# ICES WGHIST REPORT 2015

SCICOM STEERING GROUP ON ECOSYSTEM PRESSURES AND IMPACTS

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# Interim Report of the Working Group on the History of Fish and Fisheries (WGHIST)

20–23 October 2015

Ispra, Italy

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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## Contents

## Executive summary

The ICES Working Group on the History of Fish and Fisheries (WGHIST, 2015-2017) is a forum for interdisciplinary research on social-ecological change in marine and fisheries systems over multi-decadal to multi-century timescales. It comprises a diverse group of researchers including marine biologists, fisheries scientists, historians, and historical ecologists.

The 2015 meeting was the first year of the second iteration of WGHIST, and comprised a joint meeting with Working Group 1 of the EU-COST Oceans Past Platform. The meeting opened at 09:00 on Tuesday, 20 October, and closed at 16:00 on Friday, 23 October, and was hosted by Dr. Chato Osio of the Maritime Affairs Unit of the European Commission's Joint Research Centre (JRC) in Ispra, Italy. 15 participants attended in person, representing 14 institutes across 11 countries in Europe, North America, Russia, and Australia. 3 participants (UK, USA, and Denmark) joined via Skype for part of the meeting, including a representative from the ICES Data Centre. Three further participants (Germany, USA, and South Africa) contributed via email correspondence.

The meeting focused on presentations of proposed, current and completed research, as well as specific discussions regarding progress towards and future work to achieve the WGHIST ToRs under four themes:

1 ) Case studies documenting progress in marine historical ecology.
2 ) Application of historical ecology to management and policy.
3 ) Data rescue, digitization, and future development.
4 ) Social, cultural, and economic dimensions of marine systems through time.

Recommendations:

1 ) WGHIST recommends and welcomes participation of members from the ICES Strategic Initiative on the Human Dimension to help ensure integration of social and economic data in WGHIST work.
2 ) WGHIST recommends participation of stock assessment scientists (including members from SI on Stock Assessment) at future meetings to effectively feed historical data into stock assessment methods and use the obtained results in an advisory/management context.
3 ) WGHIST recommends continued liaison with DIG and the ICES Data Centre to integrate the WGHIST metadatabase with the ICES website in a way that ensures information is available to the science community.

# 1 Administrative details

| |
|---|
| **Working Group name: Working Group on the History of Fish and Fisheries** |
| **Year of Appointment within the current cycle: 2015** |
| **Reporting year within the current cycle: 1** |
| **Chair(s)** |
| Emily Klein, USA |
| Ruth Thurstan, Australia |
| **Meeting venue** |
| Ispra, Italy |
| **Meeting dates** |
| 20–23 October 2015 |

# 2 Terms of Reference

a ) Use case studies to demonstrate the tangible benefit of marine historical ecology to current marine policy and managementæ

b ) Ensure that quality-assured historical metadata are accessible to the science community to stimulate data products including digital applicationsæ

c ) Integrate non-traditional methodologies and data sources to improve our knowledge base on long-term changesæ

d ) Address social, cultural and economic dimensions of marine ecosystem goods and services through time with the aim to contribute to integrated ecosystem assessments.

# 3 Summary of Work plan

Year 1 The priority for Year 1 was to 1) summarize potential and actual approaches and challenges to the application of historical marine ecology for contemporary science and management via case studies of work within WGHIST (already initiated by manuscript in press from WGHIST 2011-2014); and 2) highlight the process of accessing and applying historical data to science and management questions by identifying regional-level North Atlantic case studies where historical data (both quantitative and qualitative) has already been developed and analyzed for results readily applicable to ICES Science Plan objectives (see ToR(a) above). In addition, the WGHIST 2015 meeting included a Special Session on Human Dimensions, which focused on interactions of human communities with marine ecosystems through time.

Year 2 Year 2 will focus on the inclusion of participants from management and policy spheres to identify areas where historical data can be explicitly incorporated into the decision-making process, and how to overcome potential challenges to doing so. The inclusion of participants outside of WGHIST will be effected by linking with members of other ICES WGs within SSGEPD, SSGEPI and SSGIEA, as well as experts outside ICES (e.g., stock assessment modellers, lawyers and policy experts from ICES member states). Potential participants will be approached by the Chairs prior to the Year 2 meeting. WGHIST will also hold follow-up discussions on the Special Session on Human Dimensions (Year 1), and meet with Data Centre and DIS staff to update the existing WGHIST metadata, ensure its availability in the ICES portal, and discuss digital applications of this work. WGHIST information may be readily included in current ICES products.

Year 3 The final year of this iteration of WGHIST will draw together the findings from the WGHIST and participants from broader management/policy spheres. We will present a detailed report on how historical data could be explicitly incorporated into current management frameworks (e.g., IEA), drawing on experience from the North Atlantic case study, and will also present recommendations for how future decision-making frameworks could be set up to maximise the use of historical data. This will also include summaries and output (ICES Reports on available socioeconomic and policy data, peer-reviewed summaries) from the Special Sessions on Human Dimensions. The WGHIST experience will be summarized in peer reviewed publications. WGHIST will also complete all data products developed in Year 2 with ICES Data Centre and DIS. Finally, WGHIST will perform a self+evaluation and solicit recommendations from participants, to be included in the final report.

# 4 List of Outcomes and Achievements of the WG in this delivery period

The following scientific paper was published in 2015 as a direct outcomes of the previous iteration of ICES WGHIST.

- Georg H. Engelhard, Ruth H. Thurstan, Brian R. MacKenzie, Heidi K. Alleway, R. Colin A. Bannister, Massimiliano Cardinale, Maurice W. Clarke, Jock C. Currie, Tomaso Fortibuoni, Poul Holm, Sidney J. Holt, Carlotta Mazzoldi, John K. Pinnegar, Sasa Raicevich, Filip A.M. Volckaert, Emily S. Klein, and Ann-Katrien Lescrauwaet. 2015. ICES meets marine historical ecology: placing the history of fish and fisheries in current policy context. *ICES Journal of Marine Science*. doi: 10.1093/icesjms/fsv219 **Selected as Editor's Choice.**

In 2015, the following scientific papers, published, submitted or in preparation, resulted from discussions during previous WGHIST meetings and correspondence.

- Jock C. Currie, Sink KJ, Atkinson LJ, Attwood CG, and Engelhard GH. *In prep*. Design and function of South Africa's earliest otter trawl: the SS Pieter Faure surveys (1897-1906).
- Emily S. Klein, Glaser S., Rosenberg A.A, Jordaan A, and Kaufman L. *In prep*. A complex past: Historical and contemporary fisheries demonstrate nonlinear dynamics and a loss of determinism. *Marine Ecology Progress Series*.
- Ruth H. Thurstan, Buckley SM, Ortiz JC, Pandolfi JM. 2015. Setting the record straight: assessing the reliability of retrospective accounts of change. *Conservation Letters*, DOI: 10.1111/conl.12184.
- Samiya A. Selim, Blanchard JL, Bedford J, and Webb TJ. 2014. Direct and indirect effects of climate and fishing on changes in coastal ecosystem services: a historical perspective from the North Sea. *Regional Environmental Change*.
- Camilla Sguotti, Lynam CP, Garcia Carreras B, Ellis JR, and Engelhard GH (*submitted*). 112 years of changing distributions of eight skate and shark species in the North Sea.

In 2015, the following PhD/Master's theses were completed having being inspired or discussed as part of previous WGHIST meetings and correspondence.

- Camilla Sguotti. 2014. From 1902 to 2013: the abundance and distribution of 8 species of elasmobranchs in the southern North Sea. MSc Thesis, Univ. Padua, Italy, 105 pp. Thesis was awarded "Distinction." Supervisors: Georg H. Engelhard, Christopher P. Lynam, Carlotta Mazzoldi.
- Samiya A. Selim. 2015. Shifting baselines in coastal ecosystem service provision. PhD Thesis. University of Sheffield, 147 pp. Advisors: Tom E. Webb, Julia L. Blanchard, Philip H. Warren.

- Sarah M. Buckley. 2015. Historical change in the marine ecology and fisheries of Australia and Kenya. The University of Queensland, 158 pp. Advisors: John M. Pandolfi, Ruth H. Thurstan, Simon Blomberg.

The ICES WGHIST metadatabase was updated and loaded onto ICES SharePoint.

# 5 Progress report on ToRs and workplan

The meeting focused on presentations of current and completed research, as well as discussions regarding the WGHIST ToRs and next steps. Presentations and discussion outcomes were organized into the following themes:

1 ) Case studies documenting research in marine historical ecology and fisheries (ToR a,c)
2 ) Application to management and policy (ToR a)
3 ) Data rescue, digitization, and future development (ToR b)
4 ) Social, cultural, and economic dimensions of marine ecosystems through time (ToR d)

As this was the first year of this iteration of WGHIST, these were further divided into completed work and proposed research to deliver expected products for our ToRs. Full descriptions of each of the listed works are provided in Annex 2.

