



Historical ecology of semi-enclosed basins: past, present and future of seas at risk

3-4 October 2016, Aula Magna Palazzo Grassi – University of Padova,
Chioggia – Italy

Book of abstracts

MEETING SESSIONS

1. Changes in knowledge, perception and use of marine ecosystems of semi enclosed basins and coastal areas
2. Changes in biodiversity, environmental/human drivers and food-webs
3. Management responses to changes in marine ecosystems and future scenarios

ORGANIZING COMMITTEE

Carlotta Mazzoldi – Department of Biology, University of Padova (Italy), carlotta.mazzoldi@unipd.it

Alberto Barausse - Environmental Systems Analysis Lab (LASA), University of Padova (Italy), alberto.barausse@unipd.it

Elena Canadelli - Department of Biology, University of Padova (Italy), elena.canadelli@unipd.it

Tomaso Fortibuoni - ISPRA and OGS National Institute of Oceanography and Experimental Geophysics, Trieste (Italy), tomaso.fortibuoni@isprambiente.it

Saša Raicevich - ISPRA Italian National Institute for Environmental Protection and Research, Chioggia (Italy), sasa.raicevich@isprambiente.it

A meeting of the EU-COST Action Oceans Past Platform: <http://www.tcd.ie/history/opp/>

Co-organized by the University of Padova (Italy) and ISPRA - Italian National Institute for Environmental Protection and Research (Italy)

Funded by EU-COST and Department of Biology, University of Padova (Italy)

Contents

Bayscapes - contested waters through time.....	4
Between the utopia and the reality around the Maritime Station of Aveiro lagoon – an observatory of perceptions (second half of 19 th century).....	4
Historical connections between marine science research and dissemination: the case-study of Aquarium Vasco da Gama (Portugal)	5
The importance of interdisciplinary research for the study of the use of marine living resources along the Israeli coast line from the 6 th to the 13 th century.....	5
An archaeozoological overview of the European hake (<i>Merluccius merluccius</i>)	6
Fishing, fish farming and processing during the Roman age: an overview on the Northern Adriatic between literary sources and archaeological data.....	6
The rehabilitation of <i>louses</i> (mussels) in the lagoon of Venice: an example of change in perception of sea resources	7
Thinking globally or just acting locally? Perceptions of environmental changes in a 16 th -century Portuguese village. A micro approach to a macro-scenario.....	7
Biodiversity variations and processes in semi-enclosed and estuaries seas	8
Fishing along the western shores of the Atlantic: Archaeological fish assemblages from Iberia and North Africa	8
Historical changes of ichthyofauna in Central-Eastern Baltic Sea: from 18 th century till present.....	9
The history of harbour porpoise exploitation in Northern Europe.....	9
Did they lose the taste for seals?	10
Analysis of historical landings of European anchovy (<i>Engraulis encrasicolus</i> , Linnaeus, 1758) in the Gulf of Trieste (Northern Adriatic Sea, Mediterranean)	10
On the evolution of red shrimps, <i>Aristaeomorpha foliacea</i> and <i>Aristeus antennatus</i> , stocks in Italian northwestern waters	11
Sclerochronology – a tool for reconstructing changes in the Adriatic and Mediterranean Seas?.....	11
Indicators of ecosystem health based on a time-dynamic food web model of the Black Sea.....	12
Evolution of the theory of rational fishing.....	13
Management practices and traditional knowledge of Japanese <i>ama</i> divers. An anthropological perspective.....	13
Trawling in the Mediterranean in the Modern period. Ancient instruments and politics for the development of these productions and the conservation of the resource	14
Community-based management in Mediterranean coastal fisheries: historical reminiscence or the root for new governance?	14
Perceptions of marine litter: why should we try to understand the values, norms and worldviews of a small group of artisanal fishermen on the Mediterranean coastline?	15
Jetties at the inlets may temporarily slow down the local sea level rise facilitating the survival of salt marshes	15

Underwater archaeological parks are good for fishes? Two Azorean case studies on the way to discuss the symbiotic natural and culture heritage preservation.....	16
The hook that bridged the Adriatic and the Baltic Sea long-lines fisheries in late 19th century.....	16
Umberto D’Ancona (1896-1964) between fishery and marine biology.....	17
Sea shells from the past. The case study of the Roman Villa in Via Neroniana at Montegrotto Terme	17
The dusky grouper in Tavolara – Punta Coda Cavallo Marine Protected Area (Sardinia, Italy): present knowledge and future perspectives.....	18
The Mar Piccolo of Taranto: historical development of an almost totally enclosed basin.....	18
Devils or saints: disentangling fishermen vs. public perceptions towards cetaceans in the Greek society	19
The fishing economy in ancient times: goods and amphorae for the Adriatic trade.....	19
Where sharks met humans: the Mediterranean Sea, history and myth of an ancient interaction between two dominant species.....	20
Data about navigation and fishing from graffiti in orthodox churches in Nessebar, Bulgaria	20
Changing practices, perceptions and preconditions of coastal fisheries in the Finnish Archipelago Sea Region.....	21
Time series of fishery data as a tool to monitor the response of thermophilic species to climate changes	22
The impact on the zooplankton abundance and diversity in a coastal region after a mining dam rupture disaster at the Doce River, Southeast Brazil.....	22
Deep sea Impact. How Human activities affect the Deep Sea Ecosystem.....	23
A rising tide of marine disease? Unraveling the dynamics of infection in a changing ocean	23
Rediscovering old fishing tradition in Sicily: history and culture of small-scale fishery	24
Management response to changes in the marine ecosystem and future scenarios.....	24
Changes in marine ecosystem: evaluating the impacts of climate change and developing adaptation strategies using application of e- governance and ICTs for protection and sustainable exploitation of coastal and marine resources.....	25
Evaluating the attitudes of common people towards sharks: a key to promote shark conservation.....	25
The use of time series in population dynamics models: tools to support the management of elasmobranchs in the Adriatic Sea	26
LIST OF CONTRIBUTORS.....	27

1° Session

Changes in knowledge, perception and use of marine ecosystems of semi enclosed basins and coastal areas

Bayscapes - contested waters through time

P. Holm

Abstract Marine environmental history is the meeting of historical research and marine science which has developed in the last twenty years. The talk opens by identifying some of the challenges to this exercise and the gains to be made. Semi-enclosed marine systems - in this talk called bayscapes – are particularly well documented both from the human and the marine dimensions. Bayscapes provide humans with the best of two worlds: protection from the dangers of the open sea and easy access to (often) highly productive inshore waters. For these reasons, “bayscapes” have been contested areas of resource use through time, while serious attempts at protecting the long-term productivity of bayscapes are also numerous throughout history. The talk will consider a few examples of changes in knowledge, perception and use of marine ecosystems of semi-enclosed basins from the medieval to modern times. Special emphasis will be made on pre-modern uses and management of semi-enclosed basins in Europe, modern depletion of bayscapes (well documented globally), and challenges of contemporary aquaculture area claims in coastal archipelagos. Finally, the talk will consider attempts at developing participatory management to ensure stakeholder rights and compliance. It will be argued that participatory management must build on an historical appreciation of natural and cultural heritage of bayscapes. Such appreciation must embrace contradictory interests for any long-term management to be successful.

Between the utopia and the reality around the Maritime Station of Aveiro lagoon – an observatory of perceptions (second half of 19th century)

I. Amorim

Abstract At the second half of the 19th century a global change on salt consumption explained by international market concurrence brings a change on sun salt places of European production. Economic, social as also scientific progress, like the research on laboratories and maritime station, are reasons to explain the changes in the use of estuaries and lagoons were the sun salt had an important representativeness. A pilot place was the lagoon of Aveiro in the Norwest coast of Portugal oftentimes compared with the lagoon of Venice for their canals (“The Portuguese Venice”). Between the utopia and the reality, the abandon of saltpans production was a real argument to transform the lagoon in experimental tanks of fish farming and of the creation of a maritime station using local administration buildings. The arguments around new uses differ between naturalists, engineers and the saltpans owners which justify why we stand that the Maritime Station of Aveiro, as a project, is an observatory of perception and use of marine ecosystems of semi enclosed and coastal areas. Scientific connections, evolution of the coastline, negotiations between central, local and communities dealing with changes in knowledge and uses of ocean resources are present in all kind of documentation. Our aim is to follow the agents of change and understand why, when and by who were mobilized arguments against the disappearance of salt uses and the renovation of its uses in the context of aquaculture concepts and scientific evolution.

