sediment samples along with two pelagic fish species (*Sardinella aurita* and *Engraulis encrasicolus*) and one bivalve species (*Spondylus spinosus*) were collected. The fish digestive tract was digested using filtered KOH 10 percent solution at 60 °C for 24 hours. The digestate was then filtered on glass fiber

filters GF/A. Water was sampled using a 52 μm plankton trawl: All visible plastics were separated and the rest of the sample was filtered on GF/A filters. Sediment samples were treated by density separation using ZnCl2. The plastic items were counted by stereomicroscopy and all identified items were divided in shape, color, and dimensional classes and polymers were characterized using Raman microscopy. This study allows to estimate, for the first time, the microplastics contamination on the Lebanese coast and its potential effect on commercial seafood species.

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Presentation title
Fate of the Mediterranean monk seal: Indicator of a healthy ecosystem

Abstract
Depending on the same resource, local fishermen and endangered Mediterranean monk seal (*Monachus monachus*) are competing counterparts within the ecosystem. In the Northeastern Mediterranean coast of Turkey, implementation of Kizilliman MPA that aims to secure the food availability and sustainable fish stock use on the zone covering the seal breeding habitats has increased fish stocks in the early 2000s. This, in turn, decreased mortality rates of the monk seals. However, after 20 years of fishery regulations applied in the area today, the species are exposed to severe threats mainly due to loss of critical habitats as a consequence of anthropogenic impacts including industrial developments in the coast. In this study, we focused on three documented populations of Mediterranean monk seals with the help of photo-identification method at different regions in Northeastern Mediterranean and tested various viability scenarios using Vortex Software to evaluate the survival of the species for next 100 years. In order to test the effect of connectivity between coastal habitats, in the first scenario, each population is assumed to be isolated from others, in the second scenario, all populations assumed to dispersed to each other with different dispersal patterns. Results showed that the existence of the populations largely relies on the dispersal. Additionally, even in the most optimistic model parameters, both isolated and dispersed populations failed to survive. This alone emphasizes the importance of the connectivity between protected areas, particularly stepping stones comprising fishery regulations for the survival of the species and sustainable ecosystem.

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Presentation title
Depredation: Social cost or positive externality

Abstract
Coastal fish eaten on nets by dolphin in the Mediterranean Sea (Italy; Lauriano, Caramanna, Scarno and Andaloro, 2009); Patagonian toothfish eaten on longlines by sperm and killer whales in Antarctica (Tixier, Gasco, Duhamel and Guinet; 2016); monkfish eaten on nets by Grey Seals in North-Brittany (France; Cudennec, 2016); Carps eaten by protected birds in German and Polish ponds (http://www.strefowe.lto.org.pl/index.php?id=10&lng=en)… While being a global phenomenon, depredation is still a rather unknown phenomenon. Recently, depredation attracted greater interest, as reflected by the development of the joint ACCOBAMS/GFCM approach to mitigate bycatch and depredation in the Mediterranean Sea (https://oceanconference.un.org/commitments/?id=16439), as well as the launching of some new national specific research projects on this topic (e.g. Orcadepred in France). For the time being, most of the research activities address biological aspects, mostly to understand the interactions between protected/vulnerable populations and human activities. This papers focusses of the costs incurred for the society in case of depredation (losses in revenues; higher fishing costs; changes in ecosystems' dynamic), but also underlines the (potential) positive aspects of the phenomenon (feeding the vulnerable populations).

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Presentation title

Mitigating sea turtle by-catch in bottom trawl and passive net fisheries: a Mediterranean case study

Abstract

This study aims to develop successful strategies for sea turtles conservation relying on the identification of possible areas ofbycatch hotspots and on the introduction of mitigation measures, such as fishing gear modification through Bycatch Reducer Devices (BRDs) and alternative fishing gears. At the beginning, an interview based approach was applied to identify areas and periods at risk for sea turtle-fishing gears interaction. To this aim, around 500 fishers all around Italy have been interviewed. Once the areas and periods at a risk of sea turtle bycatch were identified, different BRDs and reliable alternative gears were designed, developed and tested per fishing métier. In the framework of TartaLife project (LIFE12 NAT/IT/000937), Turtle Excluder Devices (TEDs) in mixed demersal trawl fisheries, UV lamps (visual deterrents) and a new type of pot in small scale fisheries, have been tested on commercial fishing vessels for a total of 110 fishing days. Considering fishers' reticence to change the gear traditionally used, determining the optimal

gear configuration to minimize commercial loss while avoiding turtle captures, was the main issue of the study. Findings show the mitigation devices tested in this project did not significantly affect the technical performance of the fishing gear nor the capture of commercial species. Moreover, the BRDs used have proved to be effective in reducing sea turtle bycatch. The findings highlight the need to develop mitigation tools and strategies for the entire Mediterranean, where the bycatch of vulnerable species seems to be a global issue.

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Presentation title

Oceanographic Turtles: Ocean monitoring platforms for conservation and dynamic ocean management

Abstract

Recent advances in biotelemetry and electronic monitoring systems allow investigating the use of space of marine animals with a high resolution. The combination of in situ observations, remote sensing and numerical models offers an unprecedented opportunity to investigate the interactions between environmental factors, marine animals and human activities. Oceanographic Turtles aims to provide the scientific basis to support the development of risk mitigation techniques based on new ocean observing and forecasting systems

and contribute to the conservation of marine turtles. The project addresses the role of operational ecology in the dynamic ocean management using the loggerhead turtle (*Caretta caretta*) in the western Mediterranean Sea as case study. This work will focus on the assessment of potential interactions between fisheries and loggerhead turtles using AIS and satellite tracking. More specifically, we will present the most significant advances that have been developed in two main axes of the project: (i) analysis of satellite trajectories in relation to environmental factors and human activities (i.e. through AIS data) using computational ecology methods, and (ii) design of operational tools for the management and conservation of sea turtles, aimed at both the reduction of bycatch and the optimization of the release of specimens from rescue centers. As a whole, the results of the project will provide a scientific basis for the development of risk mitigation techniques based on the new ocean observing and forecast systems.

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Presentation title

**Insights on elasmobranchs' use of space:
their migrations in the Adriatic Sea as study case**

Abstract

Elasmobranchs are known to display an array of behaviours that, coupled with their life history traits, make them particularly vulnerable to direct and indirect fishing. The occurrence of aggregations, sexual segregation, philopatry and extensive migrations may indeed influence connectivity and genetic diversity, on one side, and catchability, in the other one. Due to their role of apex and mesopredators in the food web, the collapse of elasmobranch populations may have strong consequences in marine ecosystem. Considering their decline worldwide, it is today mandatory to develop effective management plans for elasmobranch species. Those plans should include, to be effective, not only fishery data and life history traits, but also behavioural characteristics, including the use of space that may be differential according to the life stage and sex. This study aims at disclosing the use of space, movements and connectivity of elasmobranch species in the Adriatic Sea, with a special focus on the smooth-hounds, *Mustelus mustelus* and *M. punctulatus*, using genetic

analyses and tagging. From the start of the project, we collected 155 genetic samples and tagged more than 100 specimens belonging to eight species. Among them, *57* tagged animals were smooth-hounds. We used plastic darts and built up a website (www.shark.org) to facilitate the communication of the recapture of tagged animals. The first results of the tagging and genetic analyses are presented.

POSTER PRESENTATIONS

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Poster title

Exploring overlap between microplastic ingestion in marine species and plastic in the continental shelf and slope

Abstract

The Mediterranean basin is exposed to human activities including commercial and recreational maritime transport, fishing activities and concentrated population along its coast, affecting directly or indirectly ecosystems by increasing pollution discharge and litter in the marine ecosystems. The presence of macroplastics along the shelf and slope of the Balearic Islands reflects the availability of plastic for species inhabiting and feeding in this area (Alomar *et al.*, 2018). For the aim of this study, data from 44 hauls from experimental bottom trawl hauls carried out during a spring scientific survey and performed through the daytime, between 46 and 756 m of depth, were analyzed. Macrolitter obtained in these hauls were classified into seven different categories, including plastics, and each fraction was weighted separately and standardized to one square km. For the same hauls, 54 species were analyzed for plastic ingestion. Given the presence of marine plastics in bottom trawl hauls and the evidence of microplastic ingestion in marine organisms, a spatial overlap between these two potential indicators of plastic in the marine

environment has been studied and used as a valid indicator to describe marine litter patterns and trends. Preliminary results demonstrate that the presence of macroplastics in the seafloor doesn't implyingestion of plastics in species in all of the studied hauls. However, areas exposed to higher anthropogenic activities do reflect a higher overlap between macroplastics and ingestion. Results from this study allow detecting areas more susceptible to plastic contamination and of priority interest for conservation and management strategy purposes.

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Poster title

Biology and ecology of invasive flat crab, *Percnon gibbesi* (Crustacea, Percnidae), in the Gulf of Annaba, Algeria

Abstract

This study is a contribution to the knowledge of the biology and ecology of an invasive *Brachyura*, *Percnon gibbesi*, along the eastern Algerian coast, more precisely between the beach Lever de l'Aurore (36 ° 54'44.68 "N-7 46'18.75 "E) and Cap de Garde, Annaba (36 ° 58'04.66" N-7 ° 47'28.01 "E). Various ecobiological aspects were discussed: abundance, preferred habitat (rock-seagrass), behavior of individuals, sex ratio and reproduction period. We sampled in free diving (depth: 0-2 m, period: January 2016 - December 2017) a total of 322 individuals with a cephalothoracic length (CL) between 6.2 and 36.15 mm (0.04 < WT <19.56 g). The average annual sex ratio is 1.71 in favor of males. Females, representing 63.87 percent (76/119), appear from May to October, which places the breeding season between summer and early fall. The ecological study was conducted on a total linear transect of about 10 km divided into ten stations. In total, we counted by visual survey 844 *P. gibbesi*. The demographic structure of the *P. gibbesi* population sampled is structured as follows: small (78 ind., 9.24 percent), medium (413 ind., 48.93 percent), large (353 ind., 41.82 percent). The individuals observed have a total indifferent behaviour (100 percent) in the presence of an observer (diver) and frequent almost exclusively the rocky bottom, with a preference for crevices (94.19 percent) and accidentally small crevasses (5.81 percent). No individuals were observed on a seagrass or sand bed.

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Poster title
Killer whale, *Orcinus orca*, in the Strait of Gibraltar and interactions with Spanish tuna fisheries.

Abstract
Observation of killer whales in the Strait are reported from the nineteenth century. Spain and Morocco authors reported depredation by killer whale on the bluefin tuna caught by the handline and bait boat fisheries in the Gibraltar Strait and other authors reported a subpopulation of killer whales in spring and summer confirming bluefin tuna as a prey of killer whales. Spanish artisanal fisheries in the Strait include two gears: Bait Boat used all year round and hand line used from May to December. Killer whales use two feeding strategies: a cooperative group chasing by the endurance – exhaustion of the bluefin tuna. Second, direct depredation: a single killer whale (or a small 2–3 individual) depredates taking a part (bite) from a bluefin before they can bring the tuna onboard. From our study, main interactions with fisheries include: hooked by a hand line, entanglement and killer whale depredation on captured bluefin. Fishers' appraisal on the interactions with killer whales was as follow: significant differences were observed according to the period (before and after the International Commission for the Conservation of Atlantic Tunas [ICCAT] bluefin tuna Recovery Plan in 2007); fishers unanimously answer that killer whales cause problems due to the bites on tuna. Also the respondents say that this interaction has increased in recent years and the number of orcas present in the Strait has increased. Killer whales are currently present in the Strait more months a year. Before, they were present mainly in summer and now they are observed during near all year round.

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Poster title

Influence of hook shape and bait nature on shark bycatch in pelagic longline fishery in Tunisia

Abstract

At least 53 percent of sharks and batoids in the Mediterranean Sea are at risk of extinction and require urgent measures to conserve their populations and habitats. Considering this status and in order to mitigate shark bycatch in the Gulf of Gabès, we assess in this work the potential effect of hook shape and bait nature on pelagic longline shark captures. During July-August 2016 and 2017, 22 experimental sets were deployed to compare the traditional J-hook with circle hooks captures.

The effects of bait nature were also studied. Comparisons were based on catch per unit effort index (CPUE) calculated for each species considering the two mitigation measures. The use of circular hooks increased catches and specimens size of the sandbar shark *Carcharhinus plumbeus* and the shortfin *mako Isurus oxyrinchus* while allowing easier release of captured shark. Otherwise, the use of stingray portions as bait increases capture rates of *C. plumbeus* from 7.3 individuals/1000 hooks to 11.15 individuals/1000 hooks. Fishers were encouraged to use circle hooks and to avoid attractive baits such as elasmobranches portions.

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Poster title
Caractérisation et estimation des rejets du chalutage benthique de la pêcherie de Mostaganem (Algérie)

Abstract
La pêcherie de Mostaganem est située à l'ouest de l'Algérie et représente près de 10 pour cent de la façade maritime nationale. Dans le but de caractériser et d'évaluer la quantité de poissons rejetés par une partie de la flottille algérienne de chalutiers benthiques professionnelles, 23 marées correspondant à 41 traits de chalut ont été analysées au niveau de cette région suivant la méthode d'échantillonnage d'observateur embarqué, ce qui a permis d'observer les débarquements et les rejets. L'analyse de ces données a montré que les rejets de poissons représentent près de 16 pour cent de la capture total, pouvant même représenter 50 pour cent des captures dans quelques marées. Une moyenne de 28 kilos de poissons par marée sont rejetés et qui sont principalement représentés par une diversité spécifique composée de 67 espèces ichtyques essentiellement le *Trachurus mediterraneus* et le *Pagellus acarne*. Les prises accessoires sont peu fréquentes, Seule le rejet de l'espèce *Mola mola* a été observer. La faune et la flore benthiques font aussi l'objet de rejets qui sont caractérisés par une diversité spécifique de 35 espèces, notamment l'espèce emblématique *Posidonia oceanica* et l'espèce protégée *Pinna nobilis*. Les causes du rejet en mer ont été identifiées comme étant principalement d'ordre économique et d'ordre technique causé par la sélectivité des engins de pêche; cela concerne les espèces à faible valeur marchande ainsi que les espèces de taille non commercialisable. Les rejets d'ordre réglementaire sont faibles par manque de surveillance des débarquements.

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Poster title

Inventory and status of the non-indigenous penaeid shrimps in GSA 14

Abstract

The Mediterranean is a transition zone between the Atlantic and Indian Oceans via the Red Sea. Its population is characterized by subtropical species in the east side (southern zone) and cold temperate species in the west (Atlantic). Over time, the Mediterranean basin has experienced significant geomorphological, ecological, physical and chemical perturbations such as the opening of the Suez Canal, overfishing, pollution, maritime activities and coastal development. Thus, the GSA 14 (Gulf of Gabes) has also undergone significant changes including fauna, caused by the opening of the Suez Canal in 1869. Due to these climatic and environmental changes, we are witnessing an expansion of the distribution areas of some species and an input of more important new Lessepsian and Atlantic originated species. This work focuses on the non- indigenous penaeid shrimps in the GSA 14 (Southern Tunisia, Central Mediterranean). The inventory and the dates of their collections, as well as information on the distribution, the abundance and the status of these species are presented.

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Poster title

Contribution à l'analyse des captures accidentelles d'élasmobranches au port de pêche de Zarzis (golfe de Gabès, Tunisie)

Abstract

La capture accidentelle des espèces menacées dans les pêcheries est devenue un enjeu universel. Cette étude vise la détermination de la composition spécifique et l'estimation des captures par unité d'effort (CPUE) des élasmobranches dans les débarquements palangriers. L'étude a été menée durant juin, juillet et août en 2015, au port de pêche de Zarzis qui abrite la flottille palangrière la plus importante de la région du golfe de Gabès. Dans ce travail, 15 espèces d'élasmobranches cinq requins et 10 batoïdes ont été recensées dans les débarquements des palangriers rattachés au port de Zarzis. Dans les débarquements des palangriers de fond, les élasmobranches constituent 63,52 pour cent des captures alors que les mérous ne représentent que 24,78 pour cent. Au moins trois espèces de requins et neuf espèces de batoïdes sont capturées. Les requins et les batoïdes représentent respectivement 47,65 et 15,86 pour cent des débarquements. Le CPUE des requins est de 132,06 kg par sortie suivi par les mérous 96,78 Kg par sortie. Les débarquements des palangriers de surface sont dominés par les élasmobranches qui constituent respectivement 70 pour cent. Les espadons ne représentent que 24 pour cent. Les débarquements des palangres de surface sont dominés par le requin gris *Carcharhinus plumbeus* (65,14 pour cent) suivi par l'espadon *Xiphias gladius*

(24 pour cent). Le requin-taupe bleu *Isurus oxyrinchus* représente 4,84 pour cent du total des débarquements. Le requin tisserand est rarement observé dans les débarquements. La production en élasmobranche dans la région montre une chute depuis 2002 suggérant un abaissement des populations. Ainsi, la surveillance des captures parait indispensable afin de détecter en temps réel toute variation.