### Theme 1: Case studies documenting research (ToR a, c)

Under this theme, attendees shared completed and ongoing research. When presenting their research, attendees explained their methodological approach, analyses, and potential application of the work to management and policy. Doing so enabled participants to exchange ideas about research approaches, best practises in marine historical ecology research, and potential avenues for dissemination. This theme highlighted some of the less conventional tools used by the group, and methods for integrating disparate historical sources to improve our current knowledge base on long-term changes (ToR c). It also enabled discussions among the group about which areas of research should be targeted by WGHIST for an in-depth case study (ToR a).

#### Completed research

**B. R. MacKenzie**, K. E. Alexander, W. B. Leavenworth, S. H. Claesson, W. Jeffrey Bolster, and A. Cooper. Historical evidence opens new swordfish recovery perspectives in the northwest Atlantic.

**H. Zidowitz** and R. Thiel. When did the common skate disappear from the southern North and Baltic Seas? A reconstruction of the spatio-temporal distribution of the *Dipturus batis*-complex based on historic literature and collection data analyses.

**C. Sguotti**, C. P. Lynam , B. García-Carreras, J. R. Ellis & G. H. Engelhard. Baselines for indicators: changing distribution and abundance of eight vulnerable elasmobranchs in the southern North Sea, 1902 to present.

**A. Rijnsdorp**, O. Eigaard, G. Engelhard, H. Fock, N. Hintzen, and A. Lescrauwaet. The evolution of bottom trawling impact on the benthic ecosystem.

**P. Jones**. Estimating the Impact of Preindustrial Fishing on Scotland's Inshore Fisheries in the 19th Century.

**G.C. Osio.** The historical fisheries in the Mediterranean Sea: a reconstruction of trawl gear, effort and trends in demersal fish stocks.

**A. Kraikovski.** The history of governmental projects of introduction of oysters into the Gulf of Finland.

#### Proposed research (potential case studies for ToR a)

**A. Rijnsdorp**, G. Engelhard, H. Fock, and A. Lescrauwaet. The impact of bottom trawling on flatfish populations in the North Sea.

**H. Ojaveer**. Historical exploitation and collapse of the autumn herring in the Gulf of Riga, Baltic Sea.

**H. Zidowitz**, C. Sguotti, and G. Engelhard. Using qualitative and quantitative historical data to inform conservation measures for elasmobranchs.

**A. Punzón**, L. Rueda, A Rodríguez-Basalo *et al.* The evolution of the Spanish demersal fishery throughout the twentieth century (1933-1986).

### Theme 2: Application to management and policy (ToR a)

Under this theme, discussion focused on completed research and a potential group paper assessing the challenges to applying marine historical ecology. WGHIST also outlined several potential case studies, to be developed in Years 2 and 3, that would demonstrate the benefits of a historical perspective for marine policy and management. This progresses ToR a through; 1) a case study approach describing and quantifying the response of a North Atlantic Ocean system to perturbation; 2) by examining methods that have been used to quantify direct and indirect impacts from fisheries and other anthropogenic activities, and; 3) by advancing novel methodologies and approaches that link quantitative and qualitative methods at appropriate spatial and temporal scales. We also discussed the potential of historical work for setting reference points in marine management with attendees from the EC JRC. A particularly critical point of this conversation was advancing direct connections between historical data and results with needs in stock assessment. To this end, the Chairs aim to review the Report on the Classification of Stock Assessment Methods developed by SISAM, and work to connect with the ICES Strategic Initiative on Stock Assessment and Methods. Outcomes from that review will be presented at the 2016 meeting, and colleagues in stock assessment will be invited to engage in discussion and potentially breakout workshops at that meeting as well.

#### Completed research

**G. H. Engelhard**, R. H. Thurstan, B. R. MacKenzie, H. K. Alleway, R. C. A. Bannister, M. Cardinale, M. W. Clarke, J. C. Currie, T. Fortibuoni, P. Holm, S. J. Holt, C. Mazzoldi, J. K. Pinnegar, S. Raicevich, F. A.M. Volckaert, E. S. Klein, and A. Lescrauwaet. ICES meets marine historical ecology: placing the history of fish and fisheries in current policy context. ICES Journal of Marine Science, doi:10.1093/icesjms/fsv219.

**G.C. Osio.** 2012. The historical fisheries in the Mediterranean Sea: a reconstruction of trawl gear, effort and trends in demersal fish stocks. PhD Dissertation, University of New Hampshire.

**Proposed research to meet WGHIST ToRs**

**S. Raicevich** and T. Fortibuoni The actual value of marine historical ecology as knowledge base in support of ecosystem-based management: lessons learnt from the EU MSFD implementation.

**B. R. MacKenzie,** other interested WGHIST/OPP participants. Challenges and limitations to the application of marine historical ecology.

**A. Rijnsdorp**, G. Engelhard, H. Fock, and A. Lescrauwaet. The impact of bottom trawling on flatfish populations in the North Sea.

**H. Ojaveer**. Historical exploitation and collapse of the autumn herring in the Gulf of Riga, Baltic Sea.

**H. Zidowitz**, C. Sguotti, and G. Engelhard. Using qualitative and quantitative historical data to inform conservation measures for elasmobranchs.

**A. Punzón**, L. Rueda, A Rodríguez-Basalo *et al.* Effects of legal and technological measures in the Spanish demersal fishery during the twentieth century (1933-1986).

**G.C. Osio.** Potential for stock assessment improvements with historical data.

## Theme 3: Data rescue, digitization, and future development (ToR b)

Periklis Panagiotidis from the ICES Data Centre attended discussions via Skype to help guide next steps for making the WGHIST metadatabase accessible to the science community and for integration with the ICES Data Portal. Also discussed were potential ways to further advance ToR b in Years 2 and 3. These included linking WGHIST metadata descriptions to existing ICES maps to provide background or baseline information, especially for ICES FishMap and habitat maps, and with the ICES Spatial Facility (geo.ices.dk). These would highlight the existence of historical datasets to users of ICES data and deepen the wealth of knowledge available via existing ICES tools. Chairs will continue to discuss these options with the ICES Data Center and DIG, and anticipate workshops with these colleagues at the 2017 meeting.

As per conversation with Panagiotidis, during and immediately after the WGHIST meeting, the metadata fields were updated and streamlined to be consistent with those in the ICES catalogue. The Chairs will continue discussions with the Data Centre to ensure that the fields are standardised in a format for integration with the ICES website. The updated metadata file is now available on SharePoint to WGHIST participants, and the Chairs will ensure participants continue to update their fields prior to the 2016 meeting.

Finally, it was agreed that WGHIST does not (and will not in the near future) have the ability to hold raw datasets, only metadata. However, for individuals who wish to make their data available, there is the option for them to provide their data to the data management team for uploading on the ICES website. The WGHIST Chairs will investigate this option further, along with interested WGHIST members (guidelines can be sourced from EMODnet/OBIS). In addition, members expressed an interest in officially publishing data e.g., in data warehouses such as Pangaea or as full data papers (potential journals: Scientific Data; Earth System Science Data).

**A. Lescrauwaet**. Update on ICES Metadata file progress, and alignment with other European metadata efforts.

### Theme 4: Social, cultural, and economic dimensions of marine ecosystems through time (ToR d)

During the 2015 meeting, focused conversations were held to constitute our Special Session on Human Dimensions, which included an invited speaker attending remotely from the US. From these discussions, the following invited contributions can be found in Annex 2:

**P. Jones**. Integrating human dimensions into marine historical ecology: challenges and opportunities.

**A. Kraikovskii**. History of interrelations between human society and the marine environment: potential research questions.

**M. McKenzie.** Marine environmental history approaches to integrating human elements into ecosystem assessments.

Our Special Session discussions made clear the importance of human dimensions on understanding marine ecological and social systems. To address these needs and forward ToR d in Years 2 and 3, Chairs will engage with the ICES Strategic Initiative on Human Dimensions and WGHIST will continue conversations and forward potential future deliverables at the ICES Headquarters at the 2016 meeting. We aim to focus, in particular, on the approaches and strategies for incorporating historical social and economic (both quantitative and qualitative) data into ICES work, such as Integrated Ecosystem Assessments.

In addition to presentations and discussions advancing WGHIST ToRs, the meeting was held concurrently with Oceans Past Platform, a COST Initiative, due to overlaps in members, interests, and research. For more, please see Annex 3.

Finally, the Chairs note their commitment to continue and expand remote access for participants, given success at this meeting, especially for North American ICES WGHIST members.

## 6 Revisions to the work plan and justification

Not applicable.

## 7 Next meetings

Year 2 (2016): 6-9 September, ICES HQ, Copenhagen.

Year 3 (2017): Venue undecided, meeting to be held either September or October.