Historical connections between marine science research and dissemination: the case-study of Aquarium Vasco da Gama (Portugal)

B. Pinto

Abstract In the late 19th century, there was a bloom of public aquariums throughout Europe. Some of these aquariums were purely for educational/entertainment purposes, whereas others were connected to science research. This case-study explores the origins and development of the first Portuguese aquarium (Vasco da Gama), which was created in 1898 by the Society of Geography with the main objective of science dissemination. Since there was little technical expertise, the Society of Geography asked to a Portuguese naturalist (Albert Girard) to visit aquariums in France, England and Holland. In the first years, a deficient establishment, lack of financial resources, little technical knowledge and scarce connections to other aquariums contributed for the degradation of the aquarium Vasco da Gama. After the Navy took over management in 1901, there was a gradual reorientation for marine science research, thus becoming a marine biological station in 1919. On a first stage, marine scientific research provided technical knowledge which improved the conditions in the aquarium. On the other hand, marine biology and oceanography in Portugal had a major development since the 1920s due to the contributions of the aquarium, as well as the membership of this country in the International Council for the Exploration of the Sea (ICES). However, on a second stage, the priority given to scientific research was considered by the Navy as detrimental for the activities of science dissemination in the aquarium, which eventually led to the separation of the marine biological station in 1950.

The importance of interdisciplinary research for the study of the use of marine living resources along the Israeli coast line from the 6th to the 13th century

R. Gertwagen

Abstract The history of the Israeli coastline in antiquity and the medieval period has been traditionally studied through historic and mainly archaeological evidence (marine and terrestrial). However, only in rare occasions (the present writer excluded) it has been conducted interdisciplinary. The zoo-archaeological aspect was neglected until the early 2000 and even then it has been only partially treated. Using interdisciplinary approach, the present paper aims to introduce the zoo-archaeological evidence along 700 hundred years for pinpointing the following:

1. The impact of the shift of the Israeli coastline in the Mediterranean economic system on the local economy and consequently on use of marine ecosystems and resources
2. Involvement of foreign 'fish traders' and fishermen
3. Continuity and disappearance of certain marine species

An archaeozoological overview of the European hake (*Merluccius merluccius*)

A. Morales Muñiz, E.G. de Agüero, C.F. Rodríguez, L. Llorente Rodriguez, E. Roselló Izquierdo

Abstract From an archaeozoological standpoint, the European hake (*Merluccius merluccius*) is one of the most peculiar fishes of the NE Atlantic. Indeed, although the species presently ranges from Scandinavia to Mauritania, and also throughout most of the Mediterranean Sea, its archaeozoological finds are essentially restricted to the Northern shores of the Iberian Peninsula. Likewise, and although we are concerned with a commercially important species, finds of hakes in archaeological deposits do not reveal it to be an important element of the fish assemblages. Both patterns have been explained on account of the fact that, hake being presently a deep-water fish, it would have been unlikely for it to be accessible to inshore fisheries, as have been European fisheries for centuries. This presentation will provide an overview of archaeozoological finds of hakes on coastal and inland sites from Iberia that are currently under study and frame these from the standpoint of the biology of the species with the help of some historical data.

Fishing, fish farming and processing during the Roman age: an overview on the Northern Adriatic between literary sources and archaeological data

M.S. Busana

Abstract During the Roman age fishing and fish farming and processing represented a significant economic role in the Adriatic Sea area. The ancient sources celebrate particularly the western side of the Northern Adriatic for the abundance of fish, as well as estuaries and lagoons, while they don't make references to Adriatic plants for the processing and transformation of different fish varieties, caught or farmed. Written documentation is reflected in the archaeological record. In the Adriatic there are some archaeological remains interpretable as installations for breeding of live fish (*piscinae* or *vivaria*), concentrated in the Eastern side of the Adriatic Sea (Istria), while the structures for fish processing are not clear and less visible. The abundance of fish, the availability of salt, as well as fresh water, make highly plausible the hypothesis that not only fish farming was practiced, but also its salting and processing in the various fish sauces, at least for internal consumption and for restricted trade. The perishable characteristics of plants for breeding at the sandy bottom (well described by Columella), the significant changes in the coastal environment (compared with a rise of 2-3 m of sea level from the Roman age), the possibility to realize salted fish and fish sauces with systems of limited archaeological impact (referenced by late antique sources), the possibility of creating a simple salting of small fish uneviscerated in wooden barrels are all factors that can explain the faint traces of these activities in the Adriatic area.

The rehabilitation of *louses* (mussels) in the lagoon of Venice: an example of change in perception of sea resources

R. Vianello

Abstract If today we consult the websites of mussel farmers, we see a fundamental contradiction: even if it is a bred product, mussels are presented as a very natural food. Breeders say that these mollusks feed and grow in the sea without any food and chemical as in the wild. Synonymous of "good healthy", the "savagery" of the mussels is perceived today as a quality (although the cleanliness of the water sometimes leaves something to be desired). But this reputation is recent. This is the case of the Venice lagoon, where in the past, the mussels were suspected of being indigestible and same times even toxic. Until the 1950s, fishermen from the island of Pellestrina, in the South Lagoon of Venice, considered them inedible. This evolution highlights the fact that a fisherman, Alfredo Gilebbi from the Marches, launched mussel farming in the southern lagoon in 1939. This event has given rise to what can be defined as the "founding myths" of lagoon mussel farming. We are witnessing of a late discovery of this food and of the adoption, just as late, technical innovations for its exploitation. This paper retraces the essential steps of the "rehabilitation" of this black bivalve from ambiguous past (the Venetians, still today, call them *peòcio*, that is louse) that is become an important economical product in Venice and in worldwide. For fishermen this is not only a complex socio-economic phenomenon, but the transition from fishing to breeding, involved also an evolution that brought with it a change in their ideology.

Thinking globally or just acting locally? Perceptions of environmental changes in a 16th-century Portuguese village. A micro approach to a macro-scenario

A. Polónia

Abstract Seaports and maritime communities were crucial for overseas connections, strategic support to navigation and trade. and central for economic development in Portugal and Europe, during the First Global Age (1500-1800). Seaports' logistics and maritime voyages were predominantly driven by seafarers' and pilots and based on their practical and empirical knowledge. Climate and ecological conditions were crucial for the (un)success of such endeavours. How were environmental constraints perceived and how did they act within an ecosystem whose functioning was not fully understood by those agents? How were global climate changes, such as those resulting from the little ice age, reflected in a local maritime community; how were they perceived and how did technicians and local powers respond to changes in ecosystems which deeply interfered with their daily life and economic dynamism? The paper will approach these questions trying to discuss how micro-approaches can contribute to the understanding of global phenomena; how practical knowledge induced practical actions and how perceptions were responsible for actions over ecosystems, still seemingly mysterious, but whose changes were important enough to induce management responses to perceived scenarios. Historical knowledge, representations, actions and reactions toward ecosystems are the central focus of this paper which aims also at a reflection on how an early modern historian, facing evidence from a pre-statistical era, and sources produced by the commoners, can debate environmental changes in coastal areas and the correspondent human response.

2° Session

Changes in biodiversity, environmental/anthropogenic drivers and food webs

Biodiversity variations and processes in semi-enclosed and estuaries seas

B. MacKenzie

Abstract Semi-enclosed and estuarine habitats are exposed to multiple human impacts (e.g. eutrophication, fishing, invasive species) and often contain strong gradients in hydrographic variables (e.g. salinity, oxygen and nutrient concentration). The impacts and gradients affect local biodiversity, species distributions and compositions, food-web structures and ecosystem functioning. These changes have often transformed food-webs and ecosystems to configurations which no longer provide the same ecosystem goods and services, either in terms of value, diversity or type, as those under lower levels of human impacts. Documented evidence of past changes and current states can inform stakeholders about possible recovery goals and targets and expand the knowledge basis for new policies that can conserve and recover ecosystem structures, services and goods for future generations. This presentation will illustrate some of the ecological processes leading to variations in biodiversity and populations in time and space, and how historical ecology can help document such variations and their causes with particular reference to semi-enclosed seas and estuaries. Examples will be provided from the Adriatic, Baltic and Black Seas.

Fishing along the western shores of the Atlantic: Archaeological fish assemblages from Iberia and North Africa

S. Gabriel

Abstract Along the western coasts of the Iberian Peninsula and North Africa and since prehistoric times, people have been engaged in fishing. This activity is evidenced in the many sites situated along the present-day coast. Assemblages of archaeological fish bones from Portugal and Morocco are scarce. This is because until recently there were few attempts to retrieve fish bones systematically. Over the last decade several archaeological projects in both Portugal and Morocco have sought to investigate human interaction with ancient coastal environments. My presentation provides an overview of the fish assemblages found in archaeological sites dating from prehistoric to post-medieval times in this region. Given the taxonomic composition of the assemblages, my main aim is to discuss to what extent they indicate the importance and development of fishing as well as fishing strategies and technologies. The issues that can be addressed with these assemblages are varied both culturally and ecologically. From this perspective, the data reported should contribute to enrich the ongoing debate on the historical ecology and human impact on coastal ecosystems.