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Poster title
Bottlenose's dolphin depredation in the Tunisian sardine purse-seine fishery: factors that could engender depredation

Abstract
Depredation by cetaceans is a growing problem that may have serious economic implications for fisheries and for cetacean conservation. As a part of a pilot action coordinated by the ACCOBAMS and GFCM Secretariats, we investigated interactions between *Tursiops truncatus* and the purse seine fishery operating along the northeastern coast of Tunisia (Kelibia) to determine the factors that may influence depredation behaviour. Monitoring of the interaction between dolphins and the purse seine carried out through interviews with fishers and observations made from fishing vessels. To find out which variables begets depredation, a variety of quantitative explanatory variables was fixed and crossed to verify if their concomitance promotes or not depredation. ACM and discriminant analysis will highlight a hierarchy among variables that potentially affect the likelihood of dolphin depredation. Depredation reported in 57.12 percent of the 1722 nets inspected from 2015 to 2016 and Bottlenose dolphins were reportedly responsible for 92 percent of the depredation events. Bottlenose dolphin depredation was recorded in 61 percent of the observed fishing trips (n = 46). This phenomenon induces several holes with different location and size, which leads to additional costs for repairing nets and even for the acquisition of new engines that amortize fishermen's income. ACM revealed that season, net length and net production were important factors affecting depredation probability. Nevertheless, discriminant analysis showed that only net production seems influencing depredation. This study is the first attempt to monitor depredation by Bottlenose dolphins on a hand-jig squid fishery providing a scientific basis for future management of interactions between dolphins and fisheries.

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Poster title

A new rapid and robust procedure for isolating microplastics ingested by fish

Abstract

Environmental accumulation of microplastics (<5 mm) and their high abundance have generated considerable interest in the scientific community. The United Nation Environment Programme (UN Environment) has identified plastic pollution as one of the most critical problems. Since the natural degradation of plastics is very slow, microplastics have been accumulating in the marine environment for decades. In order to investigate the interactions between microplastics in the marine environment and the biota, a lot of procedures for microplastics identification in fish gastrointestinal tract have been recently developed. In this study, we present a new simple, rapid and robust procedure for isolating microplastics ingested by fish, to be used in future monitoring programs for marine litter. The procedure consists of: fish gut extraction; drying at 40 °C for 12 hours; organic matter digestion with a mixture of HNO_3 5 percent and H_2O_2 15 percent; vacuum pump filtration through a glass microfiber membrane; microplastics identification under stereomicroscope. To confirm the identity of the isolated polymers from natural samples, the Fourier-transform infrared spectrometry (FTIR) has been used. Due to the known nitric acid strength, we tested for the potential plastic degradation by HNO_3 at different concentrations on six types of polymers (nylon, polypropylene,

polyethylene, polystyrene, polyvinyl chloride, polyethylene terephthalate). This allowed selecting the acid concentration that showed a complete recovery of all the plastic items. The proposed protocol turned out to be applicable to fish of various sizes, being the biological materials digested with an efficiency over 95 percent. The digestion efficiency has been evaluated on a statistically representative number of individuals.

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Poster title

Marine megafauna bycatch in the Italian Adriatic pelagic trawl fishery

Abstract

Cetaceans, sea turtles and elasmobranchs are among the most threatened
marine species worldwide, and incidental catch is a major source of mortality.
The northern central Adriatic Sea, though one of the most overfished basins of
the Mediterranean Sea, supports a very valuable marine biodiversity, including
marine megafauna of conservation concern. This study assesses the impact
of the northern central Adriatic pelagic trawl fishery on common bottlenose
dolphin (*Tursiops truncatus*), several elasmobranch species and loggerhead
turtle (*Caretta caretta*) by examining incidental catches recorded between
2006 and 2017. The distribution of bycatch events was evaluated using
geo-referenced data. Catch data were standardized to predict the relative
abundance of bycatch events. Data analysis shows that most bycatch events
occurred in the northern Adriatic Sea. The models predicted significant, distinct
temporal patterns of standardized catches in line with previous investigations.

Water depth, season, latitude and longitude were the best predictors to explain bycatch events. The present data suggest that the northern Adriatic may be an important nursery area for several elasmobranchs species and a foraging area for sea turtle. The study also highlights the urgent need for a better understanding of the interactions between marine megafauna and fisheries to develop and apply suitable, ad hoc management measures.

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Poster title
Preliminary assessment of shark bycatch in pelagic fisheries of Southeastern Adriatic (Montenegro)

Abstract
During the period of two years (2016–2017), Montenegrin pelagic fisheries were monitored and sampled in order to collect first data on bycatch of endangered species of pelagic sharks in the region of Montenegrin coastal waters. Among fishing gear used in the area, the following were sampled: pelagic longlines (lower limit of detection), set gillnets (group of negotiations on services) and recreational tuna fishing teams (big game fishing). Seven hundred hooks of lower limit of detection, 2 200 meters of group of negotiations on services and four big game fishing teams were monitored for the surveyed period, mostly within the Montenegrin, but also in international waters. In total, 49 individuals of pelagic sharks were observed. Four species of sharks were found as non-targeted species in sampled gears: blue shark *Prionace glauca* (Linnaeus, 1758), shortfin mako shark *Isurus oxyrinchus* Rafinesque, 1810, common thresher shark Alopias vulpinus (Bonnaterre, 1788) and sandbar shark *Carcharhinus plumbeus* (Nardo, 1827). The most abundant species was the blue shark, followed by the shortfin mako shark, along with two other species which were registered just once. As the part of Montenegrin fishing fleet was surveyed, nominal CPUE was calculated for each species and fishing gear from the collected data. Furthermore, from this real data, an expected number of sharks to be caught was calculated for the Montenegrin pelagic fleet on the annual basis.

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Poster title

uSea: A crowdsourcing app monitoring invasive alien species (IAS) in the Mediterranean Sea

Abstract

Invasive alien species (IAS) are considered as a major threat to the local ecosystems, the native biodiversity, the local economy and human health, and as one of the main direct drivers of biodiversity loss across the globe, costing to local economies hundreds of billions of dollars each year. Both the EU and the UN include IAS among the biggest threats of the marine ecosystems, with several legislations aiming at tackling the adverse effects of IAS. The Mediterranean Sea is currently facing a severe invasion with more than 1 000 IAS already confirmed to be present in the basin (>5 percent of the total marine biodiversity). Greece is one of the most impacted countries, with more than 300 IAS already reported. Traditional monitoring methods, e.g. scientific surveys involving scientists and research vessels, are extremely expensive and usually insufficient to ensure good spatial coverage for the whole Mediterranean coastline. "uSea" is a crowdsourcing mobile app for tracking IAS in the Mediterranean Sea based on reports provided by citizens. This will allow us to provide valuable data to the scientific community through a web platform ("weSea"), sensitize and educate the users and influence policy for tackling the issue. Our records will be complemented with satellite data (geolocation, date/time, weather) facilitating more complex analyses. The app will provide several benefits to users, such as automatic identification using machine learning techniques, social networking, visualization of information and awarding system, but also targeted advertisement to related businesses. The web platform will provide raw as well as fully processed data to the scientific community.

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Poster title
Do diet variations influence the body condition of the French Mediterranean planktivorous teleosts?

Abstract

Small pelagic planktivorous teleosts play a key role in the food web channeling the organic matter from plankton to higher predators. During the last decade, the decrease in mean size and body condition (relative indices based on morphometrics considered to be closely related to fitness) of two commercial species European pilchard (*Sardina pilchardus* [Walbaum, 1792]) and European anchovy (*Engraulis encrasicolus* [Linnaeus, 1758]) in the northwestern Mediterranean sea induced a major crisis in local fisheries (Saraux *et al.*, 2018). The aim of our research was to explore the interannual and spatial variability of the European pilchard and European anchovy's body condition related to their diet in terms of species composition, size and energetic content of prey. The analyzed individuals were collected in the Gulf of Lion (2015 French Marine Strategy Framework Directive (MSFD) monitoring program, PELMED) and the Bay of Marseille (AMPED project) from 2011 to 2017. Spatial variations in relative condition related to their diet is shown. Our results show a selective feeding behavior for the European pilchard mainly for copepods: *Clausolanus/Paracalanus* spp., *Microsetella* spp., *Corycaeidae* and *Oncaeidae*. European anchovy preyed mainly on *Euphausiacea*, *Oncaeidae*

and *Microsetella* spp. These small-sized prey presented the highest energetic content among the water column plankton groups. These prey communities are similar to those observed in recent studies whereas pilchard and anchovy's body condition remains low (Le Bourg *et al.*, 2015). Why are they consuming small prey? How could this phenomenon be related to variations of available plankton community and, *in fine*, environmental parameters?

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Poster title

Does DDD03-H reduce interactions between bottlenose dolphins and sardine purse seine in northeastern Tunisia?

Abstract

Depredation by odontocetes appears to be growing in frequency, geographic extent, and severity. Therefore, the fishing industry is in an urgent need for mitigation measures that can reduce the frequency and severity of such interactions. Acoustic alarms, such as pingers, were initially developed to reduce interactions (depredation/ by-catch) between cetaceans and fishing gears. Our study focuses on the use of DDD03-H (Dolphin Deterrent Devices, DDD) to deter the bottlenose dolphin from approaching the purse seine during fishing operations. Sea trials conducted to identify the ideal location for maximum DDD03-H performance without risk of loss or damage. We compare the depredation rate, the catch per unit effort (CPUE), the rate of use and the DDD technical effectiveness in vessels with active and non-active pingers and those without repellents. The main results show that the use of pingers showed a significant effect on the CPUE. Depredation rates were more important for the control, inactive, and active DDD03-H conditions. This study is the first attempt to mitigate depredation by Bottlenose dolphins on sardine purse seine by DDD03-H. This study provide a scientific basis for future management of interactions between dolphins and fisheries.

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Poster title

Genetic Diversity of White Sharks, *Carcharodon carcharias*, in the Gulf of Gabès (central Mediterranean Sea)

Abstract

The white shark, *Carcharodon carcharias*, is one of the largest predators and among the most heavily protected marine fish. Understanding their patterns of abundance and connectivity as they relate to habitat use, is central for delineating conservation units and identifying priority areas for conservation. In this study, we use the mitochondrial control region to assess white shark genetic diversity in the Mediterranean Sea (Gulf of Gabès) and to elucidate the origin of the species and their relationships with white sharks in other areas. A 637 base pair (bp) sequence of the mitochondrial DNA (mtDNA) control region was obtained from four samples from the Gulf of Gabès (Central Mediterranean Sea). Overall, eleven polymorphic sites revealed three haplotypes, showing that *C. carcharias* exhibits the highest haplotype (0.833+ 0.049) and nucleotide (0.009+0.0095) diversities of any other sharks studied to date. Maximum likelihood phylogeny analyses corroborate the close genetic similarity of the Mediterranean and western Indo-Pacific Ocean haplotypes.

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Poster title
Study and damage assessment of the interaction of cetaceans with the trammel nets in Gandia

Abstract
The interaction between some species of dolphins and the artisanal fisheries in the Mediterranean Sea has been occurring for years. In the artisanal fisheries zone of Gandia, although there was a decreasing of this interactions for some years, since four years these interactions are now frequent. The *métier* which is being significantly damaged is trammel nets. The artisanal fisheries sector is suffering adverse effects, including losses in total amount of captures and the deterioration of fishery materials. This study offers an economical assessment of the generated damages in the fishery material, ¡just like a poblational census of the cetacean species with presence around local artisanal fisheries area. The study area is limited to five miles from coastal line and 24 miles from north to south, from Cullera to Oliva. Along this area there have been systematically executed aerial surveys with the lineal transect methodology, this method is habitual used for the study and distribution of the cetacean abundance. Two species of dolphins have been present in the area: *Tursiops truncatus* and *Stenella coeruleoalba*. The damage assessment in the nets of some members of the Cofradia de Pescadores de Gandia mean to the fishermen: loss of some percentage of total captures meanwhile the material remains damaged, costs to replace the material and time without this part of material.

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Poster title

Implication des pêcheurs dans la conservation: le cas des petits métiers de la zone Natura 2000 Camargue

Abstract

Dans le cadre d'un projet d'atténuation des impacts négatifs des activités de pêche sur les espèces marines menacées, le Centre d'étude et de sauvegarde des tortues marines de Méditerranée (CESTMed) a conduit une étude pilote avec les pêcheurs petits métiers de la zone Natura 2000 Camargue, en Méditerranée française. Coordonnée par les Secrétariats de l'ACCOBAMS (Accord sur la Conservation des Cétacés de la Mer Noire, de la Méditerranée et de la zone Atlantique adjacente) et de la CGPM, en collaboration avec le Centre d'Activités Régionales pour les Aires Spécialement Protégées du Programme des Nations Unies pour l'Environnement/Plan d'action pour la Méditerranée (ONU Environnement/PAM-CAR/ASP), cette étude a été soutenue financièrement par la fondation MAVA. Les objectifs étaient de renforcer la collaboration (née il y a plus de 15 ans) entre les pêcheurs professionnels et le centre de soins du CESTMed, de recenser les pratiques de pêche dans

la zone d'étude, d'étudier les circonstances des prises accessoires de tortues marines et de réfléchir, en concertation avec les pêcheurs, à des moyens pour limiter ces captures accidentelles et la mortalité associée. Ces actions ont été réalisées par des enquêtes informelles dans les ports de pêche, l'organisation de visites du centre de soins, la distribution d'outils pédagogiques et la réalisation de questionnaires. Par ailleurs, un pêcheur volontaire a accepté de tester des diodes électroluminescentes (DEL) sur ses filets maillants pour réduire les captures accidentelles. Cette étude a montré que les pêcheurs peuvent être de véritables sentinelles de la mer. Leur implication dans la conservation est incontournable. La concertation entre pêcheurs, scientifiques et gestionnaires doit permettre de construire des solutions adaptées aux réalités de terrain, impératifs écologiques et besoins socio-économiques des pêcheurs.

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Poster title

Mediterranean angel sharks in the spotlight

Abstract

Three species of angel shark are present in Mediterranean waters – angel shark *Squatina squatina*, sawback angel shark *S. aculeata*, and smoothback angel shark *S. oculata*. All are critically endangered and in dire need of attention having suffered declines across their range. Being large flat-bodied coastal species has contributed towards their demise in the Mediterranean and eastern Atlantic, as they more readily encounter inshore fisheries. Specialised fishing gear has even been named after angel sharks in Spain (escatera), Italy (squaenera), Croatia (sklatara), and France (martramaou). Information is sought on these three vulnerable species to enable historic and contemporary distribution to be accurately mapped and regional action plans created. Multiple experts engaged with the development of the eastern Atlantic and Mediterranean angel shark conservation strategy (Gordon *et al.*, 2017) which provides a framework for protection. The strategy was developed to i) improve the profile of angel sharks; ii) increase the number of sightings reported; iii) better understand the current distribution; and iv) contribute to IUCN Red List re-assessments and identify new collaborative opportunities. Following on from this conservation strategy, a Mediterranean Action Plan will be developed with collaborative input sought from researchers, fisheries managers, the commercial fishing industry and local NGOs – these action plans will be imperative in highlighting key conservation actions in different geographic areas. While all three Mediterranean angel sharks are listed under the 2012 binding Recommendation GFCM/36/2012/3 banning retention, this prohibition is often not enforced. Next steps in the Mediterranean must include enhancing the understanding of species distribution, quantifying incidental catch and enforcing existing management measures.

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Poster title
Pilot assessment on microplastic in guts of commercially available fish species

Abstract

This scientific work presents the results of monitoring microplastics (plastic particles ≤ 5 mm) in marine biota (fish and mussels) of the Adriatic region. The main objectives are: i) The development of harmonized sampling and sample analysis methodology for biota, using commercial fish species; ii) The estimation of microplastic concentration in the biota of the Adriatic Sea. Methodology: The biota sampling and microplastic separation protocols were done according to the protocol described in: "Biota sampling and microplastic separation" of the document: "Recommendation on regional approach to monitoring and assessment of microplastic in the marine environment" (December 2015). Twelve different fish species were examined in 2015 and 2016 for the presence of microplastics. The fish and mussel samples were mainly collected from fishers or were bought on the fish market. Those were extracted, counted and weighted, categorized into six categories (fragments, filaments, foams, granule, pellets and other) and analyzed for their chemical structure with FTIR. At the end, estimation of the density of microparticles was calculated per fish or mussel for each species and was compared among all countries in the Adriatic region. Conclusion: i) The average contents of microparticles extracted were ranged from 0.88 to 12.95 microparticles/fish and 1.65 to 3.67 microparticles/mussels; ii) Results of microparticles in fish samples from the Adriatic Sea show high variability among all of the ten compared fish samples; and iii) This research, conducted in the frame of the DeFishGear project, presents the first valuable data on the overall state of the contamination with microplastic on commercially important fish and mussels species in 2015 and 2016 in the Adriatic Sea, where first coordinated research was conducted in Italy, Slovenia, Croatia, Bosnia and Herzegovina, Albania and Greece.

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Poster title
Biological parameters of invasive species *Lagocephalus sceleratus* and *Pterois miles* in the Lebanese marine waters

Abstract
The lionfish *Pterois miles* and puffer fish *Lagocephalus sceleratus* are Indopacific species that are present in the eastern Mediterranean. The large number of adults observed and the occurrence of juveniles indicate that these species are well-established and reproducing along the Lebanese coast located in the eastern Mediterranean. Lionfish are known for their venomous dorsal, anal, and pelvic spines; however, this fish is consumable. Puffer fish are characterized by their toxicity; tetrodotoxin is found in the ovaries and liver. It is known to cause serious damage to the fisheries sector. In this study, *P. miles* and *L. sceleratus* specimens were bought directly from fishers, from January until August 2018. For puffer fish, age determination was carried out using whole vertebrae. The biological parameters (weight-length relationship, L50 and sex ratio) were also determined. Currently, no management actions are being implemented to limit the effect of these two invasive species inhabiting the Lebanese continental shelf. Such research helps scientists make better predictions regarding the status of the invasion and the effect on native species, ecosystem function, and ecosystem services.