## Annex 1: List of participants

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|---|---|---|
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| Philine zu Ermgassen | Department of Zoology, University of Cambridge, Cambridge CB2 3EJ, UK. | psez2@cam.ac.uk |
| Matthew McKenzie | Department of History, University of Connecticut, New Hampshire, USA. | Matthew.McKenzie@uconn.edu |

# Annex 2: Summaries of presented work and group discussion

## Theme 1. Case studies to document progress (ToR a, c)

### Historical evidence opens new swordfish recovery perspectives in the northwest Atlantic

Brian R. MacKenzie[1], Karen E. Alexander[2], William B. Leavenworth[2], Stefan H. Claesson[3], W. Jeffrey Bolster[4] , Andrew Cooper[5]

[1]Center for Ocean Life, National Institute for Aquatic Resources, Technical University of Denmark (DTU-Aqua), Kavalergården 6, DK-2920 Charlottenlund, Denmark

[2]Department of Environmental Conservation, Holdsworth Hall, University of Massachusetts Amherst, Amherst MA 01003-9285, USA

[3]SEARCH, Inc., Portsmouth, NH 03801, USA

[4]History Department, University of New Hampshire, Horton Social Science Center, Durham, NH 03824,USA

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Swordfish biomass in the north Atlantic is considered to have recovered to a level which can now support long-term sustainable fisheries (i.e., $B_{msy}$). However, using historical documentation from ca. 80–130 years ago, we show that swordfish were formerly abundant and supported commercially important fisheries in nearshore and coastal regions of the northwest Atlantic (New England and Nova Scotia) but became rare or locally extinct in these regions. Swordfish are still rare in these regions even though overall biomass at the stock level is at a sustainable level. We used historical fishery data to investigate whether fishing may have contributed to the disappearance of swordfish from this region. Fisheries in these areas initially increased yields as fisheries developed and as more effort was deployed. However, swordfish landings in these areas declined and fishing activity moved 100s of km offshore to maintain and expand yields. The shift to distant areas was facilitated by technological changes within the fishery, including increases in vessel size and refrigeration capacity. The recent/present situation (overall stock biomass at or beyond $B_{msy}$, but not distributed over former range) illustrates how aggregation of fishery and landings data over large spatial scales (i.e., entire stock area) can lead to oversight of local declines and potentially contribute to a shifting spatial baseline of stock status.

We also investigated ways to estimate local biomasses and to quantitatively link fishery developments to changes in local biomass. Using simple surplus production models we found that fishing was likely conducted at unsustainable levels (i. e., exceeding current estimates of $F_{msy}$) and was sufficiently high that it could have caused the observed depletions. Re-occupation of former habitat will benefit from both single-species (i.e., swordfish-specific) and broader ecosystem measures. These measures include low exploitation to allow stock biomass to continue increasing and to allow the age/size structure to become composed of older and larger individuals, and low exploitation to promote recovery of forage fish biomass in coastal and nearshore regions. Both factors could stimulate, via density-dependence, a growing swordfish population to explore more widely for prey, including the formerly occupied nearshore areas. Successful re-occupation of coastal habitats at previous biomass levels would promote more diverse and economical fisheries. Management actions should be supported by development of spatially-explicit indicators of stock status (abundance, distribution, concentration, mean size by gender) based on increased knowledge of migration behaviour and population structure.

### When did the common skate disappear from the southern North and Baltic Seas? A reconstruction of the spatio-temporal distribution of the Dipturus batis-complex based on historic literature and collection data analyses

**Zidowitz, Heike and Thiel, Ralf**

**University of Hamburg, Centre for Natural History – Zoological Museum, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany**

The common skate (*Dipturus batis*-complex) was once widely distributed in the Northeast Atlantic and adjacent waters. In the past, the species was abundant in the entire North Sea and occurred also in the Skagerrak, Kattegat and the western Baltic Sea. Over centuries, the common skate was exploited by the countries surrounding its distributional area and today is thought to be extinct locally in several areas, among these the southern North Sea and the Baltic Sea. Analysis of historic German literature and 35 European museum collections were conducted to obtain a dataset, covering a period from 1824–1971, to reconstruct the species' former spatio-temporal distribution in the German EEZ and adjacent waters. Records from relevant ICES surveys from 1968–2014 and national surveys beginning in 1959 were used to compare the dataset with recent catches. 84 records of common skate could be gathered for the dataset of which 25 were caught from the Baltic Sea to the Skagerrak and 59 in the North Sea. Seven records from the German Baltic Sea were collected between 1824–1883, with one record from 1930, while 11 records were caught in the German North Sea from 1894–1955. ICES data contains no catches of common skate in the south-eastern North Sea since 1968, and only few catches in the Kattegat but not further south confirming the extinction from German waters. Except for the record from 1930, these findings indicate the common skate's disappearance from German Baltic waters near the end of the 19$^{th}$ century, while in the German sector of the North Sea it became very scarce in the 1930s and had vanished completely by the end of the 1960s with a last record from 1963.

## Historical tuna fisheries in the Adriatic Sea

**Saša Raicevich and Tomaso Fortibuoni**

**Italian National Institute for Environmental Protection and Research (Chioggia, Italy)**

Nowadays, tuna in the Adriatic Sea (Mediterranean) is mostly fished by industrial purse seines in the southernmost areas. However, tuna fishery in the area dates back to centuries ago, and it was practised also in its northernmost area (Gulf of Trieste). The first historical account can be found in 1552, while in the 18th and 19th centuries many historical records are available, mainly regarding the trade of tuna and the infringements of local taxes. Since the late 19th to the early 20th centuries some description of fishing activities, including some scattered data on catches, exist. In this abstract we provide a preliminary description of tuna fishery in the central and northern Adriatic Sea in the 19th and early 19th centuries, providing information on how and where it was practised.

Faber (1883)[1] gave a thorough description of historical tuna fishery in the Adriatic in the 19th century.

"The *Tonnare* (*Madrague* of France), or *Poste di Ton*, are found all along the coast, but mostly on the Croatian seaboard, and they are much on the increase in Dalmatia. The distribution of the net is, as a rule, semicircular, one end being anchored close in shore; the net is then drawn out seawards, the outer part being parallel with the land, thus forming an enclosure, with one side left open for the passage of the fish (Figure 1). The locality is chosen according to the formation of the shore and bed, the chief condition being deep water, especially at the entrance. This favours the passage of the tunny, which is in the habit of approaching the shore in shoals, either in pursuit of mackerel, or, as is generally believed to be the case, to scratch itself against the rocks in order to rid itself of a parasite which irritates it. Thus, a deep creek, or bay, is favourable for fixing the net, particularly where the channel forming the opening is narrow and deep: in this case a net is simply drawn across, leaving the channel free. The fishermen must be continually on the watch for the shoals of fish; and for this purpose a watchman is constantly posted, during the season of passage, at the top of an inclined ladder, at an angle of about 75, forming a kind of observatory, or crow's nest, whence the entrance of the fish can be seen."

[1] George Louis Faber, The fisheries of the Adriatic and the fish thereof, London, 1883.

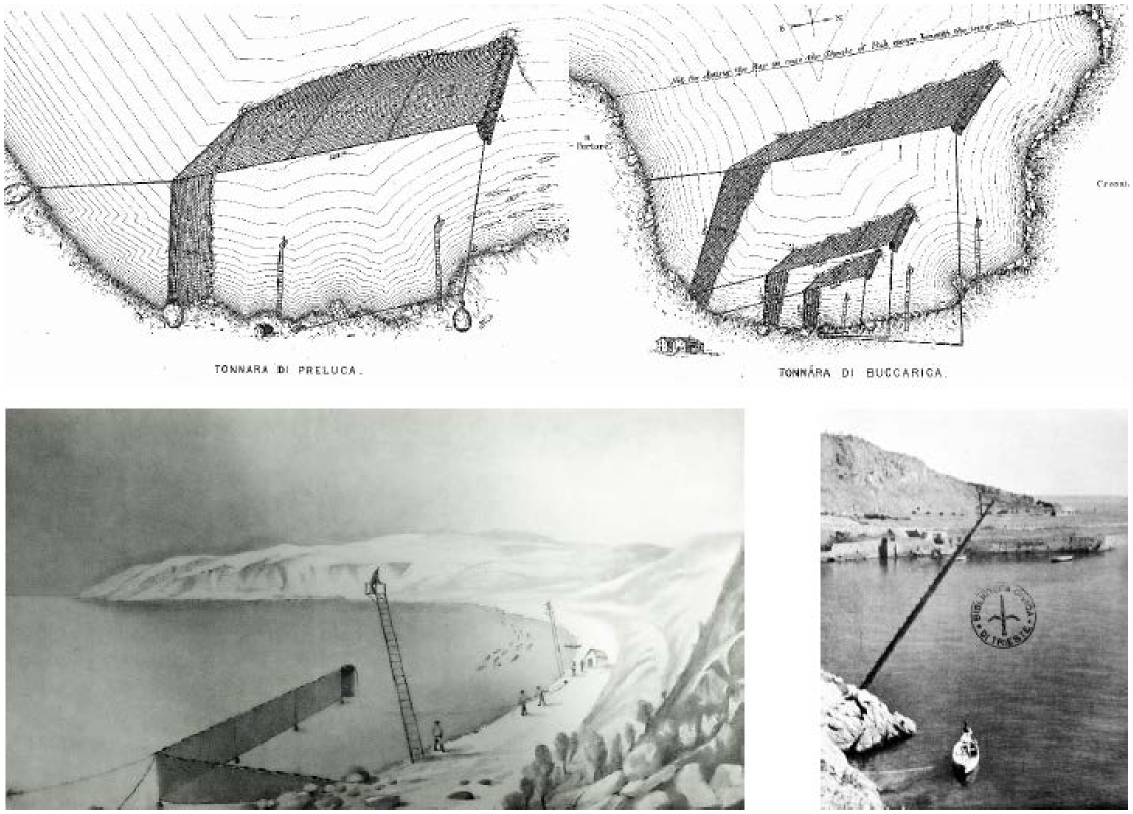



**Figure 1. Ancient tonnare in the Adriatic Sea (Pictures taken from: George Louis Faber, The fisheries of the Adriatic and the fish thereof, London, 1883); Anton Krisch, Die Fischerei im Adriatischen Meere, Pola, 1900; Bruno Coceani, Crociera di pesca nell'Adriatico redento, Padova, 1942).**