Historical changes of ichthyofauna in Central-Eastern Baltic Sea: from 18th century till present

M. Plikshs

Abstract The distribution and occurrence of fish species is highly variable in space and time, and is driven by the interaction of individual life history and behaviour, recruitment, migration, predation, habitat availability, fishing pressure, seasonality and long-term climate change. The fish community of brackish Central-Eastern Baltic Sea and Gulf of Riga consists of species of various origins: marine, freshwater and diadromous as well as the glacial relicts. The first fish species was prepared in 1771 by Jakob Benjamin Fischer. From present percept it is not complete and mainly includes fishes used for human consumption or species that have been abundant or have well distinguishable morphological features. Later the list was updated several times and presently it includes 11 diadromous, 22 freshwater and 37 marine species. Based on available historic information we are evaluating how the fish species occurrence and abundance has changed comparing following periods: 1771-1791; 1858-1883, 1928-1936, 1953-1974, 1995-2003 and 2004-2015. First results of marine area fish biodiversity pattern historical analyses show that there are no significant changes in occurrence of freshwater and diadromous fish species, however marine origin species number has steadily increasing. Most pronounced increase is recorded after the second half of 20th century when open sea trawl fishery started to operate in the Baltic Sea. Recent changes in marine species abundance dynamic are closely linked to ecosystem changes in the Baltic Sea: reduction of North Sea waters inflow frequency, eutrophication and deoxygenation of deep basins.

The history of harbour porpoise exploitation in Northern Europe

Y. van den Hurk

Abstract The harbour porpoise (*Phocoena phocoena*) is both the smallest and the most abundant species of cetacean in Northern European waters. Since the species normally inhabits shallow waters close to the shore, it often came in close contact with humans. Medieval sources from several northern European countries, including England, France and Sweden, tell us that during the medieval period, the harbour porpoise was perceived as a high status food source and when caught or stranded was claimed by the local elite. Archaeological remains of the harbour porpoise are, when compared with remains from other cetacean species, relatively common in archaeological context in Europe and can therefore help us reconstruct not only the past range of the species, but also the activities undertaken to acquire these animals. One of the great uncertainties in the subfield of the archaeology of cetaceans, is the problem of finding out whether they were actively hunted or opportunistically exploited when stranded along the shore. By collating zooarchaeological data from Northern European archaeological sites where harbour porpoise remains have been uncovered ranging from the Mesolithic up to the Medieval period, it will be possible to see where they were exploited and by whom. Furthermore, it will be possible to see whether these animals were indeed perceived as “Royal Fish” and were only allowed to be consumed by people from higher class, aristocratic backgrounds.

Did they lose the taste for seals?

A.K. Hufthammer

Abstract Today there are no breeding seal populations in the county of Hordaland, Western Norway. However, seal bones recovered from prehistoric and historic settlement sites in the county illustrate that the common seal (*Phoca vitulina*) and the grey seal (*Halichoerus grypus*) were distributed in the region in the past. Written sources, i.e. The Gulathing law and accounts for the Bergen Castle, document that seals were important in the economy prior to 900 AD as well as in the early 16th century in western Norway. In this study bones from archaeological sites (rock shelters and urban deposits) and written and environmental sources provide data for an investigation of the prehistoric and historic distribution of the two seal species in the region, the importance of seal in the economy through time and the utilization of the seal with regard to meat, blubber and fur.

Analysis of historical landings of European anchovy (*Engraulis encrasicolus*, Linnaeus, 1758) in the Gulf of Trieste (Northern Adriatic Sea, Mediterranean)

D. Panzeri, T. Fortibuoni, P. Carpi, A. Santojanni, C. Solidoro, S. Libralato

Abstract Analysis of historical landings can provide insights on the evolution of fishing technologies and strategies and, under certain conditions, on long-term ecological changes and processes in marine ecosystems. We analyzed landings of the European anchovy fished by a traditional purse seine fishery in the Gulf of Trieste (Northern Adriatic Sea, NAS), from 1902 to 2014. According to historical sources, despite gradual improvements in fishing technology, the fishing system (*lampara* purse seine) and fishing grounds remained almost the same. To verify the strength of this hypothesis, a comparison with landings from Chioggia (hosting the largest fishing fleet of the NAS) was done. The seasonality of the resource estimated by the statistical decomposition of monthly time series for both Trieste and Chioggia data is similar till the 1960s. After this period, the midwater trawl (*volante*) was introduced in Chioggia targeting small pelagic fish and gradually substituted *lampara* nets resulting in significant change. Thus from analysis of seasonality of catches was possible to distinguish changes and differences in fishing strategy of the fleets: in Chioggia the fleet was, after the 1960s, expanding and following the resource, in contrast Trieste's fishermen "wait" the resource. We further reconstructed the technological creep and effort for this fishery and main environmental drivers affecting it. These findings have important implications since the species dynamics in the NAS can be reconstructed more easily using an integrated model based on Trieste's landings to estimate the incoming biomass of anchovy in the Gulf of Trieste over more than a century.

On the evolution of red shrimps, *Aristaeomorpha foliacea* and *Aristeus antennatus*, stocks in Italian northwestern waters

A. Ligas, A. Mannini, F. Masnadi, G.C. Osio, P. Sartor, M. Sbrana

Abstract The trawl fishery of red shrimps has been carried out in the Ligurian and northern Tyrrhenian Seas since 1930s. Since the very beginning of the fisheries, giant red shrimp, *Aristaeomorpha foliacea*, was reported as more abundant than blue and red shrimp, *Aristeus antennatus*, in the landings. However, the increasing fishing effort after the 2nd World War determined the crisis of the red shrimps' fisheries and a progressive change in the abundance of the two species. Blue and red shrimp became more abundant than giant red shrimp, especially in the Ligurian Sea. In contrast, giant red shrimp remained prevalent in the Tyrrhenian Sea, where the fishing effort occurring on the bathyal areas was lower. The present study is aimed at investigating the possible drivers (environmental, and anthropogenic) determining the segregation between Ligurian and Tyrrhenian Seas in terms of prevalent species in deep-water fisheries. The time series of MEDITS trawl survey data (1994-2015) was analysed, together with a selection of environmental and fishery variables, by means of Generalized Linear Models in order to investigate the relationships between biomass of red shrimps and environmental/anthropogenic drivers. The results of MEDITS data analysis confirmed the observations gathered from historical fisheries knowledge, showing that *A. antennatus* is prevalent where fishing effort is higher. This can be related to a higher resistance of blue and red shrimp to fishery impact. Also, environmental parameters play an important role as previously outlined in other areas of the Mediterranean (e.g. Catalan Sea and Ionian Sea).

Sclerochronology – a tool for reconstructing changes in the Adriatic and Mediterranean Seas?

M. Peharda

Abstract Sclerochronology is a developing interdisciplinary field that analyses structural elements as well as their geochemical composition of bivalves, fish, corals and algae and enables obtaining of environmental data from them. These data are of great importance for understanding of marine ecosystem-level processes and responses to climate variability. Majority of sclerochronological studies were conducted in the northern Atlantic and Pacific and there were very few studies on samples collected in semi-enclosed basins such as Adriatic and Mediterranean Seas. In recent years, several studies were conducted in the Adriatic Sea looking at shell structure and geochemical composition of several bivalve species and presentation will contain their review and current status. Target species were diverse with respect to their life history and population status – from commercially important Mediterranean scallop *Pecten jacobaeus* and smooth clam *Callista chione*, to legally protected *Lithophaga lithophaga*, and finally large and long lived (>50 years) bivalves *Glycymeris bimaculata* and *Glycymeris pilosa*. Methods applied include acetate peels of shell sections and analysis of stable oxygen isotopes in shell and advantages and disadvantages of each target species will be presented. Given its longevity and clarity of annual increments, *G. pilosa* is the best target for sclerochronological studies in the Mediterranean and has considerable potential for testing hypotheses relating to environmental variability and biological response.

Indicators of ecosystem health based on a time-dynamic food web model of the Black Sea

G.M. Daskalov

Abstract Over several decades the depletion of apex predators, blooms of microalgae and invasive species, and systemic overfishing resulted in series of regime shifts cascading through all trophic levels, disturbing ecosystem functioning and damaging the water environment in the Black Sea. I developed a time-dynamic food web model of the Black Sea, which was calibrated using long time-series of biomass of the main marine populations and fisheries catches. Composite multivariate indicators were developed based on the time-series outputs from the model. They accounted for the main trends in environmental quality, pelagic fish stocks and demersal and predatory fish stocks. The multivariate indicators demonstrated a good agreement with some generic metrics of ecosystem health derived from the trophic network analysis. They can be further used in assessments of ecosystem status and change.

3° Session

Management response to changes in the marine ecosystem and future scenarios

Evolution of the theory of rational fishing

S. Holt

Abstract Demersal fishing in the North Sea has a long and fairly well documented history. The Southern North Sea seems to be a biologically rich region in which all the coastal states around it have participated in the demersal fishing opportunities, especially operating near coasts in shallow waters. However, the expansion to deeper, offshore waters in the 19th century was mostly by English fishers, with Scottish involvement in the more Northerly zone. The expansion was generated by construction of railways and availability of manufactured ice, making it possible to provide fresh fish in good condition to the expanding densely populated areas of the industrial revolution. Towards the end of the century the entry of steam vessels caused further expansion and increase in fishing intensity. From the second half of the 19th century it became apparent that the expansion was changing the fish stocks. Annual catches did not increase in proportion to the increase in intensity, the average sizes of fish in the catches declined. These events stimulated much discussion and research about how to manage these fisheries, and that situation was strengthened by the establishment of the International Council for the Exploration of the Sea in the first decade of the 20th century. After the Second World War the idea of managing to obtain Maximum Sustainable Yields by setting Total Allowable Catch limits gained hold world-wide. In the last few years the EU has changed the target to limiting fishing intensity to some level less than would be needed to obtain MSY – a quantity which is still poorly and ambiguously defined. This 'less than' management policy has yet to be implemented, but when it is it will provide huge benefits to the economics of fishing but will also reduce the deleterious impact of industrialised fishing for preferred target species by reducing unwanted incidental catches of other species and harm to the marine environment generally.