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Poster title
Sustainability of bioresources in the Black Sea as adaptation to climate change

Abstract

Global climate change encourages the development of adaptation measures for fish in the Black Sea. As an example, the Black Sea turbot (kalkan; *Scophthalmus maeoticus*) is a species whose exploitation should be regulated. In addition, global warming, water pollution and unregulated fishing seriously decrease stocks of this valuable fish species, as well as beluga, sturgeon, katran and dolphin-azovka, which continuously suffer due to bottom nets. A meaningful solution for this problem is to create a new type of private fishery centers in the Black Sea region (particularly in Ukraine) and to disseminate such project as "SuBlaSe – Sustainability for Black Sea", implemented by the "RPC Forel". Such enterprises should include (i) genetic studies on the adaptation of fish to water warming and the improvement of its resistance to infectious diseases; (ii) the identification of the most efficient microalgae species for its smart cultivation; (iii) the commercial rearing of *Psetta maxima* with simultaneous growing of microalgae towards elimination of water pollution; (iiii) the development of new types of mixed fodders taking into account marine species specificity, salinity and water temperature; and (iiiii) the use of microalgae as an alternative to antimicrobials in feeds. In addition to innovative research activities, the implementation of this project will allow to fill the market with new commercial products (incubated caviar and larvae of adapted kalkan, sustainable feeds from alternative sources of protein and the biomass of algae, applicable for any other needs – for example, energy). The social effect will consist of clean sea water, providing food products for populations, creating jobs and developing the infrastructure of coastal regions. This business model together with political mechanisms could be applied to other marine and maritime activities.

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Poster title
Preliminary assessment of trace elements in *Mytilus galloprovincialis* from a coastal lagoon in Sardinia (Italy)

Abstract
Metal pollutants have a worldwide distribution and to monitoring their fluctuations and/or the long-term effects on the environment, the use of sentinel organisms it is essential. Invertebrates such as bivalve molluscs bioaccumulate metal pollutants released in coastal and estuarine environments. The aim of the study was to evaluate the presence of trace elements in adult specimens of natural Mediterranean mussels (*Mytilus galloprovincialis*) populations collected from the Calich Lagoon, a coastal lagoon in the western Mediterranean (Sardinia, Italy). The Calich Lagoon is comprised in the Regional Natural Park of Porto Conte and plays a central role in contributing to biodiversity and protecting natural habitats. The lagoon receives an extensive freshwater inflow from fluvial tributaries. The contribution of marine and fresh waters determines a high productivity. Despite its great potential and presence of natural bivalve molluscs populations, the waters of the lagoon have not been yet classified for shellfish farming. Samples

of Mediterranean mussels were collected during early spring and summer 2017. The concentration of 16 trace elements (Al, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, Sn, Tl and Zn) in the tissues of Mediterranean mussels was quantified. The legal limits set by European Regulations for cadmium, mercury and lead were never exceeded. The highest values of metal pollutants have been reported for aluminium and iron (mean 35.5 mg kg^{-1} wet weight) and zinc (mean 25 mg kg^{-1} wet weight). Mediterranean mussels confirmed the capacity of bivalve molluscs as suitable bioindicators of the presence of metal pollutants.

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Poster title

Population structure of the Atlantic blue crab *Callinectes sapidus* (Rathbun, 1896) in two Albanian lagoons (South Adriatic).

Abstract

The occurrence of the Atlantic invasive species *Callinectes sapidus* was analyzed in two coastal lagoons of Albania, the Orikumi and Narta lagoon. Specimens were sampled monthly during 2017–2018 by local fishers using gillnets and traps in order to evaluate the abundance of the species. Specimens were enumerated, sexed, and measured. Carapace width (CW) and carapace length (CL) frequency distributions were classified three age cohorts. The carapace width (CW)-weight (W) relationship was calculated (for both sexes). Besides direct observation and samples collection in the studied area, questionnaires have also been distributed to local fishers with the purpose of gathering information about the presence of the blue crab, assessment of its state and its possible impact on the other populations in both lagoons, as this species seems to be already established. The presence of mature males and females suggests the establishment of this crab in the area of reference, although no post-larval or juvenile stages have been found. Further research will have to study the ecological effects of the presence of this species on natural systems and evaluate a possible use of the resource.

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Poster title

WARNING! Do not exploit before assessing their vulnerability - Mesopelagics of the eastern Mediterranean

Abstract

The northeastern Mediterranean is extremely oligotrophic. It is therefore very surprising that the same area is an important fishing ground for a high trophic level fish such as the Atlantic bluefin tuna. It may be more surprising that the same species has chosen this oligotrophic sea for a high energy demanding biological activity such as reproduction. However, some new findings on the diet of bluefin tuna in this area, provided clarity; they utilize a resource which has not been known; mesopelagics. This study aims to draw attention to the mesopelagic aggregations acoustically detected (SIMRAD EK60) between Turkish mainland and the Cyprus Island and to underline that this area could be a mesopelagic hot spot in the Mediterranean Sea. On the other hand, the fishing fleet of the countries around the eastern Mediterranean, Turkish in particular, has overgrown over the years and exceeded the level of sustainable exploitation. Parallel to the growth of the fleet, fishmeal industry has developed and reached a gigantic capacity. Therefore the fleet and the fishmeal industry are in demand for new resources. Within close geography, the fishery has started to exploit this resource to produce fishmeal. Although it has always been promoted otherwise, the approach followed by the Regional Fisheries Management organization (RFMO) of the Mediterranean is single-species. The concern is, if this resource in the Mediterranean were to be exploited it would be regulated by empirically set biological reference points not considering ecosystem interactions, such as how epipelagic large pelagic stocks reproducing in the same area would be impacted.

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Poster title
Fish behaviour in Mediterranean demersal trawl mouth

Abstract

To improve our understanding of fish behaviour in demersal trawl mouth, 1.800 h of underwater camera recordings were obtained in 361 hauls under natural light conditions in the Mersin Bay, eastern Mediterranean. Observations were conducted aboard six different vessels, between depths of 8-210 m, from September 2015 to May 2018. Action cameras were mounted in various sections and oriented directly at the center of ground gear. Different camera recordings of each tow were synchronized in a way that the trawl mouth could be simultaneously visualised by up to six cameras. Recordings in which any species could be identified were analyzed frame by frame. Observed behaviour of each individual was quantified in three main categories: 1) horizontal orientation, 2) vertical position, and 3) swimming speed with respect to the trawl. So far a third of the recordings were analyzed. Presently a total of 1 455 individuals belonging to fifty-six different species were identified in trawl mouth. Among them, more than fifty percent of the individuals of 30 species have shown optomotor response while over half of the individuals of seven species were always non-reactive to the gear until capture or escape at the trawl mouth. Some ray and skate species have demonstrated successful escapes below the ground gear while

some species have not even attempted to escape. Important video footages of fish behaviours were placed on marine charts by using ArcGIS, and a subject specific fish behaviour database was formed. Commercial trawlers were incorporated to the study during 24 days of sea trips or workshops where sample videos were shown and potential ground gear modifications to reduce bycatch were discussed. The study is funded by The Scientific and Technological Research Council of Turkey (TÜBiTAK, Project 115O647).

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Poster title

Conservation of the most endangered marine species under international and European law: Perspectives for future developments

Abstract

The purpose of this paper is to clarify the existing (global and regional) legal standards on the protection of the most endangered marine species (marine mammals, sharks, sea turtles) from overexploitation. First, an analysis of the current international and regional legal framework (law of the sea, sustainable fisheries management, wildlife law) applicable to marine species is provided. Next, the paper explores the contributions of the existing legal regimes (fisheries law and wildlife law) to the development of the law of the sea in terms of a major degree of protection for the most endangered marine species. A focus is devoted to the standards developed by the European Union (EU) and treaties of regional scope. In this framework, I will discuss whether the emerging concept of fish welfare can be an 'asset' if included in conservation policies. Indeed, the present analysis will start from a critical overview of the current gaps of the United Nations Convention on the Law of the Sea in conserving living resources in the oceans (focusing on the failure of the concept of maximum sustainable yield). Thus, a critical revision of the traditional approaches (in particular the resource exploitation approach) is necessary in order to explore which could be the proper contribution of international and regional organizations in preserving living marine resources and in particular the most endangered and threatened species. I contend that future developments in fishing policy must shift from utilization towards conservation. Consequently, an idea of a more ´conservation-oriented approach´ as the basis for further legal efforts is proposed.

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Poster title

Assessment of trawling pressure in the Italian Natura 2000 network

Abstract

Bottom trawling represents one of the most important human activities threatening the conservation of marine habitats and species in the Mediterranean Sea. In Italy, many Marine Protected Areas (MPAs), explicitly designed for conservation are affected by negative impacts of bottom otter trawling. This study is aimed at assessing trawling pressure exerted by Italian trawlers within conservation areas belonging to the Natura 2000 network and, at evaluating potential conflicts between fishing impacts and conservation targets. Trawling pressure is assessed in terms of seabed swept area by the gear using geo-referenced data about positions and fishing activities of vessels. The results show that, during the period 2014–2016, only 80 sites out of 152 were concerned with bottom trawling. Among these, the sites located in the southern and oriental waters of Italy were exposed to higher levels of fishing pressure. Further, considering conservation targets, sites established for the conservation of *Posidonia oceanica* and loggerhead sea turtles (*Caretta caretta*) seems to be more subject to negative effects of bottom trawling than those associated to coastal lagoon and those characterized by the presence of the common bottlenose dolphin (*Tursiops truncatus*). The analyses suggest that the information reported in official data understate the presence of bottom trawling in a great number of sites analyzed. The approach proposed in this study highlights the urgent need for a thorough identification of critical areas in relation to the interaction between bottom trawling and conservation targets in the context of the Natura 2000 network.

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Poster title
Decision support to build understanding about the solutions in EBFM: the Strait of Sicily case

Abstract
Fisheries in the Strait of Sicily have a high socio-economic and cultural value but are facing the major management issues common in the Mediterranean. They include ineffective management of shared stocks, overfishing, high impact on habitats, decline of fisheries productivity, environmental change, and lack of tools supporting Ecosystem Based-Fisheries Management (EBFM). The political incentive for EBFM is clear through the Common Fisheries Policy (CFP) and the GFCM, but operationalizing that into a fisheries context is a challenge. The primary goal of the CFP and GFCM is to reach sustainable fisheries in the Mediterranean by setting FMSY objectives. FMSY, however, may be beyond reach for harvested populations which are linked through trophic interactions and are fished in a mixture. Hake and deep- water rose shrimp are predator-prey populations which are shared among multi-national

fleets in the Strait of Sicily. Reaching FMSY for hake would result in lost fishing opportunities for the fleet while reaching shrimp FMSY would imply overfishing of the hake stock.

An additional major complication is the normative requirement of applying transparent environmental, social and economic criteria to guide management decisions. In the stakeholder objectives and concern are identified and systematically considered with a multi-criteria decision analysis (MCDA) process heavily resorting to participatory modelling. Two complementary ecosystem models (Gadget and Atlantis) were used to produce quantitative forecasts of alternative management scenarios identified during stakeholder workshops. When stakeholders revealed their subjective preferences it became possible to understand and solve the trade-offs of the management decisions.

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Poster title
Pilot assessment of marine litter in the fishing and aquaculture areas in Tunisia

Abstract
Traditional fishing areas are characterized by human activity and various anthropogenic actions, and spread from the shoreline or the harbor basin to the fishing areas. This work aims to class and quantify the marine litter in a typical fisheries and aquaculture zone in Tunisia: Monastir area with 5 fishing ports, a fleet of 1 057 units with 4 726 fishers and an aquaculture zone with 11 fish farms. The diagnosis concerns coastal litter 0 m, artisanal fishing zones from 3 to 20 m and aquaculture zones around 30 m depth. Sampling, in sediment and in water, is carried out by direct catch on foot or by scuba diving, by grab sampling (Van Veen) and by towing with manta nets (300 μm). Macro-waste distributed on the coast is dominated by plastic materials with 91.2 percent, of which 4.0 percent come from fishing and aquaculture activities (remnants of ropes, floats, bags, etc.) followed by 5,3 percent of paper; 2.5 percent of wood and 1 percent of metals. Offshore macro-waste is limited while the density of microplastics varies between 2 and 31 items per dm^3 in the sediment and from 11 to 33 floating items per 100 m^2 on the water surface. In addition, analyses of the stomach contents of wild or farmed fish reveal no presence of microplastics. This first investigation highlights the preponderance of plastics beyond the known averages of 80 percent at the beach level. This quantification and specification of items can be empowered by the identification of the main sources of pollution and the potential effects on the marine environment. Preliminary measures may be recommended to prevent, reduce and remove marine litter, starting from the offshore aquaculture zero waste to the ports basins cleaning.

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Poster title

Management, threats and opportunities of invasive rapa whelk, *Rapana venosa*, in the Black Sea

Abstract

Rapa whelk is one of the most important invasive species in the Black Sea and was recorded for the first time in 1940. The main threats of rapa whelk to the Black Sea ecosystem were the reduction on biodiversity due to preying on native mussels and oysters, and the destruction of the bottom habitat. The opportunities from *Rapana* fisheries can be summarized as to provide important income sources for small-scale fisheries and being one of the major seafood exported to Asian countries as frozen meat. The failures in rapa whelk fisheries management is the lack of data on its population parameters and insufficient monitoring of rapa whelk stocks. Some measures were taken by the authorized Ministry to protect benthic habitat, such as the extension of closed season for whelk fishery with dredge, the ban of non-targeted species harvested by dredge, two dredges per boat, fishing at night and the allocated zone within 500 m from the shore. On the other hand there are limitations regarding gear and closed areas.

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Poster title
Technical solutions for small-scale driftnets

Abstract

The main environmental impact of driftnets is due to the bycatch of non-target species. In general, likewise gillnets and small-scale driftnets have a high degree of size and species selectivity and can efficiently be regulated by mesh size and twine thickness. Few alternative fishing methods are available to catch the species targeted by small-scale driftnets, and the impact for some of these gears is controversial. The aim of the present study is to find and explore alternative technical solutions to a complete ban on European small-scale driftnet fisheries, taking into account the scientific evidence of the damage that driftnets may cause to the environment in the different regions. Environmental impact on non-target species, including protected species of current small-scale driftnet fisheries, is similar to that of other passive fishing gears, such as purse seines, boat seines, trammel nets, set gillnets, and set- and drifting-longlines. Proposals are advanced to reduce the environmental impact of small-scale driftnet fisheries, chiefly in terms of selectivity improvement. The study provides recommendations for policymakers to base their decisions on the circumstances in which the use of driftnets is not acceptable. It examines the effectiveness of mesh size and twine thickness limits of 90 mm and 0.6 mm, respectively in all driftnet fisheries, the restrictions on the fishing gear types and dimensions, and then the possible selective ban on these driftnet fisheries that are more harmful to protected species and/or are unable to avoid unwanted bycatch of unauthorized species.

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Poster title

Trawl selectivity of a shark-excluding grid device

Abstract

Galeus melastomus (blackmouth catshark) is a common bycatch in demersal trawls in the Mediterranean. Increased awareness of the impacts of fishing on "vulnerable species" such as sharks has prompted interest in the use of excluder grids combined with an escape outlet as a method of mitigating shark bycatch. This device could also improve catch quality by reducing other bycatch and debris, and sorting time on deck. We tested an excluder grid with 90 mm bar spacing during experimental fishing in the Tyrrhenian Sea (western Mediterranean). The target species were *Nephrops norvegicus* (Norway lobster) and *Phycis blennoides* (greater forkbeard). Separate covers were placed over the grid escape outlet and the codend to collect fish escaping ahead of the grid as well as through the codend. A structural model was used to estimate the contribution of the individual selective processes of the grid and codend. The 90 mm excluder grid did not prove to be efficient in excluding *G. melastomus*, but excluded more of *P. blennoides*. Catches of *N. norvegicus* were also affected by the presence of the grid, but not as much as the catches of other two species. Using explorative simulation, with other grid bar spacing, we predict that reducing the grid bar spacing to 70 mm would provide a better compromise between the reduction of *G. melastomus* as bycatch and the catch rate of *P. blennoides* and *N. norvegicus*.

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Poster title

Elasmobranchs bycatch in bottom longline: Management options

Abstract

Bycatch has become one of the issues to be considered in any fishery management. It involves loss in biological resources in addition to its negative ecological impact. Bottom longline fishing in the Gulf of Gabès region engenders bycatch of some elasmobranchs species. The objective of this work is to propose conservation measures to reduce incidental catch of this taxon on the basis of the knowledge of the circumstances of the interactions. For this, we analyze data of 37 trips on board bottom longline boats during summer 2016 and 2017. During these trips, 129 tows were made and 273 550 hooks were deployed. Five sharks and six batoïds are caught by bottom longline. They constitute 50 percent of the total catch beside groupers, the targeted species. The mortality rate is generally low in species caught by bottom longline gear. Most rays could be removed alive. This low rate is related to the short anchorage time that does not exceed two hours. The low mortality rate for certain species can offer an opportunity to release alive specimens. Other measures should be considered, such as fishing depth.