"When the shoal has entered the enclosure, the entrance is at once closed by drawing ashore a sufficient quantity of slack netting, which is left hanging for this purpose at the outer end of the net, by means of a rope, the end of which is kept on shore (…). The alarm is then sounded by throwing stones near the inlet through which the fish have just passed, and by raising a hue and cry, in which all join, in order to drive the shoal towards the closed end of the enclosure. The scene is now one of intense excitement and bustle, the nets are hauled in, and the fish are killed by means of spikes and oars, thrown ashore, disembowelled, and sent to market (Figure 2)."

**Figure 2. Tuna fishery in the Adriatic Sea at the beginning of the 20th century (Pictures taken from: Bruno Volpi Lisjak, La spettacolare pesca del tonno attraverso i secoli nel Golfo di Trieste, Trieste, 1996).**

The boat used to recover the net once fish were caught was called *tonera* (Figure 3). It was 11–12 m long and 2–2.5 m wide, moved by rows (usually 6 people rowing).


**Figure 3. Drawing by Luigi Divari.**

Most *Tonnare* were located in Dalmatia and Quarnero gulf (Croatia), while a few of them were also present in the Gulf of Trieste (Italy). In figure 4 red dots indicate the *tonnare* and red arrows the migration path of tuna, according to the knowledge of that time (Ninni, 1917)[2]. It was a seasonal fishery, practised between late summer and early fall, according to the timing of tuna migration along the coast.

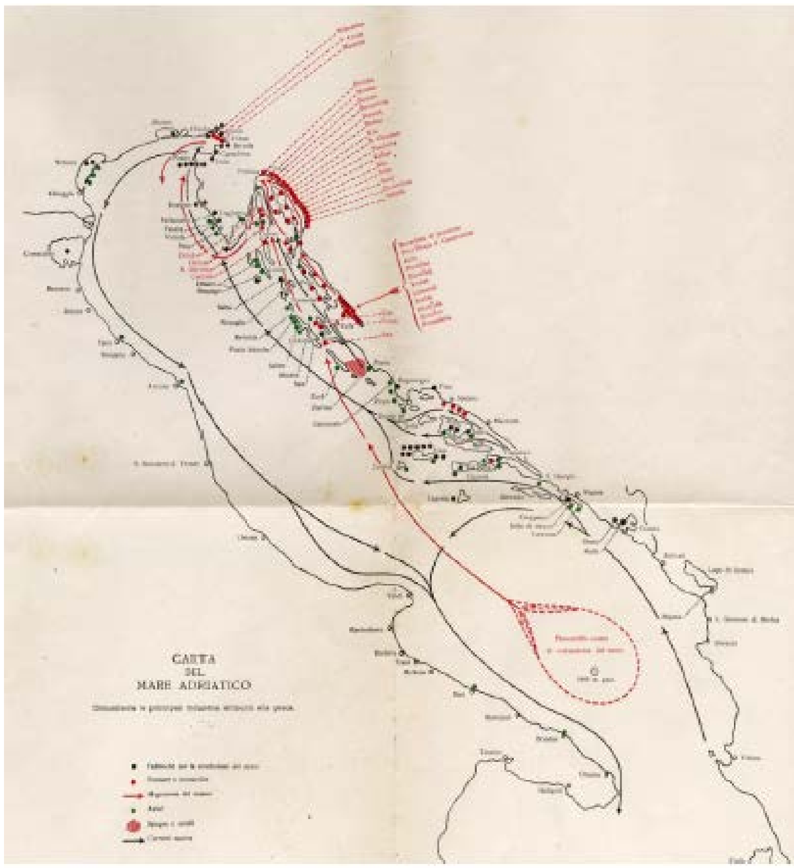



**Figure 4. Location of the tonnare at the beginning of the 20th century in the Adriatic Sea (Picture taken from: Emilio Ninni, La pesca nel mare Adriatico, Roma, 1917).**

The number of people involved in this fishery is unknown for the whole Adriatic Sea, but in Trieste (Italy), where about 2–3% of tuna Adriatic landings were caught, there were about 20 nets served by 130 fishers (in 1934). Considering the catches in the whole area (Table 1) we can hypothesize the presence of thousands of fishers along the eastern Adriatic coast.

[2] Emilio Ninni, La pesca nel mare Adriatico, Roma, 1917.

**Table 1. Catch records for tuna in 1911.**

| Fishing district | Kg |
|---|---|
| Trieste | 6350 |
| Istria (Quarnero) | 3720 |
| Lussinj | 21 900 |
| Zadar | 143 960 |
| Split | 92 000 |
| Dubrovnik | 14 370 |

The main species caught was *Euthynnus alletteratus* (little tunny), reaching a maximum length of 1 m and 30 kg of weight. However, according to historical accounts also *Thunnus thynnus* (Atlantic bluefin tuna) was caught in the *tonnare*. In the Gulf of Trieste the last catch was done in 1954. In the following years, this particular kind of fishery was gradually abandoned also along the Croatian coast, where actually tuna is caught with off shore purse seines in the southern and middle Adriatic.

All these information (along with further historical statistics, not shown in this extended abstract) allow to infer that since historical time tuna fishing was a relevant fishing activity along the eastern side of the Adriatic Sea. However, the assessment of its role, as well as the assessment of its economic, social and ecological values along this multi-centennial timeline deserve further investigation and integration with other sources. Our aim, through the application of the marine historical ecology approach, is thus to reconstruct the long-term trends in consumption and exploitation of these charismatic species and ascertain the reasons that determined the disappearance of its traditional exploitation.

### Baselines for indicators: changing distribution and abundance of eight vulnerable elasmobranchs in the southern North Sea, 1902 to present

**Camilla Sguotti [1,2], Christopher P. Lynam [1], Bernardo García-Carreras[1,3], Jim R. Ellis[1] & Georg H. Engelhard [1*]**

**[1] Centre for Environment, Fisheries & Aquaculture Science (Cefas), Pakefield Road, Lowestoft NR33 0HT, UK; [2] University of Padova, Biology Department, Via U. Bassi, 58/B 35121 Padova, Italy; [3]Imperial College London, Silwood Park Campus, Ascot, Berkshire SL5 7PY, UK**

Many marine systems have experienced important changes in the last decades and, in some cases, abrupt shifts from their previous status, and the causes of these events can be both human and natural (Kenny *et al.*, 2009). Discerning the origins of the changes is important to understand the mechanisms that have brought about the system to the transformation and to develop effective management measures. In this context, marine historical ecology can be fundamental and can make this process easier.

The North Sea is one of the world's most exploited seas and a 'hotspot' of marine climate change. These pressures will have influenced considerably its fish community over the past century, and continue to do so. Elasmobranchs, in particular, are considered vulnerable to population decline and sensitive to fishing, owing to their size, longevity, slow reproductive rates, and other life-history traits. Here we analyse a 112-year time-series of fishery-independent, ship-based survey data, collected by the Centre for Environment, Fisheries and Aquaculture Science, and study changes in presence and distribution of the elasmobranch community in the southern North Sea. Eight species of conservation concern were evaluated to ensure a better knowledge on their populations in order to inform the management, in line with the aims of WGHIST (ToR a): common skate, thornback ray, spotted ray, starry ray, tope shark, smooth-hound, spurdog and lesser spotted dogfish. Populations of each of these species followed different trajectories along the time-series with some increasing and others decreasing. Common skate (*Dipturus batis*) disappeared completely from the surveys in the southern North Sea, and has not been recorded since 1970. Generalised linear models (with logistic regression) were used to model the changing spatial distribution of the elasmobranch species from the early 1900s through the 2000s. Our maps highlight declines especially in the, more heavily beam-trawled, south-eastern North Sea, less so in the west. The possible causes of changes in elasmobranch dynamics are both anthropogenic (exploitation, climate change, habitat degradation) and natural (climate variability, competitive interactions between species).