Management practices and traditional knowledge of Japanese *ama* divers. An anthropological perspective

G. Bulian

Abstract This paper gives a preliminary overview of the management practices based on the traditional knowledge of Japanese *ama* fisherwomen, female divers who operate along the coastal and insular areas. In terms of exploitation of coastal resources, *ama* divers may be viewed to operate in a spectrum ranging from a single diver ('*funado* style') to different groups ('*kachido* style'), which are coordinated according to specific organizational modalities. These traditional fishing techniques are inextricably linked to the historical models of management organization of the local fishing communities and to a disparate constellation of socio-cultural practices (gender division of labour, rituals, ceremonies and other local traditions), economic policies and cross-scale coastal fisheries management systems (e.g. temporal restriction of harvest, community assessments, institutions). Starting from a multi-sited ethnography located along the coastal areas of Ise Bay and Shima peninsula, this paper outlines an ethnographic overview of the modalities in which *ama* divers relate creatively with their maritime environment through an operational and dynamic process of "creative indigenization" (Chevallier 1999), which constitutes an example of combination of 'new' and pre-existing elements of a small-scale fisheries system.

Trawling in the Mediterranean in the Modern period. Ancient instruments and politics for the development of these productions and the conservation of the resource

M.L. De Nicolò

Abstract This study examines various sources, even with references to the Ancient world, which reveal to the origin and evolution of some fishing methods that from the end of the 16th century contribute to an important development of this field. For the first time, we assisted in the formation along some coasts of the Mediterranean (Tyrrhenian and Adriatic) of fishing companies specialized in offshore fishing techniques transferring fishermen's trawl, already tested in the lagoon and lake areas, even far from the banks. At the same time, new ship types are built with the adoption of rigs, in order to improve sailing techniques in deep-sea, as well as new fishing nets are made. The development of these productions, especially in the 18th century, with the increase in the number of flotilla dedicated to trawl, fueled heated debate among expertise's: on one hand the deep-sea fishermen urged to increase production; on the other hand, other traditional coastal fishermen lined up to defend and preserve the fish fauna, respecting their biological cycle and more generally the marine environment. The conflict between the two categories drew the attention of governments, in relation to the protection of territorial waters from the devastating effects caused by instruments used to plow the seabed. Hence the periodic issuance of prohibitive or restrictive notices of fishermen's practices. The analysis of the legislation on the regulation of fisheries, since the 16th century, highlights the interest of government authorities, also in terms of case law, on a subject, that of the harvesting of the sea and its resource management, which remained hitherto of marginal interest in state politics. It highlights the role played by the Catalan, Provençal and, for Italy, the Gaeta first and then the Adriatic fishermen.

Community-based management in Mediterranean coastal fisheries: historical reminiscence or the root for new governance?

S. Raicevich, O. Giovanardi, T. Fortibuoni

Abstract Modern historical analysis describes several Mediterranean experiences of community-based fisheries management as being particularly effective in fostering the sustainable exploitation and the cohesion of fishermen communities. This figure contrasts with the current status of Mediterranean fisheries, where about 90% of stocks are overexploited. Can past experience guide our current approach to reshape fishing governance in this area? To answer this question, we compared the main attributes of selected fishing governance systems in the modern period to the evolution of EU Common Fisheries Policy (CFP). In particular, we focused on the Spanish *cofradías*, the French *Prud'homme* and the Venetian *fraglie*. These examples were characterized by access restrictions, including territorial users' rights for fishing, technical and market restrictions. Fishermen and their communities/corporations were directly involved in setting and enforcing management rules. This approach is rather different than EU CFP which, since its establishment in early 1980s, was mainly characterized by a top-down approach. Despite the progressive attempt to reduce fishing pressure and impose severe technical measures and control, Mediterranean fisheries are still in bad conditions. To cope with this, the EU CFP was recently reformed establishing a new paradigm that seeks to foster the derogation of power in the context of the so-called regionalization. However, this policy does not clearly establish a proper community-based approach and restricts participation to fishermen association. Without effectively engaging fishermen in this process, and re-establishing a sense of community through providing community-based rights for fishing, this new effort will likely not succeed in achieving Mediterranean fisheries sustainability.

Perceptions of marine litter: why should we try to understand the values, norms and worldviews of a small group of artisanal fishermen on the Mediterranean coastline?

R. Brennan, M. Portman, N. Carmi

Abstract The importance of research into perceptions of marine litter has increased in recent years. It is widely understood that without understanding the causes of marine litter, regulatory solutions will be challenged, that social norms are a driver of littering behavior and that littering behaviour is impacted by context-specific factors such as the waste management capacity and infrastructure, and general cleanliness, of an area. While it is important to identify and articulate perceptions, it is crucial to recognise that these are underpinned by interacting values, norms and worldviews. These underlying mental constructs, which are shaped by history, receive little or no attention in marine litter management strategies. Understanding such constructs is essential in order to tackle 'wicked' problems and increase their governability. Jisr-az-Zarqa ('Jisr') is the only exclusively Arab coastal town on the Israeli coastline. One of Israel's poorest communities, Jisr is allotted very limited space by the state in relation to its population size (13,800 residents within 1.6km²) and has large amounts of solid waste in public areas. A draft government plan proposes to develop the fishing 'village' area of Jisr into a national park. This research aims to identify points of intervention for waste planning and management approaches that could reduce the marine litter in and around Jisr's fishing village. In-depth face-to-face interviews were conducted with local fishermen and locally-based institutional representatives to elucidate the mental constructs underpinning waste management in Jisr. This presentation provides initial insights into the challenges posed to an effective marine litter strategy in Jisr.

Jetties at the inlets may temporarily slow down the local sea level rise facilitating the survival of salt marshes

S. Silvestri, G. Nordio, A. D'Alpaos, L. Carniello

Abstract Anthropogenic interventions and engineered structures play a crucial role in altering the biomorphodynamic of coastal systems, with consequences that can be observed at short to long timescales. In the present study, we investigate the effect of two anthropogenic interventions performed at the end of the 19th century in the northern Venice lagoon: i) the construction of the jetties at the Lido inlet (1870-1897); ii) the contemporary removal of reed barriers protecting a fish farm in the inner lagoon. Using a 2D numerical hydrodynamic model that incorporates different historical lagoon configurations, we investigated the effect of these interventions on the salt marshes of the northern lagoon basin. Interestingly our results show that the increased depth at the inlet induced by the jetties had a positive feedback on the stability of nearby marshes, by lowering the local mean sea level and increasing the tidal amplitude, thus locally contrasting the eustatic sea level rise for more than 30 years. On the contrary, salt marshes far from the inlet could not take advantage of this effect due to tidal wave dissipation occurring along shallow canals. In these inner areas the marsh elevation at the equilibrium state is highly reduced due to the low tidal excursion, making these marshes extremely vulnerable to changes in suspended sediment concentration and sea level rise. We show that the removal of reed barriers delimiting a fish farm area in the inner lagoon may have reduced the sediments available to the already low marshes thus contributing to their drowning.

Underwater archaeological parks are good for fishes? Two Azorean case studies on the way to discuss the symbiotic natural and culture heritage preservation

A.C. Garcia

Abstract The Azores, nowadays an ultra-peripheral region of the European Union, was in the past one of the most important passages in the North Atlantic navigation routes. The geostrategic point of this archipelago was for many sailing ships during the Modern age the last call before arriving to Europe on the returning voyages. In many cases this meant the success of trading enterprises by saving ships and cargos from enemies' attacks or from storms and in other situations helping crews and repairing ships for the long trips. This historical framework made nowadays Angra a classified underwater archaeological park with more than 80 shipwreck historically records and more than 15 identified archaeological sites. This regional classification had in mind the transformation of this sites in a protected area and at same time allowing the direct contact by the visitor with the underwater culture heritage and natural environment. The local laws prohibited spearfishing inside the limits of the park and this rule was one of the reasons way the local community ask for the classification of the Dori, a ship wreck sunk in S. Miguel island, one of the other archaeological parks of the Azores. But this situation is difficult to maintain and the maritime authorities had to be permanent vigilant. In this presentation, based on this two cases, we are going to discuss the ideal combine between culture heritage and natural environment preservation.