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Poster title

Spatial variability of plastic ingestion by *Boops boops* (Linnaeus, 1758)

Abstract

Ingestion of plastics by marine organisms is an important issue as well as related monitoring activities for baseline and trends values of marine litter. Unlike macroplastic ingestion, for which a considerable amount of information has been gathered, microplastics (<5mm) are more difficult to study for their small size. However, microplastics are highly bioavailable to ingestion by a variety of taxa, either through direct or accidental ingestion with food. This study reports on the presence of microplastics in the gastrointestinal tract of small demersal fish (*Boops boops*). Fish samples were obtained from professional fishery activities in different areas of the Central Tyrrhenian sea (Mediterranean Sea). Gastrointestinal contents of fish were analyzed to detect any spatial variability of plastic abundance, between highly and lowly impacted areas due to the MPA "Secche di Tor Paterno" and the different influence of the Tiber river mouth. For each fish, basic measurements included total length, body weight, sex and gonads maturity. The gastrointestinal tracts were removed by dissection and the organic matter was digested and filtered under vacuum pump. Plastic items were identified under a stereomicroscope and sub-divided into four categories (fibers, sphere, sheet, fragment) with the corresponding colors. Unclear items were analyzed by spectroscopy (Fourier-transform infrared spectrometry [FTIR]), to detect polymer type. Secondary contamination was avoided using a laminar flow cabinet. The results show that most of the individuals had ingested microplastics with fibers predominant. Preliminary data show a spatial variability of ingested plastic rate along Latium coastal area.

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Poster title

South Aegean coasts in terms of microplastic pollution: present and future perspective

Abstract

In parallel to the increasing population and industrialized society, the amount of pollutants entering aquatic ecosystems has increased. In 2016, 335 million tonnes of plastic were produced worldwide, 60 million tonnes of which were produced in European countries, and 31.1 percent of plastic waste was recycled. In Turkey, nine million tonnes of plastic were produced in 2016. In the last 60 years, large quantities of plastic waste have entered the ocean. With this study, the situation of microplastic pollution in South Aegean coastline will be revealed for the first time by sampling sand and surface water in two seasons (summer and winter) from six different coasts in which anthropogenic activities are intense. For every one of these coasts, manta net will be used in surface water sampling. For sand sampling, 3 kg samples will be taken randomly from 3 cm depth of a section with areas of 50×50 cm2. For the isolation of microplastics, the samples will go through some phases appropriate to international standards and then for identification, Fourier-transform infrared spectroscopy (FTIR) will be used. This study will present a specification of microplastic pollution by explaining at which levels this pollution is in sand and water and which kinds of microplastics are denser. During the literature review about the subject, it was observed that there has not been any study on these six coasts, which confirms the importance of being a pioneer to this study.

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Poster title
Storm activity in the Black Sea under changing climate

Abstract
Fisheries management in the Black Sea depends a lot on the oceanographic conditions and the marine environment. The storm wave regime is one of the most important factor of fisheries. The wind speed and its direction control a great part of the sea wave parameters. In this investigation, the storm events in the Black Sea are examined in connection with the main atmosphere weather patterns grouped into the circulation types, and their changes in present climate. A calendar of storms is derived from results of the Simulating WAves Nearshore (SWAN) model's experiments for the period 1948-2011. On the basis of this calendar, a catalogue of atmospheric sea level pressure fields was prepared for circulation types from NCEP/NCAR dataset. Then, sea level pressure fields were subjected to a pattern recognition algorithm employing empirical orthogonal decomposition followed by cluster analysis. For every circulation type detailed analysis of their seasonal and interannual changes, their role in storm events formation is analyzed. An increase of the storm circulation types' frequency in the second part of the twentieth century is shown to be in good agreement with such teleconnection circulation patterns as Arctic Oscillation, North Atlantic Oscillation, and Scandinavian blocking. Projection of storm waves circulation types frequency during the twenty-first century for RCP8.5 scenario of radiative forcing is given on the basis of CMIP5 climate models results – it is shown that the number of such extreme patterns significantly increases.

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Poster title

Size selection in Dyneema netting codend compared to traditional codend in Mediterranean bottom trawl

Abstract

This study investigates the selective properties of a 40 mm square mesh codends made out of flexible Dyneema twine. The main goal of the study was to investigate the effect of the size selection on Dyneema netting codend compared to traditional coend made of Polyamid (PA) and Polyethylen (PE) netting material on some commercial species, mainly red mullet (*Mullus barbatus*), picarels (*Spicara smaris*) and bogue (*Boops boops*) in Meditereanean bottom trawl fisheries. Moreover, the obtained size selectivity for the 40 mm square mesh codends made of netting Dyneema were compared to previous results obtained for other traditional Mediterranean codends used in the same fishery. The experiments were carried out in the eastern Aegean Sea during February and March 2018. A conventional bottom trawl was operated onboard a commercial trawl named "Efsane G". Selectivity parameters were obtained by using logistic equation with the maximum likelihood method and by taking into account between-haul variation. It was observed that the 40 mm square mesh Dyneema netting codend produced much higher L50 values than the other traditional codends generally made of standard 44 mm diamond mesh PE material. This demonstrates the high selective potential of the flexible Dyneema netting compared to nettings which are traditionally used in the construction of trawl codends. The presently reported study was funded by the Science and Technology Centre of the Ege University (EBILTEM), İzmir, Turkey (Project No. 2016/SUF/026).

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Poster title
Non-indigenous fish and crustaceans species along the Montenegrin coast (South Adriatic)

Abstract

Quantitative and qualitative composition of the Adriatic ichthyofauna have been changed significantly in the last few years. Climate change, human activity, especially the digging of the Suez Canal, as well as ballast water has enabled the new (foreign) species unimpeded passage into the Adriatic Sea. Currently, seven new species of fish and two species of decapod crustaceans are recorded in the Montenegrin waters: *Tylosurus acus imperialis*, *Caranx crysos*, *Siganus luridus*, *Fistularia commersonii*, *Lagocephalus sceleratus*, *Stephanolepis diaspros*, *Sphoeroides pachygaster*, *Callinectes sapidus* and *Farfantepanaeus aztecus*. Almost all of those species have established populations in the southern Adriatic Sea, which will, with climate changes, enable their rapid expansion in the future, and the invasion of new, not yet recorded taxa. All of them have significant ecological and economic impacts in the Adriatic Sea. Local Ecological Knowledge (LEK) monitoring system was implemented in Montenegro to gain alternative information on species presence and qualitative and quantitative indices of species abundance, according to the interviews with professional and recreational local fishers. With the LEK analyses, data for three more foreign species were recorded in Montenegro (*Saurida undosquamis*, *Sphyraena chrysotaenia*, *Sphyraena viridis*).

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Poster title
The Impacts of ocean noise pollution on fish and Invertebrates

Abstract
Most fish and invertebrates vitally depend on sound. Here, 114 studies of different anthropogenic underwater noise sources, 61 fish and 26 invertebrate species are reviewed. Noise impacts include body malformations, higher egg or immature mortality, delays in development, growth, metamorphosing, and settling. Zooplankton suffered high noise mortality. Noise caused massive internal injuries, cellular damage to statocysts and neurons causing disorientation and death, and hearing loss, even 96 hours post-exposure. Stress impacts were documented, including increased stress hormones, metabolic rate, oxygen uptake, cardiac output, parasites, irritation, distress, and mortality rate, e.g. from disease and cannibalism; and decreased body condition, growth, weight, consumption, immune response, and reproductive rates. DNA integrity and overall physiology were compromised. Animals showed alarm responses, increased aggression, hiding, and flight reactions; and decreased anti-predator defense, nest digging, nest care, courtship calls, spawning, egg clutches, and feeding. Noise caused more distraction, food-handling errors, and predation vulnerability, and decreased foraging efficiency, feeding, and schooling. Masking reduced communication quality and distance. Some commercial catches dropped substantially, with larger fish leaving. Increased bycatch rates and decreased fish abundance were observed. Key invertebrate ecological services, e.g. water filtration, mixing sediment layers, and bioirrigation, were impacted. When noise compromises population biology and ecology, fisheries and human food security are also affected. Turtles, sharks, and rays were underrepresented in noise impact studies. Research on marine animals' survival, reproduction, population viability, and ecosystem function, is vital. Long-term, realistic noise field studies also considering cumulative and synergistic effects, along with stress indicators, are needed.

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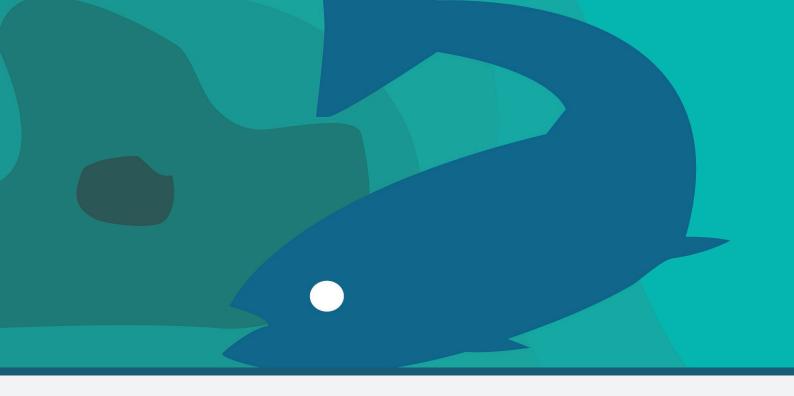
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Poster title

Conflict between fisheries and cetaceans in the Bulgarian part of Black Sea

Abstract

Conflict between cetaceans and fisheries is an important conservation and management issue in many parts of the world and the Bulgarian aquatory of the Black Sea is not an exception. In 2012, we examined the level of conflict between the fishermen using a specific static fishing gear for Bulgaria named "Dalyan" and cetaceans by means of interviews. The preliminary study showed that these facilities are a major source of conflict with fishers, due to the constant attacks of the cetaceans. The results showed that attitudes towards cetaceans are mostly neutral, but the percentage of negative answers was also high. The overall results showed that a considerable conflict exist in all the Black Sea region due to damages caused by cetaceans to the fishing gear and the subsequent catch loss. According to fishers, the most effective measure to reduce the number of damages is reducing the numbers of cetaceans. In 2015 we examined one of the possible management approaches to control the level of conflict – the use of acoustic deterrent devices (ADDs) pingers on the fishing gears. Their effectiveness was tested for the first time in the Bulgarian Black Sea coast during this study. "Dalyans" were equipped with harbour porpoise pingers (10 kHz) in the northern part of the Bulgarian Black Sea coast in an attempt to reduce bycatch of small cetaceans and/or to reduce depredation.

Theme 3
Economic analysis and technology for societal benefit

KEYNOTE PRESENTATIONS

ORAL PRESENTATIONS

Subtheme 3.1: Improving knowledge on the social and economic impact of fisheries

Subtheme 3.2: Mapping value chains

Subtheme 3.3: Marine technology promoting economic and environmental sustainability of fisheries

POSTER PRESENTATIONS

Marine fish in the Mediterranean and the Black Sea are a precious natural resource and their exploitation for nutrition and income has been deeply rooted in our culture and traditions for centuries. However, impacts from human activities, overfishing and climate change, to name but a few, have led to unprecedented changes with major societal and legal repercussions that transcend national boundaries.

The theme "Economic analysis and technology for societal benefit" aims to examine how to quantify the socio-economic value of the marine sectors, their contribution to gross domestic product, and technological developments in support of effective ecosystem based management, and of fair and sustainable development.

Keynote presentations

Theme 3 – Economic analysis and technology for societal benefit

Lasse Gustavsson – Executive Director Europe, Oceana

A new paradigm for Mediterranean fisheries: stepping up implementation and compliance

Abstract

The Mediterranean is the most overfished sea in the world, with over 80% of fish stocks excessively exploited and high catches of juveniles. Iconic European hake is the region's most overfished species, with mortality up to 13 times above sustainable levels, which calls for an immediate action to avoid a total stock collapse. Introduced in 2017, the Malta MedFish4ever Declaration is a first important step to save the Mediterranean fish stocks and protect the ecological and economic wealth of the region. Oceana is firmly committed to support the proper implementation of the Malta MedFish4Ever Declaration and urge governments to:
  a) establish a strong network of Essential Fish Habitats (EFHs) through the designation of new Fisheries Restricted Areas (FRAs); and
  b) take forceful action to enforce the protection of FRAs and stop the bottom trawlers operating within FRA limits.
  A proper fisheries management is vital to preserve the marine environment. Therefore, implementing an effective network of EFHs and improving the control, monitoring and sanctioning system should be top priorities in the Mediterranean. Rebuilding fish stocks and manage them better would benefit fishers, businesses and also improve the livelihoods of coastal communities that depend on the natural yet limited marine resources of this rich sea.

Ernesto Penas Lado – Former Senior adviser, DG MARE

Scientific advice for a future Mediterranean fisheries policy

Abstract

Whereas there is abundant and good scientific advice for fisheries in the Mediterranean, the challenge is to streamline and coordinate it in a way that will effectively serve to provide what fisheries managers need to revamp the joint management of fisheries in the Mediterranean basin. The two key elements for that are: 1) the establishment of clear management priorities by managers; and 2) the reinforcement of the cooperation among scientists in particular in the context of GFCM.

ORAL PRESENTATIONS

SUBTHEME 3.1: IMPROVING KNOWLEDGE ON THE SOCIAL AND ECONOMIC IMPACT OF FISHERIES

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Presentation title

Sustainable Mediterranean fisheries: A socio-economic approach

Abstract

Mediterranean is considered an ecosystem "under siege", due to overfishing and combined anthropogenic pressures such as plastic or marine noise. The question of how to sustainably manage Mediterranean fisheries while meeting United Nations Sustainable Goals (boosting employment, protecting environment, providing safe and healthy food) remains largely unanswered (Tsikliras *et al*, 2015). Existing works studying fisheries' sustainable management are fragmented and treat different aspects in isolation from each other. Scholars have examined performance and sustainability of fishing techniques (Furesi *et al.*, 2016; Lucchetti & Sala, 2012) or viability of small-scale fisheries (Hardy *et al.*, 2016). Other works have made

progress in refining our understanding of fishing communities' self-governance (Dietz, Ostrom, & Stern, 2003). But most scholarly or policy works still underestimate the combined importance of technologies and innovation, governance instruments, and resource demand on fishing (Finkbeiner *et al.*, 2017). Addressing sustainability of Mediterranean fisheries therefore requires a more holistic approach (Fu *et al.*, 2018) while integrating local and regional specificities. Our paper seeks to develop such a comprehensive socio-economic approach. We aim to identify the various elements that play a role in developing an economically, socially and environmentally viable fishing system. To do so, we review the specificities of Mediterranean fisheries relative to: business practices and supply systems, norms and institutions that affect these systems, and the role and organization of other stakeholders (e.g. local communities, final consumers). We then articulate these elements to build an integrative model and to identify levers of action for a more sustainable fishing system.

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Presentation title
SSF seasonality and touristic fishing; a good way to increase incomes without increasing the pressure on fishery resources

Abstract
Increasing the knowledge on small-scale fisheries, their features, seasonality, species associated, the social aspects of fishermen involved in this fishing, the economic constraints, in reflection and consciousness of the difficult state of fishery resources in the Mediterranean, pushes the policymakers and scientists to find other alternatives. The seasonal shifting from conventional fishing to a combined touristic fishing business model in the coastal areas is going to be a challenge and a new reality in some Mediterranean countries. This fishing forms, included in various touristic packages and various itineraries, can increase fishers' incomes, improve their sociality, and moreover decrease the fishery pressure on coastal fishing, thus, protecting and preserving the marine ecosystem and traditional fishing culture of the Mediterranean region.

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Presentation title

Economic impacts of environmental variability on European anchovy fishery in the Mediterranean Sea

Abstract

Small-pelagic fisheries play a pivotal role in the Sicily Channel. Biomass fluctuations have considerable socio-economic impacts on local fishing communities. During the last decades, scientific community has been investigating both biological and hydrographic processes that affect fisheries. Such an interdisciplinary and synergic approach is nowadays giving a fundamental contribution in connecting the dots between environmental parameters (e.g., sea surface temperature, chlorophyll concentration, marine currents) and

biomass variability in small pelagic fish. Here we estimate the economic impact of these biomass fluctuations, in particular, by using results from the analysis of the inter-annual variability that characterizes connectivity between spawning and recruiting areas for the European anchovy (*Engraulis encrasicolus*, Linnaues 1758) in the northern side of the Sicily Channel (Mediterranean Sea). Results show that coastal transport dynamics largely affect biomass recorded in the following years, and thus the economic value of catches. This contribution, due to wind-induced marine currents variability, results to be much larger than the one due to sea surface temperature and chlorophyll-a concentration affecting spawning rates. Our work quantifies the economic impacts of climate variability on the European anchovy fishery and sheds light on the connections between biomass fluctuations and the fishery economy. These results have significant socio-economic implications in a highly dynamic as well as exploited marine environment as the Sicily Channel.

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Presentation title
Assessing human dimension of small-scale fisheries in eleven Mediterranean Marine Protected Areas (MPAs)

Abstract
Small-scale fisheries (SSF) have long played a fundamental role in both the economy and society of the Mediterranean where they employ more than 137 000 fishers, and have considerable cultural and historical significance. However, until recently, SSF have been generally neglected by policy-makers and managers and scarce information is available about SSF livelihoods and communities at the Mediterranean scale. To better understand the human dimensions of SSF, we conducted 148 surveys with small-scale fishers operating within and around 11 Mediterranean Marine Protected Areas (MPAs) in six EU countries. The survey sought to characterize the fishers (in terms of fishers' age, household features, etc.) and to understand their perceptions about governance, management and social impacts of MPAs. Results show that SSF communities are entirely composed of men mainly originating from the same local community (i.e. town/village) where they operate and the age class most represented is 50–60 years old. Fishers generally have families formed by two or four members and fishing represents the only/main source of household incomes. Only 30 percent of fishers declared that fishing allows them to make enough income to have a good quality of life. The majority of fishers perceive MPAs as improving both fish abundance and habitats. More than 50 percent of fishers declared that decision-making in the MPAs were made after consulting with them, and only less than 40 percent were satisfied with MPAs management. We highlight similarities and differences across countries and MPAs. We argue the importance to understand fishers' perception of management to develop future strategies to improve MPAs.