In the future it will be useful to extend the time series and incorporate the use of different types of data sources, such as qualitative data from literature or museum records and other quantitative data such landing statistics. This may require innovative ways to combine these sources, allowing a more complete picture of the changes, according to WGHIST objectives (ToR c). This exercise would provide stronger evidence, would help to better frame this work in the context of management, and could be achieved through collaboration with other WGHIST members.

### The evolution of bottom trawling impact on the benthic ecosystem

**Adriaan Rijnsdorp[1], Ole Eigaard, Georg Engelhard, Heino Fock, Niels Hintzen, Ann Katrien Lescrauwaet.**

**[1]Wageningen IMARES – Institute for Marine Resources and Ecosystem Studies, P.O. Box 68, 1970 AB, IJmuiden, The Netherlands**

Benthic ecosystems provide important goods and services, such as fisheries products and supporting, regulation and cultural services. There is serious concern about the adverse impact of fisheries, in particular bottom trawling, on benthic ecosystems. The impact of bottom trawling is determined by the type of fishing gear used and the sensitivity of the sea bed habitat and benthic ecosystem. Here we reconstruct the historic development in intensity and spatial extend of bottom trawling based on a variety of data sources (archaeological, historical, fisheries technological, geological, fisheries), with particular focus on the North Sea. Although pelagic species such as herring and predatory fish species such as cod, ling and haddock were targeted with passive gear since the start of the 2$^{nd}$ millennium, the use of active gears was constrained by the available technology to shallow waters and smooth sea bed habitats. Since the 19$^{th}$ century, bottom trawling gradually spread out over the entire North Sea. In the beginning bottom trawling was mainly restricted to sea bed habitats with a soft sediments, but as steam was replacing wind and hand power, heavier gear became available allowing trawlers to move into previously untrawlable grounds. Based on the sea bed characteristics, the state of the trawling technology, and the available data on the fleet size and effort, the evolution of the trawling footprint in the North Sea is estimated.

The trawling footprint is expressed in three metrics representing the proportion of the sea bed that is not trawled, the proportion that is trawled less than one time per year and the percentage of the sea bed where 90% of all bottom trawling is concentrated. The metrics are candidate indicators for the MSFD Sea Bed Integrity Descriptor. Based on the current statistical distribution of bottom trawl intensity at small scale (1x1 minute), the historic effort data are converted to swept area estimates by ICES rectangle and then converted in trawling intensities to estimate the footprint indicator for the census periods. The figure below shows the preliminary result.

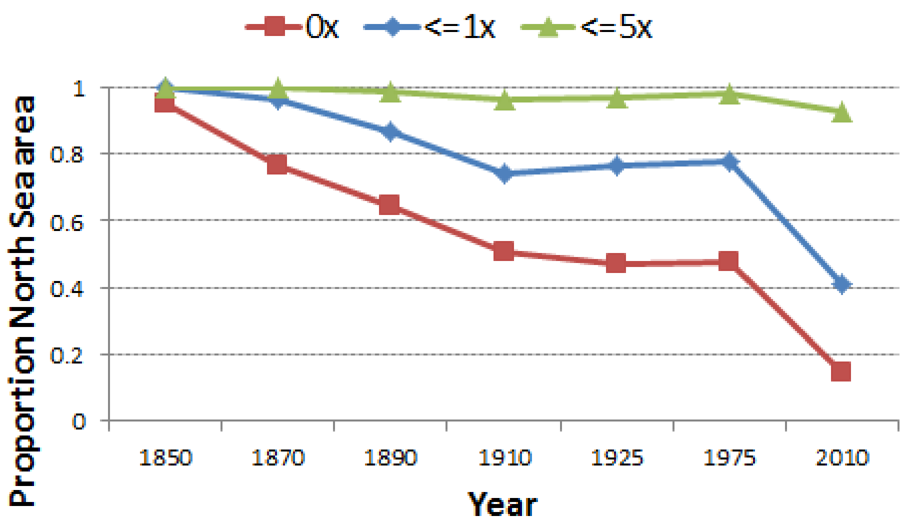



**Figure 1. Change in the surface area of the sea bed of the North Sea down to 200 m that is on an annual basis untrawled (0x), trawled less than 1x per year and less than 5 times per year.**

## Estimating the impact of preindustrial fishing on Scotland's inshore fisheries in the 19th century

**Peter Jones**

The United Kingdom Fishery Board (later, the Fishery Board for Scotland) collected comprehensive landings data for herring (*Clupea harengus*) and commercial whitefish (cod, *Gadus morhua*, and ling, *Molva molva*) between 1809 and 1939. It also collected a range of other statistics, including estimates of the amount of drift net (for herring) and hand and longline (for whitefish) which were employed in these fisheries in the nineteenth century. These data have been used to provide national and regional pictures of the trajectory of these two fisheries across the nineteenth century (Figures 1 & 2). Following on from this, the landings data was placed alongside estimated fishing power (quantities of net and line) in order to produce rudimentary estimates of catch per unit effort (CPUE) for both fisheries between 1845 and 1886 on a regional basis (e.g. Figures 3 & 4). Much of the Fishery Board statistics are based on estimated values and therefore need to be treated with caution, but by placing this quantitative data alongside other forms of evidence – in particular, the direct testimony of fishermen to public commissions of inquiry – it is possible to arrive at some relatively robust conclusions about the impact of fishing effort on Scotland's available inshore stocks during this period.