WATERCOLOR PAINTINGS

The hook that bridged the Adriatic and the Baltic Sea long-lines fisheries in late 19th century

L. Divari

Abstract In 1877 a Norwegian firm started producing hooks with a new mechanized process. Within few years the Mustad & Sons had been exporting their products worldwide, and also to Chioggia, in the northern Adriatic Sea. The local fishermen greatly appreciated the slender long hooks that resulted being very efficient to catch eels in lagoons by bottom long-lines. These hooks (locally called hooks for "*bisàti*" – i.e. eels) were also quite effective to catch other large-sized fishes whose specimens could be found in shallow waters, especially after the excavations and other works carried out in the 1880s near the seaward lagoon mouths, and in the open sea. Meanwhile, similar fishing activities, were established in different areas like the Baltic Sea, still adopting longlines and Mustad & Sons hooks. Fishing was carried out onboard of fishing vessels similar to those used in the Adriatic and targeting similar species and environment. In this contribution, fishing techniques and target species according to habitat are being compared between the Northern Adriatic Sea and Southern Baltic Sea long-lines fisheries, reflecting on the convergence that was established by simply adopting the same hook.

POSTERS

1° section

Umberto D'Ancona (1896-1964) between fishery and marine biology

E. Canadelli

The study of the Italian zoologist Umberto D'Ancona (1896-1964) allows historians to understand the growth and development of marine studies in the first half of the Twentieth century on a local, national, and international scale. His life and work help us to point out the involvement of scientists in the study and management of marine resources in a specific area such as the Venetian Lagoon and the upper Adriatic Sea. D'Ancona published important studies in the area of complex ecological interactions, focusing on variations and fluctuations in the fish stocks of the upper Adriatic Sea and on their impact on the markets of Trieste, Fiume, and Venice, which were a consequence of the forced moratorium on fishing during World War I. He was a member of the Royal Italian Thalassographic Committee and professor of Zoology at the University of Padova. In 1940 he founded the Hydrobiological Station of Chioggia. D'Ancona joined international committees such as the Commission for the Scientific Exploration of the Mediterranean Sea, the UNESCO Commission for Oceanography, and the FAO's General Fisheries Council for the Mediterranean. In 1947 he became a member of the Governing Council of the Institute of Adriatic Sea Studies and in 1953 director of the CNR's Thalassographic Center in Venice. The poster aims at presenting an ongoing research on the contributions given by D'Ancona in the areas of hydrobiology, oceanography, marine biology, fisheries management and conservation of fish stocks, topics which remain as relevant today as they were in his time.

Sea shells from the past. The case study of the Roman Villa in Via Neroniana at Montegrotto Terme

P. Cisotto

Archaeozoology and archaeomalacology are quite recent "discoveries" for classical and middle-age archaeology. These disciplines, together with iconographic and literary sources, can be really useful to describe diets, habits, productive processes and trades among old societies. This multidisciplinary point of view aimed the University of Padova archaeological team during the ten years of digging carried out in Via Neroniana at Montegrotto Terme (PD) to give a real and vivid picture of the great Villa of Tiberian age and beyond discovered there. More than one thousand shells were collected and studied. They can be ascribed to 38 taxa and among them 16 are of sea shells, for a total amount of 492 samples used in the past for diet and/or as ornament. In our site, the employ of malacofauna as ornament was really restricted to the production of a few pendants using *Pecten jacobaeus*, *Glycymeris* spp. and *Spisula subtruncata* and to the collection of a *Nassarius reticulatus* shell and of a record-sized *Acanthocardia aculeata* valve. This one was found in the middle-age necropolis that developed together with a small village inside the area of the roman villa. *Donax trunculus*, *Flexopecten glaber*, *Bolinus brandaris brandaris*, *Hexaplex trunculus* and *Ostrea edulis* were used for food revealing not only rich banquets, but also a probable worship use of shell consumption. Murexes and Oysters probably derived from *vivarìa* in North-West Adriatic sea, and Oysters are still carrying signs that can be referred to a farming on twigs and on tile or amphora fragments.

The dusky grouper in Tavolara – Punta Coda Cavallo Marine Protected Area (Sardinia, Italy): present knowledge and future perspectives

E. Desiderà, L. Di Iorio, P. Guidetti, C. Mazzoldi, A. Navone

Groupers play worldwide a key ecological and economical role. They are highly vulnerable to fishing due to their slow growth rates, late sexual maturity, hermaphroditic sexual pattern, and reproduction via spawning aggregations. The dusky grouper, *Epinephelus marginatus*, inhabits rocky reefs in the Atlantic Ocean and the Mediterranean Sea. Due to the impact of professional and recreational fishing, this species is critically endangered. Marine protected areas (MPAs) are an efficient tool for grouper conservation. In the Mediterranean Sea, the dusky grouper is larger in size and more abundant in MPAs than in nearby unprotected areas, thus enhancing the stock reproductive output and promoting population replenishment. Moreover, in Mediterranean MPAs, the dusky grouper has become a relevant flagship species for non-consumptive uses, like diving. The present knowledge on reproductive dynamics of groupers is built on studies conducted in tropical waters. Little is known about the characteristics and historical occurrence of dusky grouper spawning aggregations in the Mediterranean. This project, carried out at Tavolara–Punta Coda Cavallo MPA (Sardinia, Italy), aims at 1) filling this gap by collecting local ecological knowledge of fishermen to reconstruct past occurrences of spawning aggregations and abundance/size distribution patterns, and studying behaviour and vocalization of dusky groupers in the spawning aggregations; 2) evaluating the efficiency of MPA protection measures on grouper reproduction by comparing abundance, sex-ratio and size of dusky grouper aggregations inside and outside the MPA; 3) estimating the value of protected grouper aggregations for fishery, through their reproductive output, and SCUBA diver, as attractions.

The Mar Piccolo of Taranto: historical development of an almost totally enclosed basin

A. Giordano

Mar Piccolo is a portion of the Ionian Sea (km 8x3 ca.) separated from it by the city of Taranto. A single natural canal connects this stretch of water to the rest of the sea. Across the centuries Mar Piccolo has been used in several ways. We know that in Greek and Roman times it was famous for the abundance of a shellfish which were used to colour dresses and cloth red. During the Middle Age, Taranto and Mar Piccolo became very important for fishing and shellfish harvest. In fact, the sovereign (the Prince of Taranto and then the King of Naples) always held on to the property of Mar Piccolo and watched over its overexploitation. In order to keep the sea rich of natural resources, in XV century they started collecting fishing traditions, rules and prohibitions (and taxes on catches for every kind of fish) in a manuscript called “Red Book of the Royal Fish-Custom”. From this document we can learn a lot about fishing in this sea in the different ages (XV-XIX) and about the behavioral changes of the administration across the centuries. Between the end of XVIII and the beginning of XIX century, the most of Mar Piccolo was turned in sea-grounds devoted to mussel farming. After the Italian Unification, in 1861, Mar Piccolo became an important military port and dockyard. After Second World War, Taranto was chosen as location for the biggest steelworks in Europe, which is still cause of a devastating pollution for aquifers, rivers and, so, for Mar Piccolo.

Devils or saints: disentangling fishermen vs. public perceptions towards cetaceans in the Greek society

I. Giovos, K. Gantias, M. Garagouni, J. Gonzalvo

Common bottlenose (*Tursiops truncatus*) and occasionally short-beaked common dolphins (*Delphinus delphis*) in Greece exhibit a coastal distribution interacting regularly with fisheries. This may generate conflict that in some countries may lead to intentional dolphin culls for retaliation. The study aims at assessing the attitude of both public and small-scale fishermen towards cetaceans in Greece. For the public, an online questionnaire prepared, consisted of 3 demographic questions and a three level Likert-scale statement "Hunting dolphins/whales is wrong". Fishermen from the Aegean and the Ionian Seas were personally interviewed and asked about their age, working years, their attitude towards cetaceans, the damage caused by dolphin depredation and if they would accept scientists on-board. 270 public questionnaires and 130 fishermen interviews were collected. Most questionnaire respondents (~87%) manifested a positive attitude towards cetaceans, although their responses were highly age-dependent. Until 1960, the Greek government was subsidizing dolphin culling as a measure to protect small-scale fishery. Hence, 24% of people above 50 years old, who were kids/adolescents during culling times, accepted dolphin hunting as a legitimate activity. Contrarily, the vast majority (90%) of the fishermen had a negative attitude towards cetaceans. Further, 96% of the fishermen in the Ionian were positive in accepting a scientist on board for estimating the damage caused by dolphins versus 43% in the Aegean. During the last 25 years Tethys Research Institute has been running a dolphin conservation project in the coastal waters of the Ionian Sea. The trusting relationship developed over the years between researchers and local fishermen explains why Ionian fishermen were more receptive towards collaboration. Our findings suggest that attitudes towards cetaceans can gradually improve if public education and awareness initiatives are regularly organized.

The fishing economy in ancient times: goods and amphorae for the Adriatic trade

S. Mazzocchin, S. Cipriano

In Roman times the fishing and fish farming and processing of the fish represented a significant economic role. The ancient sources in fact describe the procedures for fish salting and for the preparation of fish sauce (*salsamenta*) and the different varieties (*garum*, *allec*, *liquamen*). The latest archaeological research has committed to identify what was the container for the transport of fish sauces in the Adriatic, as in the western Mediterranean, where some number of amphorae were used to transport and trade fish sauces. The results show that in some cases were reused amphora that had already transported for example wine, placing on the container a writing (*titulus pictus*), which warned that the type of foodstuff transported was not the one suggested by the shape of the amphora. Recent typological and epigraphical studies on the numerous *tituli picti* have identified in the "small Adriatic fish amphorae" the container for the trade of the Adriatic fish sauces.