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Presentation title
Socio-economic impact model of the fisheries sector on the coastal zones in Bulgaria

Abstract
In several EU regions, the fisheries sector plays an extremely important role in employment and economic activity - in some coastal European communities, it provides nearly half of the jobs. Small-scale fisheries can be particularly important as a source of employment in remote coastal areas and as a contribution to the local economy. The beginnings of modern fishing in Bulgaria are set in the period between the two World Wars when, in order to encourage the activity, the state creates a law on fisheries. During these years, a fishing school in Varna is being established, which trains fishers for the whole Bulgarian coast. Catches in the Black Sea in 2016 amount to 8 537 tones according to official data, and according to unofficial estimates, which account for unregulated catches, the quantity reaches 10 000 tones. In addition, there are 674 active fish and shellfish farms in Bulgaria. Thanks to the subsidies received under various EU programs, in recent years the level of the fish industry in Bulgaria has increased from the infrastructure, even though it is still far from the world standards. In Bulgaria there are 1903 registered fishing vessels. There are a number of small boat lodges and places to fish, but officially registered fishing ports are only three. The author offers a system of indicators for the complex assessing the socio-economic impact of the fisheries sector on the coastal zones in Bulgaria. The approach could also be implemented

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Presentation title
Investigating underlying dimensions of job satisfaction in small-scale fisheries

Abstract
Job satisfaction is a key aspect in the human dimension of the fisheries. The Non-Economical Social Impact Analysis (NESIA) developed in the 2000s shows that job satisfaction impacts on the fishers' decision-making process including their attitudes and behaviors. In this research we identified the underlying dimensions that affect job satisfaction in small-scale fisheries (SSF). Data were collected from a random sample of 278 Turkish small-scale fishers located along the Aegean coastline. In this research, we modified and employed the statements about job satisfaction scale developed by Pollnac and Poggie, 1988. Factor analysis generated five dimensions including 13 statements that capture the meaning of fisheries satisfaction (Cronbach's Alpha: 0.751; KMO: 0.723; Bartlett's Test of Sphericity: $p < 0.01$; Total Variance Explained: 67.83 percent). Then, a cluster analysis was performed to classify fishers into segments by using factor scores for job satisfaction dimensions derived from factor analysis. Three fishers segments were obtained labeled regarding their profiles: Unsatisfied fishers (28.4 percent), satisfied fishers (20.1 percent), and pleasure seekers (51.5 percent). The knowledge generated by the study can provide insight into policy makers, non-governmental organizations and researchers to improve acceptable, less costly and applicable policy interventions for supporting sustainable fisheries.

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Presentation title
How fishers' communities adapt to new regulations: the Gulf of Cadiz trawl fishery

Abstract
The European Union Regulation 1380/2013 revising the Common Fisheries Policy (CFP) aims at addressing the by-catch and discarding problems in commercial fisheries by implementing the "Landing Obligation" of the regulated species by 2019. To date, in adjacent waters of the Mediterranean Sea, the Gulf of Cadiz landing ports are not ready to compile with this regulation. Along this line, the present study focused on meetings, questionnaires and interviews with stakeholders, fishers and other representatives of the trawling fleet from the main ports in the Gulf of Cadiz. The challenge of this work is to find relevant and efficient management solutions, considering all relevant agents within this fishery, under the discard ban policy. To achieve this goal, we conclude that to improve the current management of this specific fishery and to bring it in line with the requirements of the CFP, economic incentives and the participation of the fishing industry at all stages is of vital importance. Therefore, opportunities and entrepreneur ideas for an efficient use of the discards generated by this fleet are promoted with the aim of contributing to the establishment of social alternative management strategies for this fishery.

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Presentation title
Socio-economic analysis of the Lebanese marine fisheries sector 2011–2016

Abstract
Lebanon's first ever countrywide assessment of the socio-economic situation of its marine fisheries sector indicated that the all-small scale artisanal fleet landed an estimated 4 850 tonnes at a value of 26.98 million USD in 2011. The fishing industry generated a net profit of 6.4 million USD i.e. 24 percent profit, which is comparable to other Mediterranean countries. The income per fisher-owner (7.400 USD) and fisher (3.000 USD) is 20 percent and 70 percent respectively less than the national Gross Domestic Product (GDP) per capita. Furthermore, a fisher earns about 45 percent less than the country minimum wage. Thus, the fishing community in Lebanon is considerably poor. Considering also that most fishers remain without any form of social security (e.g. health & pension), their situation is also of vulnerability. Further surveys for the years 2012, 2015, and 2016 showed that although some fluctuations in gross revenue and number of fishers occurred, yet the income of the fishers did not exceed 3.400 USD in 2016. The Lebanese fisheries are entirely small-scale. The 1 369 vessels of 6 –12 m length overall (LOA) represented the backbone of the fleet (1 962 vessels). Despite the 61 purse seiners landing around 42 percent of total landings, yet the 6-12 m fleet segment generated 70 percent of the revenues in 2016. The average age of the skippers, in 2011, was 48 years and that of the fishers was 35, which are both comparable to other Mediterranean countries. The fishers have a lower educational level than their children, which however is at the minimum educational level as obliged by law.

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Presentation title
Socio-economic values of the MPA in the Moroccan Mediterranean: Reference state for monitoring the impact performance

Abstract
In Morocco, the establishment of Marine Protected Areas (MPAs) is a new management approach used for strengthening traditional fisheries management measures. This approach was proposed in the Mediterranean due to the decline of the main fisheries' resources, both small pelagic and demersal species. This paper discusses the presentation and analysis of the reference state of the Alboran MPA, located to the west of the Moroccan Mediterranean coast since 2013, in relation to socio-economic aspects. The analysis revealed indicators allowing regular monitoring of the impact of the performance of the MPA. These include socio-demographic indicators and economic indicators, including household income sources and fishers' incomes, which remain very positive compared to other artisanal fishers in the region and governance-related indicators such as the acceptability of the MPA and conflicts over resources. Other socio-economic indicators were also analyzed, concerning the ones used for the choice of the area to be protected and those related to the perception of fishers. These include the acceptability of the marine population, the importance of fishing activity and fishery resources, income- generating activities and accessibility. All these indicators were very favorable to the implementation of the MPA. Social and economic considerations and socio-economic analysis are essential for the successful implementation of MPAs. Poor assessment of these aspects may lead to the failure of the implementation

of the MPA, which may also be due to difficulties of its acceptability by local communities. These considerations should be introduced in the implementation of MPAs, from planning, through the choice of the area, the implementation of the MPA to its management. At the global level, it is becoming increasingly rare to create MPAs without incorporating these considerations.

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Presentation title
Fisheries management in the northwestern Mediterranean: the word to stakeholders

Abstract
The heterogeneity of Mediterranean fisheries and the limits of traditional top-down fisheries management have made clear the need for pairing science-based advice with stakeholder consultations, as witnessed by the strengthened focus on stakeholder participation in the new EU Common Fisheries Policy (EU CFP). We developed a questionnaire to gather stakeholder opinions on the state of fisheries in the northwestern Mediterranean, conflicts, role of Marine Protected Areas (MPAs), management objectives and suggested management measures to pursue fisheries sustainability. A total of 189 questionnaires were administered to professional fishers and recreational fishers' representatives, fisheries' authorities, MPA managers, scientists, and NGOs in France, Italy and Spain. More than 50 percent of the stakeholders consider the fisheries state in the region as bad, and that it has worsened in the last ten years. Illegal fishing was the main threat to fisheries according to more than 60 percent of Italian professional fishers, while more than 50 percent of Spanish and French professionals mentioned pollution. Bad fisheries management was considered the second main threat by professional fishers in all countries. Excessive fishing effort was considered the main threat in all countries by the other stakeholders. While most stakeholders agree on MPAs' ecological benefits, they do not believe they reduce illegal fishing and conflicts among users. All stakeholder categories suggested enforcing existing management measures as the most important solution to improve fisheries state, followed by introducing seasonal closures (professional fishers) and reducing fishing effort (recreational fishers). This study provides a starting point to evaluate how MPAs networks and other area-based fisheries management rules can help achieve fisheries ecological and economical sustainability in the northwestern Mediterranean.

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Presentation title

Investing in small-scale fisheries for sustainable development in Europe

Abstract

In this article, we highlight that although major advances have been made towards addressing the global fisheries sustainability crisis, we are still lagging an innovative and holistic approach towards the sustainable development of small- scale fisheries (SSF). The small-scale fisheries profile has been recently elevated to the global agenda with the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines), and to a much lesser extent, in the Sustainable Development Goals (SDG) agenda as part of SDG14b. A comprehensive understanding of the complexity of these systems and how to govern them with the right tools to ensure their sustainability is more critical than ever. Drawing from a philosophy of transcending disciplinary boundaries in knowledge production, integration and synthesis posited in a transdisciplinary perspective, we argue for a proper positioning of the SDG framework with the SSF Guidelines in order to achieve both goals. This means, first and foremost, going beyond focusing only on access to markets and resources for small- scale fisheries (i.e. the SDG Target 14b) to encompass coordination across the entire Sustainable Development Goals such as reduced inequalities, improved livelihoods, smart economic growth, and strong institutions. Such an alignment can help facilitate the implementation of these global instruments in ways that not only optimize human and financial resources required but also result in concerted and sustained efforts for the sustainability of fisheries worldwide. The paper illustrates this proposition using European small-scale fisheries, which are in a good position for an integrated implementation of these instruments.

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Presentation title
Recreational fishing along the middle and eastern Black Sea Turkish coasts: Biological, social, economic aspects

Abstract
This study investigated biological, social and mainly economic dimensions of recreational fishing in eight coastal middle and eastern Black Sea provinces of Turkey. In all provinces, a total number of 874 shore-based recreational fishers were interviewed via on-site face-to-face interviews during the fishing activity or at access points being monthly from January to December in 2015. Market value with recreational fishing index of added value approaches were used to calculate economic gains and losses from recreational fishing. The consistency was observed with the high education levels, high expense and high market value for fishers in the middle Black Sea provinces: Kastamonu, Samsun, Sinop and Ordu. In all provinces, the harvesting costs stayed far below the average market prices of target species. Also, positive values of the recreational fishing index were observed in all provinces. The species catch composition in western and eastern provinces did not showed great differences. Furthermore, even if the habitat type along the Black Sea coast of Turkey does not show great variations, in the western provinces some certain species including *Trachurus trachurus, Sarda sarda, Belone belone, Pomatomus saltatrix, Mugil cephalus* were caught in higher amounts. To summarize, recreational fishing along the Black Sea coasts of Turkey is an industry creating high economic returns by expenditures, jobs, catch value and further increased indirect economic impact in services sector.

SUBTHEME 3.2: MAPPING VALUE CHAINS

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Presentation title
Beyond certification: Information-based tools as sustainability indicators in Slovenian fisheries markets

Abstract
The value chains are increasingly recognized as a significant site of greater fisheries sustainability. Understanding them consists not only of a thorough mapping, but also of an appreciation of their context and dynamic evolution. This paper will examine the market for fish products in Slovenia, specifically with the view to highlighting the use of information-based instruments in fisheries governance. In the literature, third-party certification (notably, the Marine Stewardship Council [MSC]) is most often (if not exclusively) presented as a promising market-based governance tool. However, the MSC has a very variable penetration outside certain developed countries. Specifically in Slovenia, its spread and recognition are low. This urges us to comprehend the demand for sustainability in other ways. Against this background, this paper will first explore the elements that work as proxies for information on the sustainability of fish products in the local market. Their use will be situated in the overall demand for the sustainability of seafood and agri-food products more broadly. Secondly, this paper will consider the potential of these sustainability-flagging mechanisms to act as governance tools in influencing supply chains. One specific factor to explore is the common reliance on the "local" provenience of fish products. The value of equaling "local" provenience with sustainability will be considered in the context of the presence and practices of small- scale fisheries in the northern Adriatic Sea. Finally, based on the findings, ways of enhancing the sustainability of fisheries supply chains will be outlined, at the intersection of locally meaningful indicators and transnational certification schemes, such as the MSC.

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Presentation title

Designing marine fishing opportunities to support onshore value chains certification: Information-based tools as sustainability indicators in Slovenian fisheries markets

Abstract

Despite the clear dependencies between the catching and selling sides of fisheries, there is often a separation between the management of marine fisheries and the promotion of onshore value chains. This presentation will explore how the management of marine fishing opportunities could be designed differently if resilient and profitable value chains were instead taken as a key policy objective. Issues explored include the sustainability of fish stocks and how that relates to the stability and value of supply, systems of fishing opportunities (e.g. quota, effort, spatial management) across the same outcomes, market impacts from eco-labelling fisheries, restrictions on landings to countries or regions in order to support particular coastal communities, market power in the ownership of fishing opportunities and the capture of resource rent in the value chain, and the role of fish processing in diversifying products and markets to build resiliency. Welsh fisheries are used as a case study in the context of planning for changes in the management of fishing opportunities and change in the trade regime post-Brexit.

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Presentation title
Making better value from catches in the EU: outcomes from the SUCCESS project

Abstract
In general, the seafood sector in highly globalized, with about 78 percent of seafood products estimated to be exposed to international trade and international exports reaching around 148 billion USD in 2014 (FAO, 2016). In this context, domestic EU products are competing in the market with imported products from all over the world, pushing down ex-vessel prices. While such a situation can be beneficial to EU (intermediate and final) consumers and third countries' exporters, it could also challenge the profitability of some EU producers. A potential answer from the EU producers could consist in differentiating their products through the development of alternative value chains. This paper presents some of the initiatives identified during the H2020 three-year European project SUCCESS (http://www.success-h2020.eu/): origin and quality labels; institutional innovations to create a market-oriented management system; innovative organization of sales to promote the origin and freshness of the product; technical innovations to increase the freshness of the products.

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Presentation title

Evaluating ecological and economic effects of landing obligation with an ecosystem model

Abstract

In order to reduce the discarding practices, the reformed Common Fisheries Policy (CFP) (Regulation (EU) 1380/2013), introduced the obligation to land unwanted catches gradually from 2015 to 2019. In areas where fisheries are managed through quota system, this is seen as a positive measure, but in the Mediterranean and Black Sea the regulation's implementation is controversial and its effectiveness doubtful. An ecosystem model for the northeastern Adriatic Sea is used to quantify the long-term ecological and socio-economic consequences of this regulation. An Ecopath with Ecosim model was calibrated to make available time series using different fitting strategies, thus producing an ensemble of models. The analysis of accuracy and precision revealed sufficient model's performances in representing past time series (hindcast) and identified the confidence interval of model simulations, i.e., of management scenarios. The results of the simulated application of the landing obligation

indicate landings will increase (+13 percent), causing an increase in fishers workload, reduction of biomasses at sea (-0.20 percent), thus a decrease in fisheries revenue (-0.50 percent). Economic losses will not be compensated even by selling landed unwanted catches for fishmeal production. Additional adaptation scenarios were tested: i) introduction of quotas for small pelagics, ii) reduction of effort for bottom trawlers, iii) improvement of gear selectivity and iv) a combination of i) and iii). Improving selectivity and introducing quotas revealed to be the best alternative but none of the adaptation scenarios compensated the adverse effects of landing obligation, suggesting that landing obligation has negative ecological and economic effects when fisheries are not regulated by quotas.

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Presentation title
Optimizing effort allocation in data-poor mixed fisheries

Abstract
Management of mixed fisheries requires reconciling many different and often conflicting objectives (satisfying single species targets, ensuring economic viability, etc.) and achieving optimum exploitation levels for all target stocks is usually not feasible due to conflicting effort requirements. Management advice is even trickier when different fleet segments are involved in mixed fisheries exploiting the same stocks. In such cases, reallocation of effort between fleets to optimize the biological and socio-economic outcome of the fishery is a challenging task. Existing tools for effort allocation, such as Fcube and FcubEcon require extensive data on effort and catchability. We present an effort allocation scheme that overcomes the need for such data by using effort multipliers instead of absolute effort values. The scheme applies to data-poor fisheries for which no analytical age-structured assessment is possible. Maximization of the total revenue is considered the overall management goal, which can be constrained by single species biological targets and other economic or social requirements. The method is applied to the demersal fishery of the Aegean Sea, where two fleet segments, coastal vessels and trawlers, exploit numerous commercial species. The model demonstrates that optimum exploitation of target stocks or maximization of total landings does not necessarily correspond to maximization of revenue. We found that for the fishery to be in line with the MSY principles the total effort has to be reduced by at least 30 percent, while the most economically profitable allocation corresponds to 30 percent and 13 percent reduction of the trawler and coastal fleet efforts respectively.

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Presentation title

Developing innovative and participatory strategies for the sustainable exploitation of French bluefin tuna fisheries

Abstract

The bluefin tuna fisheries in the Mediterranean Sea is an ancestral activity, dating back to several thousand years BC. On the coasts of the French Mediterranean Sea, bluefin tuna fishery is widely documented. Captured traditionally with small purse seiners, nets or hooks, the bluefin tuna fishery has undergone many changes, as a result of many environmental, regulatory and societal challenges. Today, two fleets coexist, purse seiners in the aggregative zones (Balearic Islands, and Malta) and hook fisheries (longline or hand line) in the Gulf of Lion. Through a presentation of the evolution of fishing techniques, regulations and markets, we will analyze the characteristics of this fishery and we will explain how in less than ten years, this species "flagship" for non-governmental organizations has passed from "endangered" status to a status emblematic of sustainable management. Finally, we will discuss

the future of this fishery through innovative initiatives led by professional fishers in partnership with scientists to meet the challenges of selectivity and conservation. We will develop our proposal through the results of two scientific projects carried out over the past five years and valued within the professional sector through modern technological tools, in order to enable the acquisition of data, the development of good practices, the reduction of bycatches, and the establishment of official quality signs to certify and manage this species in the long-term basis.