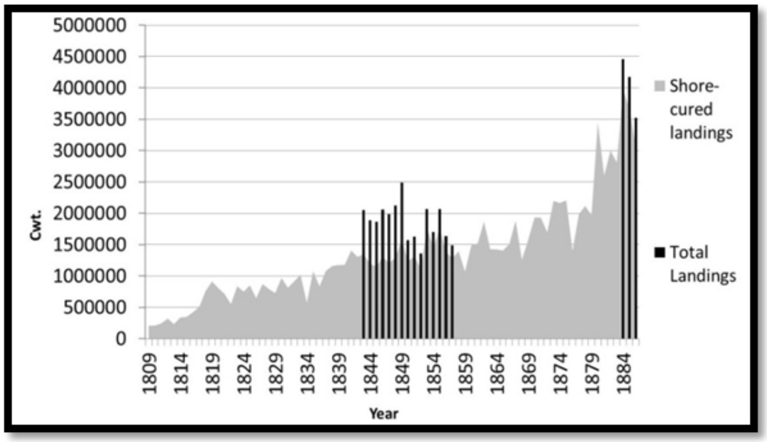



**Figure 1. Herring landings at all Scottish ports (Cwt.), 1809–1886.**

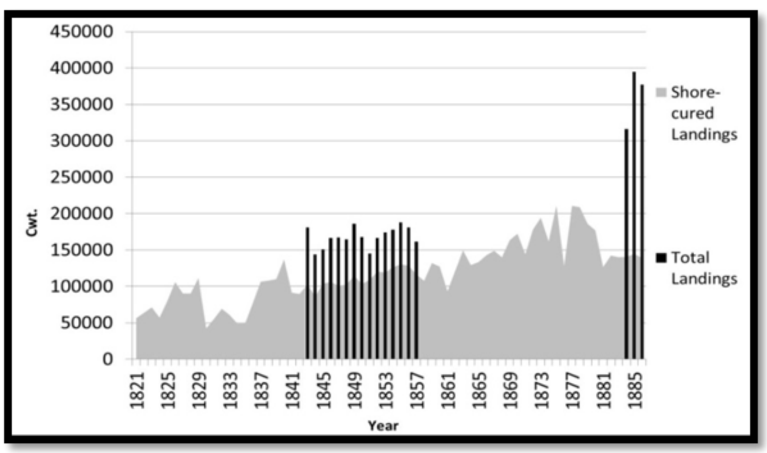



**Figure 2. Commercial whitefish landings at all Scottish ports (Cwt.), 1821–1886.**

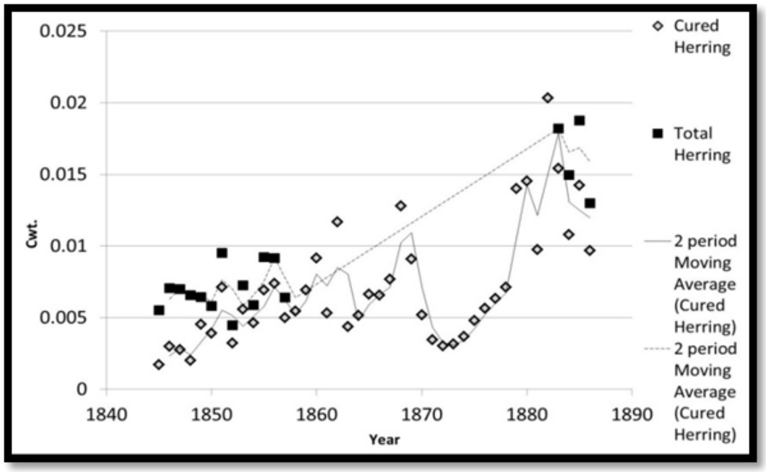



**Figure 3. Herring fishing CPUE in the mid-west of Scotland (Cwt./Sq. Yd. Net) 1845–1886.**

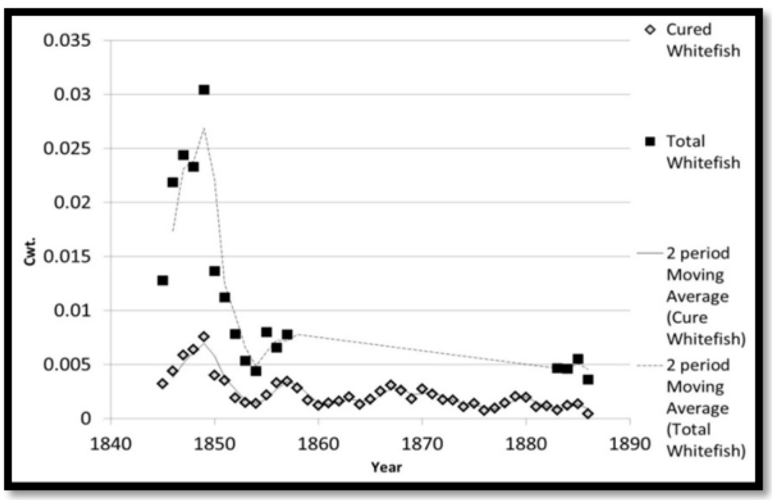



**Figure 4. Whitefish fishing CPUE in the mid-west of Scotland (Cwt./ Yd. Line) 1845–1886.**

### Key findings so far:

Available stocks of herring appear to have declined in the southeast of Scotland in the early-1850s and did not recover thereafter during this period.

Available stocks of whitefish appear to have declined in many of Scotland's inshore fisheries at around the same time, particularly in the east, southeast and southwest of the country, and these also failed to recover during this period.

A number of causal factors are likely to have been at play in these declines, but in the case of whitefish the most influential is likely to have been large increases in fishing activity from the beginning of the century onwards.

These declines began years, and sometimes decades, before the widespread adoption of beam trawling and other modern industrial fishing methods in most of Scotland, and must therefore be attributed, in large part, to the exponential increase in traditional fishing effort – drift-netting from small boats for herring, and hook-and-line fishing for whitefish.

### The impact of bottom trawling on flatfish populations in the North Sea

**Adriaan Rijnsdorp[1], Georg Engelhard, Heino Fock, Ann Katrien Lescrauwaet.**

[1]**Wageningen IMARES – Institute for Marine Resources and Ecosystem Studies, P.O. Box 68, 1970 AB, IJmuiden, The Netherlands**

One of the objectives of ICES WGHIST is to use case studies to demonstrate the tangible benefit of marine historical ecology to current marine policy and management. North Sea flatfish are intensively studied and historic reconstructions have already been made back to 1900 for plaice (Rijnsdorp and Millner (1996) and back to the start of the 1950s for sole (de Veen, 1978). Building on the ongoing study on the reconstruction of the evolution in bottom trawling, and with support of OPP, data on bottom trawl effort and landings will be collected from the available sources, as a basis to estimate the evolution of the stock biomass since the start of the 19th century.

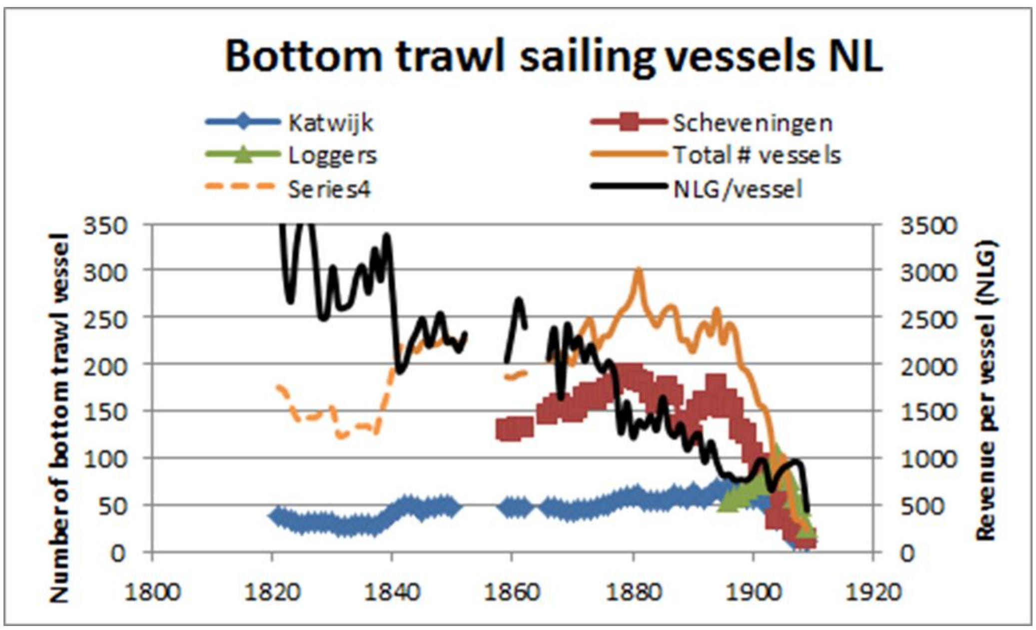



**Figure 1. Number of sail trawlers deploying beam trawl gear to target flatfish in the North Sea operating from the three main fishing villages and the annual revenue by vessel. Data reported in Jaarverslagen Visscherij.**

## Historical exploitation and collapse of the autumn herring in the Gulf of Riga, Baltic Sea

### Henn Ojaveer

Herring has been far the most important commercially exploited fish in the Baltic Sea for centuries. Both spring and autumn spawning are present in the Baltic Sea with general domination of the spring spawning component, which has a wide distribution and is well adapted to the local spatially variable environment. In contrast, the autumn spawners are living at the edge of the distribution area in the Baltic Sea and therefore experience substantially higher fluctuations.

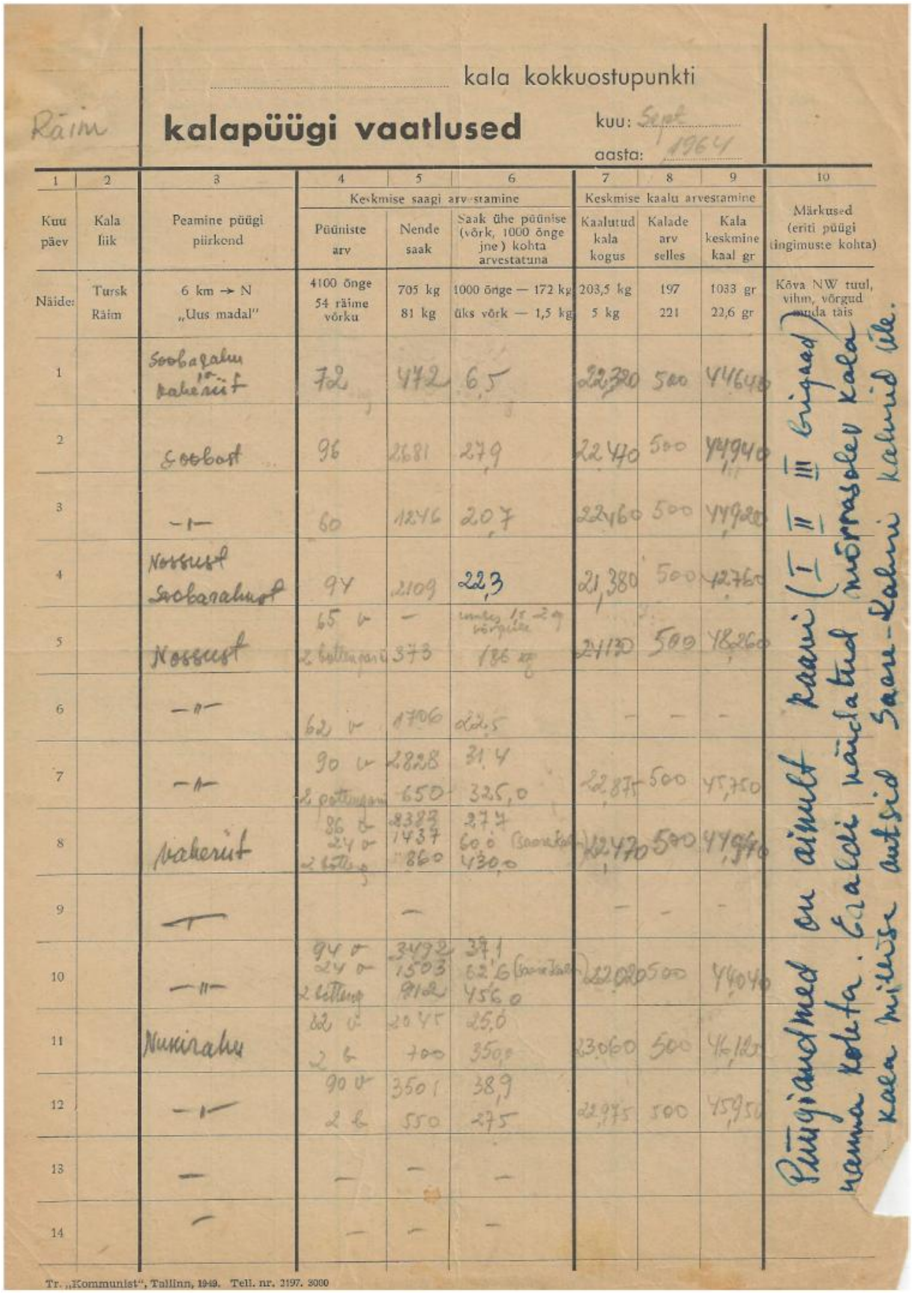
Historically, autumn herring has dominated in the Baltic Sea Swedish fisheries (by making over 90% in the 1920s, Hessle 1931). Also, the fish has been abundantly present in bottom trawls in the Gulf of Riga by making over 40% in some years in the turn of the 1950/60s. However, the population has faced steep decline since the second half of the 1960s and has entered into a deep depression phase since the early 1980s. The fish is nowadays exploited by gillnets in spawning grounds and this activity is very important for local coastal communities.