Where sharks met humans: the Mediterranean Sea, history and myth of an ancient interaction between two dominant species

A.R. Mojetta, A. Travaglini, U. Scacco, M. Bottaro

The Mediterranean Sea can be considered the first environment where human species (and its ancestors) and sharks have raised their interaction: here, in fact, the evolution of sharks and their relatives can be traced back until 5.4 million years ago. The first evidence can be identified in the Bronze age with the development of fishing communities in the eastern Mediterranean, whose fishing techniques allowed the capture of species pelagic, like lamnidae and hammerhead sharks. Later, interactions between humans and sharks had been becoming more evident, as demonstrated by the "Crater of the sinking," a painted vase of the VIII century BC coming from the necropolis of Pithechusa, the ancient Ischia. In the Roman age, sharks were part of many artistic representation of fishing, like in the two ancient mosaics of Pompei, where catsharks (*Scyliorhinus* spp.) are visible among the coastal marine fauna. After the end of the Roman Empire naturalistic observations were replaced by mysticism and superstition. Olaus Magnus (1539) restarted the study sharks and their relatives, followed by others researchers operating in the Mediterranean, like Guillaume Rondelet (1554). From this period of renewed scientific interest, it is worth to note the presence of a rostrum of a sawfish, *Pristis* spp., in an important church of Naples: according to the ancient engraving under the rostrum, the sawfish was killed by local mariners in 1573 in the Sebeto river, providing a very interesting element for the debate on the possible historical occurrence of the genus *Pristis* in the Mediterranean area.

Data about navigation and fishing from graffiti in orthodox churches in Nessebar, Bulgaria

P. Peev

In Nessebar, Bulgaria there are two preserved orthodox churches which give us extremely valuable information about marine life and navigation in the Black Sea region. The first one "St. Stefan" was built initially in the 11th-13th c. but later during the period 16th-18th c. was reconstructed and widened. The second one "St. Spas" (or "Ascension") was built in 1609. In the Late Medieval churches have very well preserved luxurious wall paintings which could to be associated with navigation and fishing along the Bulgarian Black Sea coast. In graffiti scenes are performed images of sea-going vessels as well fishing scenes. The information of church's graffiti is very important because the navigation in the Black Sea during the Late Medieval Age is poorly studied because of lack of data in the written sources and historical documents.

Changing practices, perceptions and preconditions of coastal fisheries in the Finnish Archipelago Sea Region

P. Salmi

This presentation focuses on changes in the use of fish resources and its interrelationships with societal and natural transformations in the Baltic Sea setting within the last 150 years. The study area, the Finnish Archipelago Sea Region, consists of unique coastal landscape with shallow water areas between thousands of islands and islets. Fishing income was traditionally combined with shipping and small-scale agriculture, but today fishing families' income combinations are more diverse. The fishing livelihood in the archipelago is typically seasonal operation and targets several fish species with e.g. gill nets. Extraction of fish resources has been of utmost economic and cultural importance in the Archipelago Sea Region: fisheries contributed to habitation of outer parts of the region at the turn of the 20th century. In mid-20th century fishing started to lose its profitability and many islands became desolated. Decline in the fishing employment was due, for instance, to technical development, urbanization and industrialization of the society. In the 1970s a new innovation, fish farming in net cages, compensated for the decline of capture fisheries. At the same time the production landscape of fishing peasants began its change towards one of leisure and nature conservation. This 'post-productivist' transformation contained not only an increase in the competition of space, but also a remarkable change in people's perceptions and values about the use and governance of fish resources. This analysis is based on a wide collection of published articles, books and documents, together with unpublished interview material illuminating the most recent transformations.

2° section

Time series of fishery data as a tool to monitor the response of thermophilic species to climate changes

A. Barausse, C. Mazzoldi

Global warming, and specifically the increase in seawater temperature, is causing changes in marine species distribution, and the occurrence of thermophilic species in northern waters is becoming a common phenomenon. However, changes in species distribution are often inferred from occasional recordings, while more systematic information is still scarce. In this context, fishery data represent a valuable tool to better understand changes in marine communities, especially for commercial species, despite the well-known biases of this kind of data. The reason is that commercial fisheries target large areas with high effort and fishing records cover long time spans, and therefore fisheries are comparable to an intense and widespread sampling activity. Here we present the use of an open-access database of time series of fishery data to evaluate and monitor the spreading of thermophilic species in the northern Adriatic Sea, Mediterranean. We use the Clodia database, which contains the landings of fishing vessels in Chioggia (Italy), representing the main fleet of the entire northern Adriatic Sea. Data from 1997 to present highlighted the first recording or an increase of the landings of four thermophilic species: *Pomatomus saltatrix*, *Lepidopus caudatus*, *Sphyræna* spp. and *Coryphaena hippurus*. Since this increase can be explained by an increase in the abundance of these species in the target area but also by other processes, for example by a change in their commercial value, we analyzed landings in relation to several potential predictors such as fishing effort, the prize of landings at the fish market of Chioggia, and seawater temperature.

The impact on the zooplankton abundance and diversity in a coastal region after a mining dam rupture disaster at the Doce River, Southeast Brazil

L.L. Fernandes, J.B. Pereira

Mesozooplankton plays a key role in marine ecosystems given their ability to control the phytoplankton population, regenerating nutrients and export biogenic matter to the sediment. Fish populations can be affected by variations in the zooplankton community, with important economic consequences. Knowing how the distribution of marine planktonic species are limited by the bio-geophysical characteristics of the pelagic environment is crucial to understanding the ecological properties of regional ecosystems and their potential responses to changes in the environment. Favourable conditions may contain certain species that can help to overcome others, while specimens that cannot escape the unfavourable conditions suffer stress and an increase in mortality. Mesozooplankton was sampled in the coastal region at the Doce River, Southeast Brazil, after the worst mining dam disaster ever recorded in Brazilian history. Samples were collected using a WP2 plankton net fitted with a 200-micron mesh and a mechanical flowmeter, and preserved in a 4% buffered formaldehyde for further analysis. Results showed an increase in abundance right after the disaster with more than 222.959 ind.m⁻³ at the river mouth, a two-hundred-fold increase over the past year at a station nearby, with two copepod species, *Parvocalanus scotti* and *Oithona nana*, making up to 80% of this total abundance. A decrease in species richness and diversity was also observed in the sampling area. A significant impact on the zooplankton community was observed due to the mining residues that reached the coastal area of the Doce River with possible consequences for the entire local food web.

Deep sea Impact. How Human activities affect the Deep Sea Ecosystem

M. Peruzzo

Deep sea ocean apparently represents endless reserves of resources for human kind. Is a common target both for exploration and exploitation. But we are far to perceive threats when they are happening below certain deeps, nevertheless, when accident like Deepwater Horizon oil spill of 2010 in the Gulf of Mexico happened, we still can see worrisome effects after 6 years in “our own garden”, the coast of southern states of USA, and this can rise attention and needs for a better understanding of our actions. South Adriatic Sea had been used as dumping area for chemical weapons and a fully consciousness of consequences of the disposal and toxicity of those pollutants to deep-sea organisms, and the trophic nets that are involved, it's far do be achieve. It's not wrong to fear that ocean acidification and climate changes will have different and perhaps more seriously effect in enclosed areas where exchanging of water masses is limited due to geographical characteristics. These all are subject that have been under observation for many years. Right now technological advances can help address these challenges: we need to fill knowledge gaps, better define climate change uncertainties, develop new approaches to conserve the biodiversity and ecosystem services we value in the deepest half of the planet.

A rising tide of marine disease? Unraveling the dynamics of infection in a changing ocean

C. Wood

Recent decades have seen explosions of infectious disease among marine organisms, including die-offs of sea stars on the west coast of North America, endangered black abalone in California's Channel Islands, sea urchins in the Caribbean, and pilchards in Australia. These events appear to be increasing in frequency and magnitude, so it is only logical to ask: are human activities to blame? Are such events natural, or is disease transmission intensified by biodiversity loss, climate change, and other impacts? To understand temporal patterns in disease prevalence requires that we contrast contemporary conditions against appropriate “baseline” data, which can be difficult to come by. To date, my research program has circumvented this problem by quantifying marine disease across spatial variability in human impacts. My ability to do the same across time – to “hindcast” disease change – has been limited by an absence of historical data on marine disease. I am now embarking on a new research program designed to “turn back the clock”, generating primary data on the dynamics of marine disease over long time profiles and at unprecedented temporal, spatial, and taxonomic resolutions. I will extract information on historical marine diseases from the biological collections of museums around the world, where wet preparations preserve parasites alongside their fish hosts. This new project will provide the world's first glimpse of disease dynamics in a “pristine” ocean, and will indicate whether contemporary oceans are experiencing a rising tide of disease.