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Presentation title
Edible jellyfish in EU: new opportunities for local fishery

Abstract

Fishery, market and consumption of edible jellyfish are spread in Southeast Asia and currently established in America where they are still limited by the lack of market demand. Globalization of food markets and the recent upgrade of the European regulation on novel foods (EC 2015/2283) opened new possibilities to the introduction of edible jellyfish in the European diet. Considering jellyfish as a new food resource instead of waste is in line with principles of sustainable food systems. Although the tradition of eating jellyfish is still absent in Europe, our recent studies showed that several Mediterranean jellyfish species have biologic and nutritional features with a large potential as innovative novel food and bioactive compound source. New opportunities for expanding jellyfish uses in EU countries depend on the development of new processing technologies and an internal market demand, which is in turn influenced by the scientific studies on jellyfish raw material, and on its public acceptance and appeal as innovative food. With GOJELLY EU H2020 project n. 774499 we are exploring different approaches dealing with microbiological and food safety issues, sensory analysis as well as food design and functional food features of some Mediterranean jellyfish treated by western-style food-processing as alternative to the traditional Asiatic treatment. Jellyfish collagen and other proteinaceous and non-proteinaceous bioactive compounds are investigated for their putative health promoting features.

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Presentation title

The potential of the invasive ctenophore *Mnemiopsis leidyi* as a source of protein in fish feed

Abstract

Farmed fish production has outpaced wild capture fisheries in seafood destined for human consumption and aquaculture now supplies around half of the fish consumed directly by humans. The rapid growth of aquaculture has led to an increasing demand for fishmeal and fish oil, and consequently, a gradual substitution for fish-based protein in feed is needed. Recently, there is an increasing interest in using jellyfish as alternative feed in aquaculture. Jellyfish blooms have increased in frequency and extension in coastal waters worldwide, and large biomass has been removed from the locations where they are interfering with economically important sectors. In this regard, we investigated the potential of the highly invasive jellyfish, *Mnemiopsis leidyi* as a source for protein in feed for fish in aquaculture. *M. leidyi*, has proven to be a highly successful invader and listed among the 100 worst invasive alien species worldwide. The most notorious example is its introduction into the Black Sea in the 1980s that had catastrophic consequences for the pelagic fish populations, leading to large economic losses for the fishing industry. Based on the elemental (C, N and P) analysis, total protein and lipid content, and fatty acid profiles, we evaluated the potential of utilizing this protein-rich gelatinous biomass as food in sustainable culturing of the European bass (*Dicentrarchus labrax*).

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Presentation title
Transparency in the traceability of valued fish product for sustainability standards

Abstract
Fisheries industries have significantly contributed to the socio-economic status at all levels in the world. These opportunities are attributed to the abundance of valued fisheries products from aquatic environment and farmed fish products with associated chains. Most of the fisheries practices in the world are unsustainable due to uncoordinated traceability systems, which rise doubts as to the transparency level of fish products. Transparency and adequate traceability mechanisms are essential for resources management and the conservation of aquatic resources including green consumption (noted to be major requisites of the recent Sustainable Development Goals [SDGs] aimed to be transformed in 2030). Sustainability appreciably recognizes traceability in the life cycle of fish products with labels and highly coordinated and sustainable certification process. This study evaluates the transparency in both value and supply chains in the fisheries industry, adopting the portal value chain analysis and the World Wide Fund for Nature (WWF) principles of traceability. In addition, the study identifies the various challenges in the transparency of the chains and issues affecting the traceability of fish products, which therefore suggests various sustainable solutions for transparency analysis of fish for both developing and developed countries.

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Presentation title
Counting recreational fishing vessels from space in the Aegean Sea (eastern Mediterranean Sea)

Abstract

In the Mediterranean Sea, recreational fishing is part of the local culture and has been practiced for centuries using various techniques and gears. Yet, recreational fishing effort and catches are not officially recorded in most Mediterranean countries, Greece included. The objective of this work was to estimate the number of vessels fishing for recreational purposes in the Aegean Sea (Greece) using two independent sources of data. Firstly, we physically visited 42 ports and marinas across the Greek Aegean Sea coastline and counted the recreational vessels. Secondly, we used satellite image frames (from Google Earth) to count the recreational vessels at the same time and in addition 400 ports and marinas of the entire Aegean Sea coastline, including the inhabited islands. The agreement between the *in situ* visits and the satellite data was very high (correlation coefficient r = 0.92, P < 0.001), indicating that Google Earth is a valuable and low cost tool that provides useful information for fisheries management. According to the satellite data, the total number of recreational fishing vessels in the 442 ports of the Aegean Sea was 24 200. Although the number of vessels was rather balanced between northern and southern Aegean Sea, most vessels were recorded near large cities, where the majority of inhabitants are concentrated and in islands, where the majority of tourists spend their time.

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Presentation title

Creating value in supply chains and markets for small-scale fisheries engaged in sustainability initiatives

Abstract

Small-scale fisheries (SSF) often experience difficulty in gaining access to formal markets, or deriving benefits from the globalization of supply chains and trade. SSF face a number of common challenges, including a lack of organization, a disadvantage in terms of economy of scale which may limit access to value-adding opportunities, the inability to meet stringent traceability or quality standards for export, and a data deficiency around stock status and harvesting rates that could limit their potential to gain certification, or ability to track improvements towards sustainability. These factors can make SSF less competitive in a global market and can ultimately threaten their long-term environmental, social, and economic sustainability. Potential mechanisms for overcoming these challenges include market-based mechanisms such as certification schemes, Fishery Improvement Projects (FIPs) working towards certification, the formation of cooperatives or community-supported fishery programs, and the adoption of digital tools for data gathering and traceability. All these initiatives have the common aim of creating value in the supply chains and markets for SSF. Value creation occurs when drivers enable one product to be distinguished from a similar one in the marketplace, therefore gaining a competitive advantage to satisfy specific market demands. Benefits derived from such value creation could include improved marketability, higher income, or more equitable distribution of benefits. This oral presentation will show how governance arrangements or sustainability initiatives such as the Marine Stewardship Council (MSC) certification, the participation in FIPs, the formation of cooperatives, the adoption of digital tools, and a growing interest in product provenance and storytelling may contribute to value creation for SSF.

Author

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Presentation title

Protecting markets in combatting illegal, unreported and unregulated fishing

Abstract

The persistence of illegal, unreported and unregulated (IUU) fishing is a key impediment to sustainable ocean economy and the need for strong policies and international co-operation to tackle this problem is increasingly acknowledged. To complement the monitoring effort led by the FAO in relation to SDG 14, the Organisation for Economic Co-operation and Development (OECD) is working on a methodology for setting-up a long-term mechanism for monitoring progress in the implementation of recognized best policies and practices to deter IUU fishing by its member countries and cooperating economies, including a number of GFCM countries. The analysis is based on six policy indicators reflecting the most important areas of governmental intervention in relation to IUU fishing. State responsibility indicators assess country's regulatory activity as a flag state (regulating domestically-flagged fishing vessels in the areas beyond national jurisdiction), coastal state (regulating vessels in the domestic exclusive economic zone), port state (applying port controls and regulating flow of products to the market) and market state (creating economic disincentives for IUU fishing and using market tools to detect illegal seafood moving along the value chain). International co-operation indicator assesses the scope of international cooperation against IUU fishing, mostly through Regional fisheries management organizations (RFMOs). Enforcement indicator assesses the capacity of the monitoring, controls and surveillance schemes, national interagency co-operation practices, as well as the comprehensiveness of the sanctioning systems in place. Indicators, built based on communication with over thirty countries, reflect the efforts made throughout the last decade and point areas needing attention in order to resolve the issue of IUU fishing globally.

SUBTHEME 3.3: MARINE TECHNOLOGY PROMOTING ECONOMIC AND ENVIRONMENTAL SUSTAINABILITY OF FISHERIES

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Presentation title
Implementing operational fisheries oceanography in the Mediterranean

Abstract

During the last decades, the study of the response of fish populations to environmental variability has been a main interest of fisheries ecology, aiming at supporting sustainable harvesting strategies of marine living resources. These studies underlined the potential of mesoscale oceanography to improve the calculation of fish abundance indices and recruitment scenarios or to implement dynamic spatial management approaches. At the same time, operational oceanography has been advancing fast, propelled by the implementation of new multi-platform observing systems and the improvement of data quality, quantity and accessibility. Nevertheless, the initiatives directed to facilitate and promote the systematic integration of operational oceanography into the current fisheries management are scarce. Linking operational oceanography with fisheries science indeed offers a new path for improving fisheries assessment and management, but in order to achieve this objective a number of gaps and challenges have to be resolved. Here we identify successful study cases implementing a practical "operational fisheries oceanography", analyze the state of the art, and identify the gaps to be resolved. We also discuss a roadmap towards the integration of these two disciplines (fisheries ecology and operational oceanography) in the Mediterranean Sea by aligning the developmental strategies of the fisheries management bodies and the ocean observing systems.

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Presentation title
The impact of endocrine disruption on fish reproduction: biomarkers of reprotoxicity

Abstract
The marine environment is exposed to various and complex forms of pollution from both industrial and urban effluents. The molecules generated are susceptible to alter the physiology and the reproduction of marine organisms. Endocrine disruption by xenobiotics has firstly been described in wildlife. At highly polluted sites, correlations between effects on reproduction and development and exposure to endocrine disrupting chemicals (EDCs) have been described for varied fish species. Of particular importance are EDCs that mimic estrogens and androgens (and their antagonists), because of their central role in the reproductive function. Estrogens are substances both natural and synthetic that mimic the effect of the female estrogenic hormone in the body and impart estrogenic activity. Observable and measurable effects such as early maturity, reproduction disruption, intersexuality, vitellogenin induction in male fishes, have been reported by several authors. Researchers are now validating different monitoring tools called reprotoxicity biomarkers that could be used as early warning systems detecting pollution impact at very low levels. These biomarkers are measurable parameters at different organizational levels: molecule, cell, organ, and organism biological organization, molecular, cellular or physiological. They traduce changes in the metabolic regulatory processes resulting from the effect of anthropogenic stressors. Their relevance is based on the facts that are early warning systems detecting pollution impact at very low concentrations and avoiding any damage for the organism and for the community. In this presentation different results from *in situ* and *in vivo* studies will be presented. The usefulness of these predictive tools for an environmental sustainability of fisheries will be discussed.

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Presentation title

General evaluation of the monitoring and control by satellite technology in the Mediterranean Sea

Abstract

The study presents a general evaluation of the monitoring, control and surveillance (MCS) using satellite technology. This technology was applied to the whole Mediterranean as a preliminary study in order to achieve a global state of the maritime traffic and the presence of fishing vessels from April 1 2015 to April 1 2016. In addition, taking into account the trawler closed area and the Marine Protected Areas (MPAs), an example of a case study in the Alboran Island was chosen to specifically analyze the level of compliance of the fishing rules in one restricted area. Furthermore, a different technology for artisanal fisheries and other fleets can be applied, since this fleet does not have satellite technology on its ships. The results have been compared with several management scenarios previously analyzed. The results highlighted that the MCS applied in the Mediterranean and the Alboran MPA shows an example of the level of compliance in the area, as well as the pressure of maritime traffic in the Mediterranean Sea.

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Presentation title
Using AIS data for a risk-based approach to support Port State Measures Agreement (PSMA)

Abstract
The United Nations Food and Agriculture Organization Port State Measures Agreement (PSMA) is an international agreement that attempts to standardize port inspections across all coastal countries globally. The agreement is designed to close off the opportunities for illegal, unreported and unregulated (IUU) fishing vessels to land catches and obtain supplies. However, with thousands of vessels at sea, limited information on their activities, and scarce resources to support inspections, identifying priority vessels for inspections is a key need to support the implementation of PSMA. One tool for identifying key vessels is to use a risk-based approach, identifying factors that together suggest a vessel is high risk for IUU fishing. We present a comprehensive risk framework which uses data categories that fisheries inspectors and maritime surveillance professionals consider key to identifying suspicious vessels, including ownership/crew history, anomalous vessel movements, tampering of AIS, rendezvous and cargo. Underlying risk indicators are statistical models. These risk indicators are used to rank a vessel against all other vessels in a given region, for risk of anomalous behaviour, providing a risk score on each indicator, and cumulatively across all indicators. This risk-based approach will provide key support to prioritizing inspections and investigations, and effectively implementing PSMA.

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Presentation title

New approaches in utilizing data and technology to combat IUU

Abstract

The challenge to maintain the sustainability of fisheries from a particular fish stock depends on a number of components that need to be applied concurrently. One of those components is to monitor as accurately as possible the utilization of the stock (the catch). Illegal, unreported and unregulated (IUU) fisheries may have a major impact on the accuracy of the measured catch. In this presentation, some ideas will be discussed on how data from vessel monitoring system (VMS), port State measures (PSM) systems, catch reporting, IUU lists and other available data streams can be combined to calculate, with the aid of artificial intelligence, an IUU-risk factor for vessels and how FLUX can play a role. This approach relies on new and existing technology, aiming at combating IUU.

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Presentation title

Preliminary results of the first video-based ecological monitoring in the Croatian Natura 2000 coastal site

Abstract

Legally prescribed ecological data monitoring has not been established at most of marine Natura 2000 areas in Croatia, and therefore legislation of ecosystems management and protection is not completely fulfilled. For the first time, to the best of our knowledge, a coastal time-lapse imaging survey has been carried out targeting the Šibenik coastal fish community (off Krka River, 5 m depth). Temperature and salinity data were collected concomitantly, both parameters being relevant to fish presence and abundance. One image per hour was collected during daytime continuously from January to March 2018, such collection is still being continued today. A total of 7 311 time-lapse images were analyzed for species classification and

animal counting (epibenthic invertebrates included). Forty-one taxa were detected with fish prevalence, 70.73 percent of all recorded species. The rest being echinoderms (12.25 percent), cephalopods (7.3 percent), crustaceans (2.43 percent), anthozoans (2.43 percent), reptilians (2.43 percent) and birds (2.43 percent). Relevant observations were made of flagship species such as bluefin tuna, *Thunnus thynnus* (Linnaeus, 1758) and loggerhead sea turtle, *Caretta caretta* (Linnaeus, 1758). The latter was observed in both hibernation and swimming modes. Species richness, calculation of biodiversity, and degree of coverage of benthic invertebrates were also obtained as proof of concept of the validity of such coastal monitoring actions for large and growing EU infrastructural assets such as the Expandable Seafloor Observatory (OBSEA) and the European Multidisciplinary Seafloor and water column Observatory (EMSO) testing sites. Our data support the need for permanent video-based technical development of the European Strategy Forum on Research Infrastructures (ESFRI) to increment its social projection.

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Presentation title
GIS-aided spatial analysis of biomass distribution and catch per unit area of commercially important fish species in the Bulgarian Black Sea

Abstract
Quantitative data from performed scientific trawling on total biomass and catch per unit area for several commercially important fish species (e.g., sprat, horse mackerel, red mullet) at given locations in the territorial sea of Bulgaria were provided as Excel tables with accompanying geographic coordinates. These were integrated in a geographic information system (GIS) and exported as point data with attribute records on geographic location (projected coordinates in WGS 1983 UTM Zone 35 North), total biomass and catch per unit area of target species. Subsequently, the point data were extrapolated into equally-spaced ESRI grid raster files with a cell size of 50 m using the interpolate to raster tool: inverse distance weighted technique in ArcGIS Desktop 10.1. The seasonal distribution of researched species were presented and analyzed. The present paper sheds light on the importance of using geographic information systems in fisheries management and planning.

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Presentation title

OBSERVA.FISH: Autonomous observing systems in fishing vessels for the support of marine ecosystem management

Abstract

OBSERVA.FISH aims to develop a totally autonomous system (no human action), integrating several new parameters (meteorological and oceanographic), to install onboard of all types of fishing vessels (trawlers, purse seiners, longliners). This observation system should allow high-resolution *in situ* monitoring and spatial coverage of the ocean and coastal areas. The use of fishing vessels is one way to make long-term scientific measurements sustainable since fishing vessels ply coastal seas at all times of the year and in almost all weather conditions. The operational environment tests will be carried out on several IPMA's research vessels and it is proposed that the system achieves a TRL 7 to install on the fishing fleet for collecting data with large space coverage and high time resolution, difficult to obtain with other observing platforms.

The data collected operationally will be validated and integrated into a wider observational programme that includes other *in situ* platforms, satellites and models. The analysis will support the development of new products for more safe and efficient maritime operations, to support fishing activities and an integrated management of marine ecosystems.

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Presentation title

SEAGrid: a transparent and participatory tool for marine spatial planning (MSP)

Abstract

Sustainable management of coastal and marine areas is a complex process that is increasingly requiring practical tools to effectively support a coordinated development of socio-economic activities while preserving the environment. In this context, SEAGrid is a decision support tool designed, in compliance with the latest available web-based geographic information system (GIS) technologies, to advice marine spatial planning (MSP) activities. It allows decision makers to make spatial transparent and participatory choices that strike a balance between multiple ecological, economic and social objectives derived from the integrated involvement of stakeholders. The tool is based on a stepwise methodological approach to integrate interdisciplinary data, perform scenario analysis, quantifying the overlapping of sea uses and the related spatial

conflicts (i.e. generation of matrices of interactions, calculation and geospatial visualization of spatial conflict scores etc.), and produce environmental suitability and social acceptance maps as well as economic evaluation. In this presentation, the potential of SEAGrid for sustainable management of coastal areas will be shown performing different scenario analysis and testing the effects of alternative spatial management plans.