We have restarted investigations on the autumn herring through exploring the available historical material stored at the Estonian Marine Institute. Several original paper files (such as Figure 1) allow us to reconstruct exploitation history for the Gulf of Riga since the 1920s as well as to map the fishing/harbour localities and compare those with the contemporary situation. The retrieved summary sheets on the age composition of catches during 1950s–1970s might allow us to estimate fishing mortality and therefore evaluate the importance of fishery as a factor behind the drastic decline of the fish. In addition, establishing the long-term time series on the key abiotic factors influencing the autumn herring (such as winter air temperature and strength of westerly winds; Ojaveer 1974) will assist in evaluating the potential climate-driven bottleneck for the recovery.

### References

Hessle, H. 1931. Biological statistics regarding the herrings along the Baltic coast of Sweden. Journal du Conseil International pour l'Exploration de la Mer, 6: 21–27.

Ojaveer 1974. On conditions determining the abundance of the Gulf of Riga spring and autumn herring year-classes. Limnologysymposium: 105-117



kala kokkuostupunkti

Räim **kalapüügi vaatlused** kuu: Sept aasta: 1964

| 1 Kuu päev | 2 Kala liik | 3 Peamine püügi piirkond | 4 Püüniste arv | 5 Nende saak | 6 Saak ühe püünise (võrk, 1000 önge jne) kohta arvestatuna | 7 Kaalutud kala kogus | 8 Kalade arv selles | 9 Kala keskmine kaal gr | 10 Märkused (eriti püügi tingimuste kohta) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Keskmise saagi arvestamine | | | Keskmise kaalu arvestamine | | | |
| Näide: | Tursk<br>Räim | 6 km → N<br>„Uus madal" | 4100 önge<br>54 räime võrku | 705 kg<br>81 kg | 1000 önge — 172 kg<br>üks võrk — 1,5 kg | 203,5 kg<br>5 kg | 197<br>221 | 1033 gr<br>22,6 gr | Kõva NW tuul, vihm, võrgud muda täis |
| 1 | | Soobagalu<br>Pakeriit | 72 | 472 | 6,5 | 22320 | 500 | 44640 | |
| 2 | | Soobast | 96 | 2681 | 27,9 | 22440 | 500 | 44940 | |
| 3 | | —"— | 60 | 1246 | 20,7 | 22460 | 500 | 44920 | |
| 4 | | Nossust<br>Soobaraluest | 94 | 2109 | 22,3 | 21380 | 500 | 42760 | |
| 5 | | Nossust | 65 v<br>2 [illegible] | —<br>373 | [illegible]<br>186 kg | 24130 | 500 | 48260 | |
| 6 | | —"— | 62 v | 1706 | 27,5 | — | — | — | |
| 7 | | —"— | 90 v<br>2 [illegible] | 2828<br>650 | 31,4<br>325,0 | 22875 | 500 | 45750 | |
| 8 | | Pakeriit | 86 v<br>24 v<br>2 [illegible] | 2383<br>1437<br>860 | 27,7<br>60,0 [illegible]<br>430,0 | 22470 | 500 | 44940 | |
| 9 | | —"— | | — | | — | — | — | |
| 10 | | —"— | 94 v<br>24 v<br>2 [illegible] | 3492<br>1503<br>912 | 37,1<br>62,6 [illegible]<br>456,0 | 22020 | 500 | 44040 | |
| 11 | | Nukiralu | 62 v<br>2 [illegible] | 2045<br>700 | 25,0<br>350,0 | 23060 | 500 | 46120 | |
| 12 | | —"— | 90 v<br>2 [illegible] | 3501<br>550 | 38,9<br>275 | 22975 | 500 | 45950 | |
| 13 | | — | — | — | — | | | | |
| 14 | | — | — | — | — | | | | |

Püügiandmed on ainult raami (I II III Brigaad) nomma kohta. Eraldi näidatud mõõrrasolev kala kala millise autsid Saare-Kalmi kalurid üle.

Tr. „Kommunist", Tallinn, 1949. Tell. nr. 2197. 3000

**Figure 1. Example of the autumn herring landings record from September 1964.**

### Using qualitative and quantitative historical data to inform conservation measures for elasmobranchs

**Heike Zidowitz, Camilla Sguotti, Georg Engelhard (with potential to extend this work to the Mediterranean with WGHIST colleagues from Italy).**

Objectives: Identifying the trends in presence/absence and spatial-temporal distribution in the past in the North Sea of elasmobranchs (8 species) using different type of qualitative and quantitative data, in order to inform management decisions. This work is under development following discussions at WGHIST 2016.

Data sources: Cefas surveys (1902–2013); Museum collection records (1800s–recent); Literature (before 1960s); ICES Landings statistics (1950–2010).

### Historical fisheries data in the Mediterranean: useful for stock assessment?

**Giacomo Chato Osio[1]**

**[1]European Commission, Joint Research Center**

An extensive search of historical data sources and publications has been carried out in different countries of the Mediterranean, leading to the largest compilation of historical fisheries information existing in the Mediterranean region. The first goal using this information was to quantify historical trawling effort. Results show that Mediterranean demersal communities underwent a much longer and more systematic exploitation than previously thought, very likely the longest known exploitation by means of trawls in Europe and North America. Analysis of the data available for the Catalonian, Italian and French areas showed a clear pattern: fishing capacity increased in Mediterranean EU countries up to and through the 20th century until the 1980s–1990s, depending on the area. From that period on, fleet size has been decreasing steadily. However, it is unclear whether this decrease in vessel numbers in the last 20 years has been accompanied by a decrease in fishing power and fishing mortality.

Under this assessment of the historical data, trawl gear was reconstructed to derive qualitative and quantitative estimates of increase in fishing power and improved gear performance. The rate of adoption of new technology (synthetic nets, hydraulic winches, navigation equipment, etc.) was reconstructed by area and the effect of these improvements on catch rates discussed. Analysis of the change in the horizontal opening in trawl nets over time, parameter A1, proved that, with the adoption of new net material and net rigging, the actual size of the net, and for the same vessel horsepower, almost doubled over 40 years.

Another assessment of this primary goal was to reconstruct relative trends in demersal species abundance, as far back in time as possible. A first set of analyses was carried out by individual fishing areas/countries with consistent data going back only to 1950. In Blanes, France, the Adriatic Sea, and the Sicilian Channel, the drop in biomass was extremely large. In Tuscany, the temporal trend since the mid-1960s appears flat, but in this analysis, the historical data are likely underestimates and a fishing power correction was not used. The second set of analyses pooled all available data together, covering the entire western Mediterranean, and included LPUEs from sail and steam trawlers starting at the beginning of the 20th Century. When LPUE kg/fishing day was modelled, the highest relative biomass was identified in the 1920s with a second lower peak in the 1960s, and contemporary biomass even lower. The further back the series was reconstructed, the larger the decline in demersal biomass. This is a quantification of the shifting baseline syndrome: today we are assessing stock solely based on data from the past 20 years, which correspond to the lower part of the trends in all models. Consequently, we are unaware of the extent of abundance declines. To further explore these trends, a case study was built with data from Catalonia for individual species. Results showed steep declines for red shrimp and blue whiting, and important declines for hake and mullets, although residual patterns are not optimal for the latter.

To connect this work with contemporary fisheries, the second part of the presentation covered the current status of assessed Mediterranean stocks, highlighting the shortness of the time series used so far: most assessments start in 2000. This is in striking contrast with the long exploitation history of this area and clearly it is of uttermost importance to extend the time series of fisheries data back in time.

To show the use of historical data in the context of extending stock assessments, a case study was built on hake in the Gulf of Lions using previously unexploited trawl surveys and a time series of catch going back to 1950. This case study was used to show the importance of historical surveys to better inform the selection/estimation of the fisheries selection pattern, which is a critical aspect of modern statistical catch at age and integrated assessment models.