3° section

Rediscovering old fishing tradition in Sicily: history and culture of small-scale fishery

F. Andaloro, T. Romeo, P. Battaglia, E. Incontro

The fishermen knowledge as well as historical and archaeological data, are a relevant source of information on the ancient fishing catches, techniques and gears. This information is important to describe the ancient biodiversity and can be also utilized in the development of new sustainable strategies. The small scale fishing using only spears, fixed nets, traps, harpoons, hooks and others simple devices was an ancestral human activity based on a harmonious relationship with marine environment and its biodiversity. By contrast, modern fishing activities, are dominated by the tendency to maximize profits, developed industrial fishing and the market globalisation, thus penalising traditional fishing activities and driving them in a state of crisis. In south-eastern Sicily, the fishery represents, since Paleolithic age, one of the oldest human activity and developed, through centuries, also with important fishing methods such as tuna traps and FADs, called "*cannizzati*", to catch dolphinfish. The results of this study on historical fishing in this zone underline the evidence of a fishing lore anthropology as well as numerous architectural vestiges that need to be recovered and safeguarded. To revive, today, the fishing culture, before it is irretrievably lost, must be a priority of a great cultural value than can no longer postponed. This cultural heritage can represent, also, a base to develop integration between the fishing and the touristic activity as is recommended in the new Fishing European Policy by FEAMP.

Management response to changes in the marine ecosystem and future scenarios

P. Battaglia, P. Perzia, V. Esposito, P. Consoli, F. Andaloro, T. Romeo

Development of the Italian swordfish harpoon fishery as well as crisis reasons, related management actions and new possible scenarios are analyzed. The swordfish harpoon fishing has been practiced in Italian waters (Strait of Messina and nearby areas) since ancient times. During these centuries, this fishing has maintained its artisanal features, although some technological innovations have been welcomed during the last decades. The unsustainable competition with modern fishing activities (longlines, driftnets and related illegal gears) determined a drastic decrease of harpoon fleet: the number of vessels in the area was 310 at the end of the 19th century and 13 in the 2016. The negative effects of the rapid increase of global fishing effort on Mediterranean swordfish, during the second half of 20th century, were in part attenuated by recent new European regulations, such as the ban of driftnets and the temporal limitations to the use of longlines to avoid the catch of juveniles. Indeed, CPUE values for the period 2002–2014 show a positive trend, after the marked reduction in catches reported during the previous 25 years. Swordfish harpoon fishing cannot be compared with other modern fishing activities in terms of catches or revenues, however it has a great social, cultural and historical importance and for these reasons the correct management of swordfish stock and this fishing activity are crucial points to be addressed. The analysis of current management actions and regulations as well as problems and critical issues highlights that illegal fishing is the main threat for the survival of harpoon fishing.

Changes in marine ecosystem: evaluating the impacts of climate change and developing adaptation strategies using application of e- governance and ICTs for protection and sustainable exploitation of coastal and marine resources

K. Chaudhari, P.T. Karule, A.G. Bhole

The Information and Communication Technologies plays an important role in rural development. The Empowerment of coastal communities is crucial for the development of the marine resources. Brining the coastal population along the coastal region in to the mainstream of the digital technologies for the assessing the impacts of climate change on marine resources and mitigation is a major concern now. Evaluation of the climate change and its impact is a complex process based on the real time data analysis related to climate, natural recourses and socio- economic conditions along coastal region. In order to provide the people along coastal region with better prospects and opportunities for economic development, aquaculture development and management; increased participation of people along coastal region in electronic governance through information and communication technologies are envisaged. This paper aims to explore the nature, role and relevance of the Electronic/Digital Governance using ICTs for assessing the impacts of climate change and mitigation for marine resources along coastal region and its impacts to highlight approaches and methods for improving local environmental governance, having particular regarding to the range of interests and actors involved in socio-political process. The paper will examine the current status of marine ecosystem along Indian coast in different coastal regions for the assessment of impacts of climate change and natural disasters along coastal regions.

Evaluating the attitudes of common people towards sharks: a key to promote shark conservation

I. Giovos, L. Endrizzi, D. Borme, C. Brito, C. Mazzoldi

Sharks have always reawakened contrasting feelings in human, from fear to attraction. The occasional occurrence of shark attacks against people and the message regarding these species delivered by books and movies reinforce the picture of animals dangerous for human. On the other hand, shark constitute commercial species, in some context of high value (for instance, shark fin trade) and their exploitation led them to severe depletion worldwide. To promote shark conservation, the attitude of common people towards these animals should be evaluated and then programmes to raise public awareness should be developed. To this aim, we set up an online multilingual questionnaire to be diffused in different countries. The questionnaire, completely anonymous, is composed by three parts. The first part is constituted by some demographic and general information of the responders. The second part includes 13 statements used to measure the attitude of the responder towards sharks. The 13 statements used are based on the classic study of Kellert (1996), in which he describes the attitudinal dimensions towards wildlife. The third part aims at evaluating the knowledge of the responder towards sharks, and will be used to analyse how knowledge can affect the attitude. Results of the questionnaire will be compared among countries, range of ages and background of the responders. For further information, to participate to and help in diffusing the questionnaire: www.tshark.org/questionnaire.

The use of time series in population dynamics models: tools to support the management of elasmobranchs in the Adriatic Sea

C. Zampierin, A. Barausse, F. Colloca, C. Mazzoldi

Global fishery statistics show that catches have remained constant over the past years, following either the collapse or the overexploitation of many fish stocks. International policies are pushing so that fishing activities are pursued at sustainable levels and management measures are based on sound scientific information. In this context, mathematical models represent a valuable decision support tool to develop more effective management plans. This study illustrates the role of long-term time series of landings to support the development of population dynamic models for commercial species. Specifically, we developed models for two commercial smooth-hound sharks, *Mustelus mustelus* and *M. punctulatus*, as a contribution to their management and conservation in the Adriatic Sea, a semi-enclosed and human-impacted basin where top predators, including sharks, have suffered from a marked decline over the past centuries. We assess the status of these *Mustelus* spp. by developing mathematical models based on available time series of fishery data such as FAO and Chioggia records (fishing pressure, landings, size distribution). We first assess the sustainability of the Adriatic *Mustelus* spp. fishery by calculating the Maximum Sustainable Yield according to different formulations. Then, we develop several population dynamics models, ranging from classical to more complex equations including ecological factors (temperature, prey availability), and carry out an information theory analysis to select the model that best agrees with available records. All analyses indicate that *Mustelus* spp. are overfished in the study area. Consequently, we provide management advices by running the developed models under possible future scenarios and by underlining the missing information required to improve our understanding of *Mustelus* spp. population dynamics.

LIST OF CONTRIBUTORS

<p>Franco Andaloro Italian National Institute for Environmental Protection and Research, Palermo (Italy) e-mail: andalorofranco@virgilio.it</p>	<p>Inês Amorim Faculty of Arts of University of Porto/CITCEM, Transdisciplinary Centre of Culture, Space and Memory (Portugal) e-mail: inesamorimflup@gmail.com</p>
<p>Alberto Barausse Environmental Systems Analysis Lab (LASA), University of Padova (Italy) e-mail: alberto.barausse@unipd.it</p>	<p>Pietro Battaglia Italian National Institute for Environmental Protection and Research, Palermo (Italy) e-mail: pietro.battaglia@isprambiente.it</p>
<p>Diego Borme National Institute of Oceanography and Experimental Geophysics, Trieste (Italy) e-mail: dborme@inogs.it</p>	<p>Massimiliano Bottaro Italian National Institute for Environmental Protection and Research, Rome (Italy) e-mail: Massimiliano.bottaro@isprambiente.it</p>
<p>Ruth Brennan Technion - Israel Institute of Technology (Israel) e-mail: ruth.brennan@sams.ac.uk</p>	<p>Cristina Brito CHAM Portuguese Center for Global History FCSH/NOVA University, Lisbon (Portugal) e-mail: escolademar@gmail.com</p>
<p>Giovanni Bulian Department of Asian and North African Studies Ca' Foscari University of Venice (Italy) e-mail: giovanni.bulian@unive.it</p>	<p>Maria Stella Busana Department of Cultural Heritage University of Padova (Italy) e-mail: mariastella.busana@unipd.it</p>
<p>Elena Canadelli Department of Biology, University of Padova (Italy) e-mail: elena.canadelli@unipd.it</p>	<p>Nurit Carmi Technion - Israel Institute of Technology (Israel) e-mail: nuritcar@telhai.ac.il</p>
<p>Luca Carniello Department of Civil, Environmental and Architectural Engineering, University of Padova (Italy) e-mail: luca.carniello@dicea.unipd.it</p>	<p>Piera Carpi Centre for Environment Fisheries and Aquaculture Science, Lowestoft (United Kingdom) e-mail: piera.carpi@cefas.co.uk</p>
<p>Kalpana Chaudhari Institute For Sustainable Development and Research, ISDR (India) e-mail: isdrklc@hotmail.com</p>	<p>Silvia Cipriano Department of Cultural Heritage, University of Padova (Italy) e-mail: silvia.cipriano@museodellacenturiazione.it</p>
<p>Paola Cisotto Department of Biology, University of Padova (Italy) e-mail: paola.cisotto@unipd.it</p>	<p>Francesco Colloca National Research Council, Institute for coastal marine environment (Italy) e-mail: francesco.colloca@iamc.cnr.it</p>
<p>Giorgi M. Daskalov Institute of Biodiversity and Ecosystem Research, Sofia (Bulgaria) e-mail: georgi.m.daskalov@gmail.com</p>	<p>Andrea D'Alpaos Department of Geosciences, University of Padova (Italy) e-mail: andrea.dalpaos@unipd.it</p>
<p>Maria Lucia De Nicolò Department for the Cultural Heritage, University of Bologna (Italy) e-mail: marialucia.denicolo@unibo.it</p>	<p>Elena Desiderà Department of Biology, University of Padova (Italy) e-mail: elena.desidera@gmail.com</p>
<p>Lucia Di Iorio Chorus – Exploring underwater soundscape, Grenoble, (France) e-mail: lucia.diiorio@chorusacoustics.com</p>	<p>Luigi Divari Expert of traditional fishing in the Adriatic Sea and watercolor painter e-mail: luigi.divari@alice.it</p>