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Presentation title

Detecting fish aggregating devices (FADs) and estimating use patterns from vessel tracking data in small-scale fisheries

Abstract

Fish aggregating devices (FADs) remain a challenge for effective fisheries management. Higher fishing efficiency and catch mean that FADs are widely used, not only by commercial operators but also by artisanal fishers. Fishers tend to avoid disclosing the number and locations of their FADs, making them difficult to monitor. Moreover, since FADs have a finite life, continuous and spatially spread deployment further complicate monitoring. Detecting the location of FADs is essential for management as well as for law enforcement. To address this challenge, 34 tracking devices were attached to small-scale fishing vessels in Indonesia over a month period each. Cluster analysis was performed on this tracking data to find the fishing grounds and determine whether FADs were being used. Interviews with fishers were also used to validate the findings. We found 48 FADs and 28 of them matched locations indicated by fishers. Several FADs were also illegally located less than ten nautical miles distance from each other. Since FADs are often owned by communities, sharing of FADs is a common practice. FADs are often visited consecutively by different fishers without waiting for fish to reaggregate. Furthermore, even though FADs can reduce the overall time spend on the sea, some vessels spend several weeks fishing on one FAD. Our results provide an example of the value of a voluntary vessel tracking program, implemented in cooperation with small-scale operators to both understand the operation of a fishery and identify key management challenges.

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Presentation title

Developing statistically-based risk assessment tools for illegal, unregulated and unreported (IUU) fishing using vessel monitoring system (VMS) data

Abstract

Illegal, unregulated and unreported (IUU) fishing is a global issue, with priority both in the GFCM region and elsewhere. Tools such as vessel monitoring systems (VMS) can provide detailed information on the activities of operators and their potential violations. However, identifying patterns of interest is often subtle and difficult to automate, requiring significant inputs by human observers. The Commonwealth Scientific and Industrial Research Organization (CSIRO) has been leading a project to develop tools for estimating a range of behaviors of interest, including transshipment, use of fish aggregating devices (FAD), and unauthorized landings, from VMS data. These analyses take a risk-based approach, assuming that the goal is to identify high-risk vessels and contexts, even where the behaviours of interest are not directly observable. These tools are implemented in the R statistical language, and are being released in an open-source form for other users.

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Presentation title
Using helicopters smartphones and Facebook to quantify recreational fishing in Israel

Abstract
Recreational fisheries are common around the Mediterranean Sea using various methods such as spears or rods. In this sector, fishers are independent of market fluctuations and are scattered both temporally and spatially. This variation makes it very difficult to determine fishing pressure and annual yields for this fishing sector. In Israel, the number of fishers earning their living from fishing is decreasing rapidly. However, recreational fishers are increasing in numbers. Due to this sharp increase in the amount of fishers, the fisheries and aquaculture department together with the national park authority and the Tel-Aviv University have initiated an extensive survey, designed to document and quantify recreational fishing patterns around Israel. We quantified this fishing sector using complementary strategies: i) surveys conducted by a helicopter; ii) ground surveyors working in teams along the Israeli coast, performing interviews with local fishers; iii) data collection from fishers social networks; and iv) personal communications via phone interviews. The data collected contain biomass and abundance of the catch to the species level. Importantly, we have also created a platform for the fisher's community to provide information to governmental authorities, built on trust and the mutual interest to support healthy fish populations. To integrate the different sources of data, we used various methods including general additive models (GAMs) to quantify the annual yield of this fishery, and to understand its spatiotemporal dynamics. The results will be used to evaluate fishers' preferences and their ecological impact, which will be used for creating better management plans.

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Presentation title

EMODnet Black Sea checkpoint: Framework for quality assessing fisheries management and impact data sets

Abstract

The EMODnet Black Sea checkpoint project aimed to qualitatively assess and extract the synergies between and identify the gaps of the present monitoring data sets for the entire Black Sea in view of eleven applications or "challenges", two of which focused on fisheries, namely Challenge 6 - Fishery Management and Challenge 7 - Fishery Impact. The object of the fisheries management challenge was to construct the Black Sea fishery data sets and information for the EMODnet Black Sea checkpoint portal. Specifically, the objective was to deliver tables of mass and number of landings of fish by species and year and mass and number of discards and bycatch of fish species and year using as long as possible time series. The final aim was to provide over the years an overall picture of the trends of landings, discards and bycatch by species. The resulting products (excel spreadsheets) and the data quality assessment are available online on the EMODnet Black Sea checkpoint portal: http://emodnet-blacksea. eu/portfolio/fishery-management/. The fishery impact challenge compiled vessel monitoring system (VMS) information and scientific publications, grey literature and data sets from studies on the spatial distribution of the trawler fishing effort, in

order to evaluate changes in level of disturbance on the sea floor. Specifically, the objective was to deliver a set of data represented on maps showing the extent of the trawling fishing areas in order to identify the areas more disturbed by bottom trawling and damage to sea floor to both living and non-living components. Similarly, the resulting products (GIS maps) and the data quality assessment are available online on the EMODnet Black Sea checkpoint portal for the fisheries impact challenge: http://emodnet-blacksea.eu/portfolio/fishery-impacts/

POSTER PRESENTATIONS

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Poster title
Quantifying ecosystem impacts and economic profitability of fisheries in the Strait of Sicily

Abstract

Fishing activities have several effects on marine ecosystems that go beyond induced mortality rates for single species. Disentangling the effects of mixed fisheries therefore, requires sketching a description of ecosystems using tools that can quantify direct and indirect effects. With this as a main objective, a food web model was developed for the Northern Strait of Sicily. Although in the area several fish species are exploited by one of the largest Mediterranean demersal fisheries, a study of the interactions driven by mixed fisheries on the marine food web and related bio-economic aspects is still lacking. The food web model reconstructs the Northern Strait of Sicily food web in the mid-2000s through 69 living functional groups. The fishery consisted of 18 fleet segments resulting from a combination of 13 *métiers* and three fishing vessel sizes. The model was developed using the Ecopath with Ecosim (EwE) software package. The results showed important indirect interactions among ecosystem components mediated by the food web that cannot be inferred by direct measures. Moreover, considering direct and indirect effects, it was possible to rank the fleet segments by their negative impact on groups of species, and considering the profitability of fleets it was possible to scale ecological impacts against economic profitability. Trawling has the higher profits but also the largest negative impact on the marine ecosystem even on non-target species (discarded bony fish and selachians). Remaining segments have shown a large range of profits against variable impacts suggesting a spectra of solutions for management in the area.

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Poster title
Monitoring of fisheries activity in the southern lagoon of Tunis

Abstract
The southern Lagoon of Tunis is a coastal Mediterranean lagoon located in the southwest of the Gulf of Tunis. Given that the fisheries activities are not officially reported, we have monitored the fishing effort in the lagoon, we followed the installation of fishing gear by a global positioning system (GPS) and monthly surveys of fishers and experimental fisheries have been carried out. The ichthyofauna is mainly represented by several species of fish such as Mugilidae, Sparidae, Soleidae and Gobidae. We have recorded that the common cuttlefish (*Sepia officinalis*) accounts for 70 percent of all catches during the specific fishing seasonal campaigns (December 2015-November 2016). Among the fish species caught in the lagoon, there is the European eel (*Anguilla anguilla*) which is currently the most important species targeted by fishers from the southern lagoon of Tunis, not only for their commercial value but also for their high demand. The exploitation of eels in the southern lagoon of Tunis is primarily by the fixed fisheries, called verves installed in the east sector. The present work contains also an analysis and evaluation of the socio-economic situation of fishers working in the lagoon through a survey followed by interpretation. Observation of the fisheries activities during the monitoring period showed very significant improvements by referring to the history of the lagoon. These improvements are confirmed by the emergence of marine-affinity species, we note in this work that the areas targeted by the fishers are located mainly at the level of the central and the southeast zone of the lagoon. The improvement of the economic value of the southern lagoon of Tunis after the restoration project is reflected by a notable increase of fishing activities.

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Poster title

Local Ecological Knowledge (LEK) as a support for *Octopus vulgaris* fisheries management

Abstract

Fishers' Local Ecological Knowledge (LEK), when documented, may play an important role in documenting fishing practices, enhancing the understanding of ecological changes and scientific data. Furthermore, through targeted questions, researchers and managers can get information on several social and economic features of fisheries and their value for the local communities, contributing to create improved management plans. We developed a questionnaire to gather LEK information, from fishing activities and species' ecology to fishers'

perception on fisheries management and impacts. The survey, carried out in 2017, focused on *Octopus vulgaris* fishery involving three fishing communities: Komiža (Croatia), Patti (Sicily, Italy) and Palamós (Catalonia, Spain), resulting in a total of 47 interviews. In these areas *Octopus vulgaris* was targeted in multispecific and multigear fisheries, with clear seasonal patterns. *O. vulgaris* was never the single target species, and its relevance for fishers decreased from Palamós to Patti and Komiža communities. In all areas, fishers reported a decline in octopus catches. In particular, they pointed to recreational and illegal fishing as the worst source of impact, affecting the stock and determining economic losses. According to fishers' perception, the impact of this activity seems to be higher than marine pollution, requiring an increase in controls by the Authorities. The majority of fishers considers to be duly involved in setting the rules and management processes, though there is the need to increase collaboration with researchers and policy makers to fully implement co-management that shall result in more effective measures at local level.

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Poster title

Fisheries monitoring indictors: socio-economic status

Abstract

The Common Fisheries Policy (CFP) aims to ensure that fishing and aquaculture are environmentally, economically and socially sustainable and that they provide a source of healthy food for European Union (EU) citizens. While the use of biological indicators in the development of fisheries assessments and management plans has been standard practice in most countries for many years, relatively little attention has been paid to the development of economic and social indicators that serve to assess progress on other aspects of sustainable development. The Scientific Technical and Economic Committee for Fisheries (STECF) Annual Economic Report (AER) on the EU fishing fleet provides a comprehensive overview of the latest information available on the structure and socio-economic performance of EU Member States (MS) fishing fleets, based on data collected under the EU Data Collection Framework (DCF). The AER has become the reference document and source of economic and social data and indicators for scientific advice on the performance of the EU fleets, providing insight into the drivers behind recent trends in profitability. The main aim of the annual exercise is to contribute to the improvement in the measurement of economic and social dimensions of sustainable development of fisheries at the EU level, and where possible, relate these to the resource and environmental dimensions. These indicators are used to support impact assessments of management plans; the balance between fleet capacity and fishing opportunities; development and monitoring of measures under the European Maritime and Fisheries Fund (EMFF), amongst others.

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Poster title
Application of information and communication technologies for economic and environmental sustainability of fisheries

Abstract
Marine and inland fisheries are the fastest developing sectors in the world and there is an increasing need for appropriate governance through information and communication technologies (ICTs) for its sustainable development in the Indo-Pacific region. A lack of information and communication facilities in fishing communities inhibits the social, political and economic empowerment of the majority of the population. Information and communication technologies have been playing a significant role in all aquaculture communities across the world since the dawn of civilization. ICTs are crucial for the development of marine and inland aquaculture in our Indo-Pacific region. This presentation deals with the role of information and communication technologies in the governance of the fisheries sector. It aims at discussing the new ICTs which are being used across the globe in the fisheries sector for resource assessment, capture or culture, processing and commercialization. Some presentations will be based on specialist applications of ICTs in the fisheries sector for the sustainable exploitation of marine and inland fishery resources. This presentation intends to bring together the planners, managers, researchers and community workers functioning on interdisciplinary as well as multidisciplinary issues involved in conclave of fisheries management, coastal and estuarine resources planning, coastal risk and vulnerability, social-ecological vulnerability and resilience in coastal region, human pressures on coastal environments, land water-sea water interactions, economic issues and challenges related to Indo-Pacific aquatic resources.

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Poster title

Analysis of fishing vessels operational profiles

Abstract

High energy consumption and high fuel prices heavily affect the economic performance of fishing fleets. Understanding how fuel consumption varies with variations in fishing activity may help change fishing behaviours and devise more energy-efficient practices. This study analyzes and compares the operational profiles of three commercial fishing vessels corresponding to three common, highly energy-intensive *métiers* in the Mediterranean Sea: a semi-pelagic pair trawler (engine power 940 kw, length overall [LOA] ca. 28 m); a bottom otter trawler (engine power 478 kw, LOA ca. 22 m), and a beam trawler (engine power 780 kw, LOA ca, 24 m). Their routine activities were recorded by the researchers of CNR-ISMAR (Ancona, Italy). The characteristics of typical trips were identified by collecting information on fuel consumption, working speed, heading changes, bathymetry ranges, and spatial distribution and seasonal patterns of fishing activities. Application of mixture analysis to the speed profile of each vessel allowed assigning the activities involved in each *métier* to three discrete modes: steaming, towing, and maneuvering. Individual hauls were identified. Trawling, which was found to be the most fuel-intensive mode, was characterized in detail. The fuel demand and consumption of each *métier* were analyzed based on activity mode, to establish how the different activities weigh on the fuel bill of a typical fishing trip.

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Poster title
Use of artificial reefs in the Black Sea

Abstract
The Black Sea needs support due to its fragile and polluted ecosystem caused by anthropogenic wastes, disposal of untreated domestic wastewater – so called "deep discharges" –, spread of solid wastes on the bottom, degradation of bottom algal communities resulting with oxygen deficiencies, and the last loss of biodiversity due to invasive species. Furthermore, illegal, unreported and unregulated (IUU) fishing and overfishing and the use of destructive fishing methods in a very narrow continental shelf, like bottom trawls and dredges, add more threats to the marine living resources. Climate change and landfills have also an impact on the Black Sea ecosystem. As a result of all these factors, fishers are facing social and economic losses and the ecosystem is getting far from a good environmental status. On the other hand, the construction of hydroelectric power plants on all the rivers of the Black Sea has a great impact on the nutrient types and quantity carried by causing different plankton species composition. So, the Black Sea ecosystem needs urgent support for the expected rehabilitation. There are no marine protected areas and marine parks along the TR BS coasts. Artificial reefs may play an important role for the recovery of the ecosystem in smaller areas and may act as "eco-islands" under the water to increase biodiversity by providing wider attachment, shelter and protection. Preliminary results by plastic, eco-friendly vertical towers have given us very optimistic outputs which can be used for ecosystem recovery and reduce organic pollution coming from fish farms.

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Poster title
Scalable live tracking and modular fisheries information solution beneficial and essential to all sectors and levels within the fisheries industry

Abstract

LOQUS everyday's challenge is to enrich its scalable live Tracking and modular FIS, to provide best practice movement and management of fisheries data for small-scale fisheries (SSF) as well as medium and large vessels across the Mediterranean and the Black Sea, addressing various issues within the marine environmental sector and contributing towards the Member States requirements imposed by the Marine Strategy Framework Directive.

LOQUS and its partners, each having their own area of expertise within the SSF and other areas, have strong expertise and skill sets required to address the various facets of the system, including on-board vessel instruments (weighing scales, gear operation and underwater sensors), advanced solar powered satellite transponders, data management techniques, software platforms and application development.

Working hand-in-hand with Governments, entities, partners and the users i.e. fishers, providing them cutting-edge technology for the collection and aggregation of the required data and rendering it available through a secure cloud-based online platform, facilitating the adoption of the regulations set by the EU and the local Government, LOQUS priority. As key experts in data collection and geographic information system (GIS), LOQUS offers a modular cost-effective solution, enabling all sectors and levels within the fishing industry, to collect accurate reliable and related environmental data.

LOQUS' aim is that high-level Authorities and fishers obtain the best solution for economic valuation and full traceability of all fisheries activities, together with GIS and marine spatial planning solutions, promoting economic and environmental sustainability.

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Poster title

Caractérisation socio-économique de la pêche dans la retenue du barrage Sidi Saâd (Centre de Tunisie)

Abstract

L'analyse de la situation socio-économique de la population des pêcheurs du barrage Sidi Saâd a permis d'estimer la production réelle de la pêche dans ce barrage, de déterminer la structure démographique des pêcheurs et de fournir des informations sur la rentabilité de la pêche dans cette étendue d'eau continentale. À cet égard, il a été constaté que la population des pêcheurs est relativement jeune (âge moyen 39 ans), d'un niveau scolaire moyen (64 pour cent niveau d'étude primaire) et d'un revenu mensuel faible (n'atteignent pas le niveau du SMIG). Les productions de la pêche estimées sont largement supérieures à celles déclarées aux services des statistiques de pêche de l'administration des pêches (95 tonnes contre une production déclarée de 62 tonnes en 2007 et 112 tonnes contre 72 tonnes en 2008). Par ailleurs, l'étude socioéconomique a montré que la majorité des pêcheurs pratiquent une deuxième activité en plus de la pêche (61 pour cent). Le suivi scientifique continu de l'exploitation de ces plans d'eau est nécessaire, pour maintenir l'activité de la pêche dans ces plans d'eau d'une part, et pour fixer les populations des pêcheurs dans ce barrage et par voie de conséquence ne pas augmenter l'effort de pêche au niveau de la pêche côtière en mer d'autre part.