<p>Lara Endrizzi Department of Biology, University of Padova (Italy) e-mail: lara.endrizzi@gmail.com</p>	<p>Luiz Loureiro Fernandes Universidade Federal do Espírito Santo, Dep. de Oceanografia e Ecologia, Vitória (Brazil) e-mail: luiz.ufes@gmail.com</p>
<p>Tomaso Fortibuoni Italian National Institute for Environmental Protection and Research, Chioggia (Italy) National Institute of Oceanography and Experimental Geophysics, Trieste (Italy) e-mail: tomaso.fortibuoni@isprambiente.it</p>	<p>Sonia Gabriel Laboratório de Arqueociências, Direção Geral do Património Cultural, Lisboa (Portugal) e-mail: sgabriel@dgpc.pt</p>
<p>Kostas Gantias Laboratory of Ichthyology, Department of Biology, Aristotle University of Thessaloniki (Greece) e-mail: kgantias@bio.auth.gr</p>	<p>Maria Garagouni University College Cork (Ireland) e-mail: maria.gkaragkouni@ucc.ie</p>
<p>Ana Catarina Garcia CHAM Center for Global History, Universidade Nova de Lisboa (Portugal) e-mail: catarinagarcia@gmail.com</p>	<p>Ruthy Gertwagen The University of Haifa (Israel) e-mail: ruthygert@gmail.com</p>
<p>Andrea Giordano Independent researcher (PhD at Università degli Studi "Federico II" di Napoli) e-mail: andrea.jordan@libero.it</p>	<p>Otello Giovanardi Italian National Institute for Environmental Protection and Research, Chioggia (Italy) National Research Council - Institute of Marine Sciences, Ancona (Italy) e-mail: otello.giovanardi@isprambiente.it</p>
<p>Ioannis Givos iSea - Non Profit Non-Governmental Organisation for the Protection of the Aquatic Ecosystems (Greece) e-mail: ioannis.givos@gmail.com</p>	<p>Joan Gonzalvo Tethys Research Institute, Milan (Italy) e-mail: ioan.gonzalvo@gmail.com</p>
<p>Paolo Guidetti Université Nice Sophia Antipolis e-mail: Paolo.GUIDETTI@unice.fr</p>	<p>Poul Holm Department of History, Trinity College of Dublin (Ireland) e-mail: holmp@tcd.ie</p>
<p>Sidney Holt e-mail: sidneyholt@mac.com</p>	<p>Anne Karin Hufthammer The University Museum, University of Bergen (Norway) e-mail: anne.hufthammer@uib.no</p>
<p>Enzo Incontro</p>	<p>Simone Libralato National Institute of Oceanography and Experimental Geophysics, Trieste (Italy) e-mail: slibralato@inogs.it</p>
<p>Alessandro Ligas Centro Interuniversitario di Biologia Marina ed Ecologia Applicata, Livorno (Italy) e-mail: ligas@cibm.it</p>	<p>Brian MacKenzie National Institute of Aquatic Resources (DTU Aqua), Technical University of Denmark (Denmark) e-mail: brm@aqu.dtu.dk</p>
<p>Alessandro Mannini Joint Research Centre, Ispra (Italy) e-mail: Alessandro.Mannini@unige.it</p>	<p>Stefania Mazzocchin Department of Cultural Heritage, University of Padova (Italy) e-mail: stefania.mazzocchin@unipd.it</p>
<p>Francesco Masnadi University of Bologna (Italy) e-mail: francesco.masnadi@studio.unibo.it</p>	<p>Carlotta Mazzoldi Department of Biology, University of Padova (Italy) e-mail: carlotta.mazzoldi@unipd.it</p>

<p>Angelo R. Mojetta Istituto per gli Studi sul Mare, Milan (Italy) amojetta@tin.it</p>	<p>Arturo Morales Muñiz Laboratorio Arqueozoologia (Dept. Biología), Universidad Autónoma de Madrid (Spain) e-mail: arturo.morales@uam.es</p>
<p>Augusto Navone Marine Protected Area “Tavolara-Punta Coda Cavallo” (Italy) e-mail: direzione@amptavolara.it</p>	<p>G. Nordio Department of Civil, Environmental and Architectural Engineering, University of Padova (Italy)</p>
<p>Giacomo Chato Osio Joint Research Centre, Ispra (Italy) e-mail: giacomo-chato.osio@jrc.ec.europa.eu</p>	<p>Diego Panzeri National Research Council – Institute of Marine Sciences, Ancona (Italy) National Institute of Oceanography and Experimental Geophysics, Trieste (Italy) e-mail: diegopanzeri10@hotmail.com</p>
<p>Preslav Peev Institute of Oceanology, Bulgarian Academy of Sciences, Varna (Bulgaria) e-mail: peev@io-bas.bg</p>	<p>Melita Peharda Institute of Oceanography and Fisheries, Split (Croatia) e-mail: melita@izor.hr</p>
<p>Juliano Bicalho Pereira Departamento de Oceanografia e Ecologia, Universidade Federal do Espírito Santo, Vitória (Brazil)</p>	<p>Mariano Peruzzo Marine Biological Association of UK, Plymouth (United Kingdom) e-mail: marper@mba.ac.uk</p>
<p>Bruno Pinto MARE Marine and Environmental Sciences Centre, University of Lisbon (Portugal) e-mail: bmpinto@fc.ul.pt</p>	<p>Maris Plikshs Institute of Food Safety, Animal Health and Environment BIOR (Latvia) e-mail: maris.plikss@bior.lv</p>
<p>Amelia Polónia Department of History, University of Porto (Portugal) e-mail: amelia.polonia@gmail.com</p>	<p>Michelle Portman Technion - Israel Institute of Technology (Israel) e-mail: michellep@cc.technion.ac.il</p>
<p>Saša Raicevich Italian National Institute for Environmental Protection and Research, Chioggia (Italy) National Research Council - Institute of Marine Sciences, Ancona (Italy) e-mail: sasa.raicevich@isprambiente.it</p>	<p>Teresa Romeo Italian National Institute for Environmental Protection and Research, Milazzo (Italy) e-mail: teresa.romeo@isprambiente.it</p>
<p>Pekka Salmi Natural Resources Institute Finland (Luke), Turku (Finland) e-mail: pekka.salmi@luke.fi</p>	<p>Alberto Santojanni Institute of Marine Sciences, National Research Council, Ancona (Italy) e-mail: alberto.santojanni@an.ismar.cnr.it</p>
<p>Mario Sbrana Centro Interuniversitario di Biologia Marina ed Ecologia Applicata, Livorno (Italy) e-mail: sbrana@cibm.it</p>	<p>Paolo Sartor Centro Interuniversitario di Biologia Marina ed Ecologia Applicata, Livorno (Italy) e-mail: sartor@cibm.it</p>
<p>Umberto Scacco Italian National Institute for Environmental Protection and Research, Rome (Italy) e-mail: umberto.scacco@isprambiente.it</p>	<p>Sonia Silvestri Nicholas School of the Environment, Duke University (United States of America) e-mail: sonia.silvestri@duke.edu</p>
<p>Cosimo Solidoro National Institute of Oceanography and Experimental Geophysics, Trieste (Italy) e-mail: csolidoro@inogs.it</p>	<p>Andrea Travaglini Stazione Zoologica di Napoli “Anton Dohrn”, Naples (Italy) travagli@szn.it</p>

<p>Youri van den Hurk University College London (United Kingdom) e-mail: yourivandenhurk@gmail.com</p>	<p>Rita Vianello Ca' Foscari University of Venice (Italy) e-mail: rita.vianello@unive.it</p>
<p>Chelsea Wood School of Aquatic and Fishery Sciences, University of Washington (USA) e-mail: chelwood@uw.edu</p>	<p>Chiara Zampierin Department of Biology, University of Padova (Italy) e-mail: zampierin.c@gmail.com</p>