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Poster title
Investigation of exoparasites of *Sparus aurata* and *Boops boops* in the Syrian marine waters

Abstract
This study aimed to investigate exoparasites species of two fish species in the Syrian marine waters. A total of 55 individuals of *Sparus aurata* and 85 of *Boops boops* were collected from different localities off the Syrian coast during 2015–2016 using trammel nets and longlines. Skin, mouth cavity, nostrils, gill cavity and gills were examined. Three exoparasites were isolated from *Saprus aurata* gills: *Lamellodiscus elegans*, Monogenea (family: Diplectanidae), with a prevalence of 20 percent and an intensity of 2.4. This exoparasite species was isolated in autumn and summer, where the highest prevalence and intensity were recorded in summer with 50 percent and 2.6 respectively. The second species was *Furnestinia echeneis*, belonging also to Monogenea and Diplectanidae, with a prevalence of 23.63 percent and an intensity of 2.1. This exoparasite species was isolated in all seasons, where the highest prevalence and intensity were recorded in spring with 28.57 percent and 3.2 respectively. Finally, we isolated *Gnathia* sp. genus belonging to Crustacea (family: Gnathiidae), in spring (March) with a prevalence and an intensity of 3.63 percent and 2 respectively. Concerning *Boops boops*, two exoparasite species were isolated from gills: *Axine belones*, Monogenea (family: Axinidae) with a prevalence of 52.94 percent and an intensity of 2.6. This exoparasite was isolated in all seasons, where the highest prevalence and intensity were recorded in spring with 58.97 percent and 2.8 respectively. *Furnestinia echeneis* was also isolated in winter. All these exoparasites species were isolated for the first time in the Syrian marine waters, but *Furnestinia echeneis* was recorded in *Boops boops* for the first time in the world.

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Poster title
Traditional production of clam in Southern Tunisia: value chain and environmental constraints

Abstract
This work focuses on traditional clam fisheries in Southern Tunisia (Gulf of Gabes). It is based on socioeconomic enquiries, field investigations and diagnoses conducted with all stakeholders in the sector, namely collecting women (3 500 women across three collecting zones), transporters, development groups, and operating of clams and purification centers. The results of this study revealed the key role of women in the production and the extensive experience in the field; however, an analysis of the value chain reveals that these assets are sanctioned by marginalization in terms of revenues and benefits where women turn out to be the lowest paid (4.45 percent of benefit) compared to other industry players (95.55 percent). Other parts are the carriers and purification centers, which monopolize the workings of the industry, as groups of fishers prove largely beneficial when properly managed. Concerning the environmental constraints, although the Gulf of Gabes is the seat of several sources of marine pollution, clams collection areas show no apparent remarkable pollution. However, the water quality is affected by hydroclimatic changes, the summer heat raising the water temperature to around 30 °C in the foreshore area, also causing a rise in salinity over 40 psu. Analyses of nutrients show an average wealth with fairly similar values, primary productivity is confirmed by the chlorophyll, reaching 0,412μg/l. Such conditions may increase phytoplankton development with several dinoflagellates harmful blooms.

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Poster title

Potential for positive synergies important in the interactions between small-scale fisheries and other maritime activities

Abstract

Recent changes and economic pressures are creating a new situation for fishing communities in the Mediterranean and the Black Sea. There has been a rapid increase in fishing activity. Indeed, the trend towards modernization with its increase in boat size and effectiveness is resulting in an ever more acute fishing pressure. The development of small-scale fisheries in the Mediterranean and the Black Sea must therefore be oriented, not towards an increase in fishing effort, but towards sustainable fisheries and the development of identified synergies with other maritime activities such as tourism and management of protected areas, and the enhancement of product quality as well as their commercialization (increase in value added). The priority should be on environmental protection and ensuring the sustainability of such activities for future generations. The potential for positive synergies is expected to be mostly important in the interactions between small-scale fisheries (SSF) and coastal tourism, including ecotourism, and between SSF and marine protected areas (MPAs), where SSF can take on functions related to tourism and monitoring/management of protected areas. There are, however, other positive synergies with maritime transport and aquaculture through shared facilities and suppliers. MPAs can be used as a fisheries management tool that can contribute to the sustainable exploitation of fish and the conservation of aquatic biodiversity. MPAs have positive effects on fish stock abundance, recruitment and age structure, thus contributing to fisheries resources and productivity, stability and resilience.

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Poster title

Spatio-temporal fishing effort on bathymetric zones in the Aegean Sea using VMS data

Abstract

The majority of the Greek trawlers and purse seiners operate in the northern part of the Aegean Sea that is the most productive area in Greece. The main species targeted by bottom trawlers are hake, red mullets, shrimps and common pandora. Purse seiners mainly fish small pelagic species, mostly sardines and anchovies. Vessel monitoring system (VMS) data and bathymetry were used to estimate the spatio-temporal distribution of fishing effort on depth strata. VMS data of the period 2010–2015 were analyzed and fishing effort was estimated "in days at sea * Gross Tonnage". Annual and monthly maps of fishing effort distribution were produced for depth strata <100 m, 100–200 m and 200–500 m and the total fishing effort by depth stratum was estimated. Fishing effort was calculated as a proportion of the area falling inside each depth stratum. Given that the values of fishing effort need to be comparable between bathymetric zones, the total fishing effort of each zone was standardized by 1 000 km^2. Results revealed that the shallower stratum (<100 m) is highly fished by trawlers, while in April and May a movement of vessels to deeper strata was observed. Purse seining was higher at depths <100 m while the maximized fishing effort for all depth strata was between May and September. Our findings suggest a marked seasonality of the distribution of fishing effort by depth stratum for both fishing techniques. This is probably a cumulative effect of several factors such as environmental and weather conditions, seasonal closures, fuel price, the spatio-temporal variation of target species distribution, and their persistence in preferred habitats.

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Poster title

Spatial distribution of elasmobranch species in the Gulf of Gabes (GSA 14) based onboard observer method

Abstract

To study the impact of deep-sea fishing on the benthic resources and ecosystems (case of elasmobranchs) in the Gulf of Gabes (GSA 14), an onboard observer method was adopted. This method was adopted for the first time in the area. Monthly outings were carried out from January 2016 to March 2017, aboard a commercial trawler named "Bâati". The collection of information was based mainly on the monitoring of catches from fishing operations. A total of 478 hauls were made at depths between 12 and 63 m. Captured specimens were identified, sexed, measured and weighed. In the same way the stage of maturity of each one was determined. During the 478 hauls, the landing of cartilaginous fishes represented five percent of commercial catches. Elasmobranchs are represented by a large diversity of families such as: Rajidae, Torpedinidae, Rhinobatidae, Dasyatidae, Myliobatidae, Triakidae, Carcharhinidae and Scyliorhinidae. We took the example of Rajidae to study their seasonal abundance. Moreover, examination of landed specimens revealed the presence of pregnant females in several Rajidae species. The presence of ovisacs of Rajidae and Scyliorhinidae in trawl rejections suggests that these species find favorable conditions for breeding in the Gulf of Gabes. This area could be a nursery for them.

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Poster title

Some socio-economic indicator in Algerian fisheries. Study case: Annaba port

Abstract

Les enquêtes socioéconomiques ont été réalisées de juillet à décembre 2017, dans les ports d'Annaba et de Chetaibi situés dans la partie est de la côte algérienne. Elles ont été organisées en 12 composantes et ont été collectées mensuellement. Quelques indicateurs socioéconomiques en relation avec l'effort de pêche (nombre et durée d'une sortie), les revenus et aussi la performance économique. Le traitement a été fait par segmentation de la CGPM pour les trois métiers existant dans la zone à savoir les petits métiers, les chalutiers et les senneurs.

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Poster title

A framework for small-scale fisheries sustainability in the context of the UN Sustainable Development Goals

Abstract

This study highlights that although major advances through enhanced knowledge have been targeted towards addressing the fisheries sustainability crisis, we are still lagging in adopting a holistic approach towards the sustainable development of small-scale fisheries in the Mediterranean and beyond. The sustainability of small-scale fisheries has been recently elevated to the global agenda with the FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines), and to a much lesser extent, in the Sustainable Development Goals (SDGs) agenda as part of SDG14b. An innovative approach to understand the complexity of these systems and to govern them with the right tools to ensure their sustainability is more critical than ever. By drawing on a philosophy of integration between the SSF Guidelines and the SDG targets as the way forward in achieving sustainable small-scale fisheries, this article highlights that our lens must go beyond access to markets and resources, which is the focus of SDG14b, to encompass coordination across the entire SDGs such as reduced inequalities, livelihood challenges, economic growth and strong institutional frameworks. This will also help align the SDG framework with the SSF Guidelines to optimize human and financial resources required to achieve better science for better advice. A transdisciplinary perspective that incorporates both academic and Local Ecological Knowledge (LEK), with an underlying holistic governance framework, is a vehicle that is capable of fostering concerted effort in the implementation of these major global instruments in the context of the Mediterranean small-scale fisheries sustainability.

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Poster title
Marine policies and vulnerability of fishing community

Abstract
The vulnerability of fishing communities is well established in my publication "Socio-economic vulnerability due to climate change: Deriving indicators for fishing communities in Mumbai", where I derived vulnerability of a fishing community named

Koli community. Vulnerability of these communities is manifold, including social, financial, physical as well as their livelihood, which is also sensitive to climate change. Fishing in India is treated in an equivalent manner to agricultural activities; however fishing communities do not receive the required attention that farmers are getting. The marine policies of the government have very limited role, though the recently drafted marine policy talks about sustainability, socio-economic upliftment, intergenerational equity and partnership. My observation and interaction among the fishers (around two hundred fishers from Mumbai) are different. Many families in the fishery household don't want their children to fish because it involves hard work and a risk to life. According to them, sometimes there is a drought-like situation in the sea, but there is no provision or a very limited provision of any kind of financial assistance. However, all fishers are not vulnerable, the fishers having big trawler are maximizing their benefit by undermining the policies, and they fish intensively for few months. Taking the case of the fish market in India, it is much more complicated due to the complicated pricing system because of the variety of fish in size and type. Hence it is necessary that appropriate policy mechanisms be put in place in order to reduce the impacts of climate change on the fishing community.

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Poster title
Kolkheti National Park's fish diversity

Abstract
Kolkheti National Park is located in West Georgia. It consists of two water resources objects: Paliastomi Lake and part of the Black Sea, and planning protected area – part of the Rioni delta. One of the important components of Kolkheti National Park is Paliastomi Lake, which is designated as Ramsar site. Paliastomi Lake presents mix water types and is a typical Black Sea lagoon: there are 30 species of fish, one of them being the local endemic species *Alosa caspia palaeostomi* (Sadowsky). In the Black Sea part, 110 species and subspecies of fish were identified. Marine fish are: anchovy, Black Sea horse mackerel, species of mullets, Black Sea red mullet, Black Sea whiting and Black Sea sprat. Very small population of Gobiidae, bonito, Black Sea turbot and others. Black Sea sides parts and rivers present six "Red lists" (Georgian and IUCN) species.

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Poster title
Bioeconomic modelling of the Black Sea anchovy fisheries: An age-structured model under climate uncertainty

Abstract
Black Sea anchovy, *Engraulis encrasicolus*, is the key species especially for the Turkish fleet, as one species of every two species caught by the Turkish fleet is anchovy. During the last half century, the Black Sea anchovy has faced significant human-induced threats such as overfishing, domestic and industrial nutrient input via rivers, especially from the Danube Delta, invasive species (e.g., *Mnemiopsis leidyi*) and climate change. The use of age-structured models for pelagic species was quite limited, especially considering the fishing mortality and the recruitment under climate change. In our study, deterministic and stochastic models mainly focused on the optimal management of Black Sea anchovy fishery based on an age-structured model under climate uncertainty. The novel contribution of this bio-economic model further gave insights on the biological and economic reference points including fishing mortalities, maximum economic and sustainable yields (MEY and MSY) under different temperature scenarios. The results were contrasted against each other for varying climate scenarios and also compared with similar previous studies in the literature. The output of this study were supposed to add value in the decision making process of the Black Sea anchovy fishery in the region.

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Poster title
Fisheries buyback Programmes in Turkey: Overall results of five-year experiences

Abstract
Buyback programmes in fisheries go back over half a century. In Turkey, five different programmes were conducted between 2012 and 2018. The present study evaluates the outcomes of the fisheries buybacks in Turkey. 1 253 boats in five years bought back with a total cost of around 165 million Turkish Lira. Programmes resulted in a twelve percent drop in the number of boats, more than ten meters in the fleet. However, 87 percent of the boats decommissioned from the fleet were observed to be small-scale fisheries (SSF) vessels of ten-twelve meters.

According to the results of the first three buybacks (interviews for the third and fourth programmes were ongoing at the time of writing of this Abstract), 61.5 percent of the fishers in the programme wanted to continue fishing, 25 percent among which expressed plans to buy a new boat. Furthermore, whether bold goals such as a) establishing a balance between fish stocks and fishing capacity, b) preventing overfishing, and, c) supporting sustainable fisheries have been achieved is still debatable. With the analyses of five years of data, important questions related to fisheries management will be answered, such as why and which fishers applied for decommissioning (socio-demographic features, experiences), whether they really quit fishing, which boats were sold (length, age, gears, number of crew, days at sea), what happened to those boats, and fishers' satisfaction with the programmes.

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Poster title

A bioeconomic model to test regulation measures in fisheries of the Strait of Sicily

Abstract

In the Sicilian channel, four demersal trawlers fleets exploit the hakes and deep-water rose shrimps stocks: the coastal Italians, the distant Italians, the Maltese and the Tunisians. These fleets catch also other fish species as bycatches (common pandora, red mullet, surmullet, Atlantic horse mackerel, bogue, picarel, spotted flounder, gurnard, ray, catshark, seabream, scorpionfish, grouper, angler, dogfish, sole, etc.). In Northern Tunisia, the Tunisian trawlers fleet shares these fishes' stocks with the coastal gillnet fishery which targets also hakes. A bioeconomic model was performed using the Vensim® simulation software to assess the biological, economic and social impacts in Tunisia of several management measures or exogenous forcing through scenarios run over a fifteen years projection period. The biological parameters of the two main species are derived from XSA analyses; the simulation is based on age-structured population with a monthly recruitment of the deep-sea shrimps and a quarterly recruitment of the hakes. Biological parameters of the 27 fish species are derived from Fox models assessed using Aspic7. Combinations of management measures for trawlers were tested, including reduction of fishing capacity, temporal closure and change of the 40 mm diamond mesh of the codend to a 40 mm square mesh, and removal of some tax and of fuel subsidies. A drastic reduction of fishing capacity with other regulation measures could greatly increase the economic rent, the total net profit, the state revenues and the ship-owner and fishers revenues, and restore some fish stocks. The scenarios show the synergistic effects of the regulation measures.

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Poster title

Italian fisheries mapping

Abstract

Fisheries mapping is a useful tool to get a comprehensive overview of the fishing activities, their contribution to the total catches, fishing effort and landing values. In 2018, Marine Stewardship Council (MSC) launched the BluFish project: a project pre-assessment aimed at engaging multiple fisheries at the same time assessing where these set in relation to the MSC sustainable fisheries standard. BluFish aims to involve not only the fisheries and NGO stakeholders, but notably also the management Authorities, scientific advisory bodies and the supply chain interested in sourcing from these fisheries. The fisheries mapping is the first stage of BluFish project pre-assessment and it has two main goals:

1. To obtain information about the central and southern Italian fisheries (i.e. GSA 10, 11.2, 16, 18, 19).
2. To provide the necessary data and information for the stakeholders involved and interested in the project to select fisheries as to identify units of assessments (UoAs) defined as species & stocks x gear x fishing group of vessels) that will be pre-assessed on the basis of the MSC standards.

The mapping exercise includes two steps: i) a fast scan, aiming at gathering information about fisheries or commercial species in an area, that fit within the scope of the project; and ii) the deeper mapping, focused on gathering more in-deep information on the fisheries, in order to identify UoAs that will be pre-assessed. As part of the deeper mapping, it is essential to consult and engage stakeholders in the selection of the UoA.

On the occasion of the FishForum2018, the result of the deeper mapping from BluFish project will be presented to the Forum participants as to received inputs on the result of the mapping, the UoA to be selected as well as on the process.

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Poster title
Sustainable fisheries on the open sea island – the island of Vis, Croatia

Abstract
Due to its geographical position, the island of Vis has first developed into a strong fisheries and later into a fish processing center. However, becoming a military base in the second half of the twentieth century made the island even more isolated. Opening to tourism and long-term isolation made the island especially sensitive to changes. In view of these conditions, the paper aims to explore the economic (contribution to local economy) and cultural (part of identity) role and future of sustainable fisheries (case study) in the island of Vis.

This volume includes all the abstracts of the keynotes, oral contributions and posters presented by participants on the occasion of the Forum on Fisheries Science in the Mediterranean and the Black Sea (Fish Forum 2018). Organized by the GFCM at FAO headquarters, Rome, Italy, from 10 to 14 December 2018, in collaboration with technical partners, the Fish Forum 2018 is a first-of-the-kind event gathering scientists, researchers, engineers, academics, practitioners, managers and decision-makers from around the world to discuss and share knowledge on the latest developments in fisheries science.

The material contained in this book of abstracts stems from the contributions received from participants and selected by an international scientific committee based on their technical quality and relevance. The abstracts are subdivided according to the three main themes of the Fish Forum 2018: Better science for better advice; Healthy seas and sustainable fisheries; and Economic analysis and technology for societal benefit. Each theme is introduced by a keynote presentation, followed by oral presentations and posters. These documents form the basis of the discussions held during parallel sessions and poster sessions of the Fish Forum 2018.

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