Finally, this work demonstrated the importance of information on historical exploitation, effort, and the fishery evolution in the context of projecting stock assessments forward in time. Using a case of the hake assessment in the Gulf of Lions, it is clear the importance for validating forecasted catches when strong reductions in fishing mortality are simulated. Moreover, if forecasted levels in the future had been achieved in the past, this indicates such forecast can be realistic. The other aspect related to projecting in the future is that short assessment models are parameterized on highly exploited populations that display heavy age truncation. It is thus difficult for the model to capture stock dynamics when the stock recovers from a demographic point of view. Thus, incorporating data from periods with low exploitation in assessment models can be crucial for more reliable predictions in the future.

In conclusion, the importance and advantages of incorporating past information in the assessments were highlighted, along with acknowledging the technical challenges that need to be solved for doing so.

## The history of governmental projects of introduction of oysters into the Gulf of Finland

**Alexei Kraikovski**

Government activities undertaken with the aim to establish an oyster population in the Gulf of Finland ("our Sea" according to the terminology used by the official documents) is a poorly known episode of the Europeanization and modernization of Russian marine harvesting in the 18th century. The paper discussed the origins of the idea born apparently during the Grand Embassy in the Netherlands (1697–98) as well as the further development of the project in the middle of the 18th century, during the time of Elizabeth and Catherine II. The proposed mechanism of environmental control supervised by the Imperial court involved the Admiralty and the College of Foreign Affairs as the oysters were considered as a specific part of European civilization. Diplomatic formalities were very important in the eyes of the Russian government in order to provide their "loyalty" and successful resettlement in the new water. The failure of the project is a very impressive demonstration of the role of the Environment as a powerful actor able to restrict the development of human activities. The Russian expansion to the Black Sea in the second half of the 18th century gave the Russian Empire control over the oyster beds of Crimea, thus opening a new page in the history of oyster cultivation in Russia.

### Design and function of South Africa's earliest otter trawl: the *SS Pieter Faure* research surveys (1897–1906) – *submitted via email*

**Jock C Currie[1,2,3], Kerry J Sink[3], Lara J Atkinson[1], Colin G Attwood[2], Georg H Engelhard[4]**

**1 South African Environmental Observation Network, Cape Town, South Africa**

**2 Marine Research Institute, University of Cape Town, South Africa**

**3 South African National Biodiversity Institute, Kirstenbosch, South Africa**

**4 Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, United Kingdom**

Long-term change in marine environments is frequently investigated by comparison of historical and contemporary trawl catch data. Such investigations are challenged by opaque biases caused by advances in gear technology and a lack of knowledge on the fishing power of historical trawl designs. To account for such biases, historical surveys can be repeated by imitating the historical trawl gear and methods. In this context, we investigated the trawl gear used during 1897–1906 surveys on board South Africa's first research vessel, the *SS Pieter Faure*. Component materials and dimensions were captured from historical reports, literature and photographs of the vessel, providing a detailed plan for reconstruction of a functionally-similar trawl net. The gear consisted of a primitive 'Granton' otter trawl net made of manila hemp. The otter doors were flat wooden boards in a steal frame, which were connected directly to the headline and ground-rope of the net. The towing speed was estimated to be 2.6 knots. The *Pieter Faure* surveys provide valuable insight to demersal marine ecosystems prior to the development of industrial fisheries in the region. As similar trawling equipment was used globally during the early 20th century, including the UK, USA and Australia, this information provides an internationally-relevant foundation for studies aimed at investigating historical trawl records and their associated fishing power.

## Theme 2. Application to management and policy (ToR a)

### ICES meets marine historical ecology: placing the history of fish and fisheries in current policy context

Georg H. Engelhard[1]*, Ruth H. Thurstan[2], Brian R. MacKenzie[3], Heidi K. Alleway[4], R. Colin A. Bannister[1], Massimiliano Cardinale[5], Maurice W. Clarke[6], Jock C. Currie[7], Tomaso Fortibuoni[8], Poul Holm[9], Sidney J. Holt[10], Carlotta Mazzoldi[11], John K. Pinnegar[1], Sasa Raicevich[8], Filip A.M. Volckaert[12], Emily S. Klein[13], and Ann-Katrien Lescrauwaet[14]

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As a discipline, marine historical ecology has contributed significantly to our understanding of the past state of the marine environment when levels of human impact were often very different from those today. What is less widely known is that insights from marine historical ecology have made headway into being applied within the context of present-day and long-term management and policy. This paper draws attention to the applied value of marine historical ecology. We demonstrate that a broad knowledge base exists with potential for management application and advice, including the development of baselines and reference levels. Using a number of case studies from around the world, we showcase the value of historical ecology in understanding change and emphasise

how it either has already informed management or has the potential to do so in the near future. We discuss these case studies in a context of the science–policy interface around six themes that are frequently targeted by current marine and maritime policies: climate change, biodiversity conservation, ecosystem structure, habitat integrity, food security, and human governance. We encourage science–policy bodies to actively engage with contributions from marine historical ecology, as well-informed policy decisions need to be framed within the context of historical reference points and past resource or ecosystem changes.

This paper has been accepted for publication as the concluding article in the special Proceedings Issue of ICES Journal of Marine Science on the Oceans Past V Conference (18–20 May 2015, Tallinn, Estonia). It contributes to ToR (a) of WGHIST 2015 and to WG1 of COST OPP.

### The actual value of marine historical ecology as knowledge base in support of ecosystem-based management: lessons learnt from the EU MSFD implementation

**Saša Raicevich and Tomaso Fortibuoni**

**Italian National Institute for Environmental Protection and Research (Chioggia, Italy)**

The MSFD (Reg CE/56/2008) is a European law aimed at achieving the Good Environmental Status in EU Waters by 2020. It represents one of the pillars of the Maritime Policy of EU which is strictly related to other Directives, like Habitat, Birds and Water Framework Directives, and has the goal of enforcing an "ecosystem approach" for the management of human pressures in the marine domain.

The MSFD implementation relies on the concept of Good Environmental Status which means the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations.

In such context Member States were requested to carried out a series of activities including assessing/defining:

- The initial assessment of the current environmental status of national marine waters and the environmental impact and socio-economic analysis of human activities in these waters (by 15 July 2012)
- The determination of what GES means for national marine waters (by 15 July 2012)
- The establishment of environmental targets and associated indicators to achieve GES by 2020 (by 15 July 2012)
- The establishment of a monitoring programme for the ongoing assessment and the regular update of targets (by 15 July 2014)
- The development of a programme of measures designed to achieve or maintain GES by 2020 (by 2015)
- The review and preparation of the second cycle (2018–2021)

In relation to the Initial Assessment and GES definition, as well as for the establishment of environmental target, Marine Historical Ecology was seen as a potential source of data and methods to set baselines, i.e. the description of state at a specific point against which subsequent values of state are compared, to be used as yardstick against which thresholds or trends for GES can be set. In this context reference conditions could be a description of a state with no, or very minor disturbance from human activities. That means that human pressure would be allowed as long as there are no or only very minor ecological effects.

This approach could thus consider baselines derived from different methodologies, including (i) reference state/conditions, (ii) a known state in the past, such as the beginning of a time series (e.g. the Large Fish Indicator used 1983 as a first valid data point in the time series) or (iii) a present state.

The current stages of MSFD implementation provides the availability of reports, data and methodologies in relation to its enforcement from each Member state across EU marine waters.

We propose to carry out an in depth assessment of such material to assess the actual value of MHE in the implementation of the MSFD, with the aim of answering to the following questions:

- Were MHE data used to assess the current status (Initial Assessment) of marine EU waters?
- Which methods were used to define GES (baselines definition) – were MHE data used?
- Were targets defined according to historical baselines and how?
- Was MHE considered a "new" data source in setting the monitoring programs (in there a future for MHE?)

The work will be carried out on a selected number of descriptors and indicators, in particular the most relevant candidates are those related to D3+ (i.e. Commercial fisheries + fisheries related indicators D1, D4, D6, at least for fish and fisheries related items) and could include data from also D2 (invasive species).

To this aim scholars participating to WGHIST and OPP (and potentially, other researchers working in the MSFD implementation) will be involved to collect data according to an ad hoc methodology, ensuring at least a Member State from main MSFD regions to be involved.

Moreover, it is envisaged to include in the assessment information from other geographical domains such as USA and Australia, to provide a more comprehensive assessment of the actual use of MHE data and methods in the implementation of policies aimed at managing marine ecosystems, in particular in reference to fish and fisheries issues.

### Challenges and limitations to the application of MHE

**Brian R. MacKenzie[1], interested WGHIST/OPP participants**

[1]Center for Ocean Life, National Institute for Aquatic Resources, Technical University of Denmark (DTU-Aqua), Kavalergården 6, DK-2920 Charlottenlund, Denmark

The working group discussed some of the limitations and challenges for using marine historical ecology (MHE) data in policy and management. The discussion addressed some of the difficulties occasionally encountered when attempting to introduce MHE findings and data into management, advisory and policy contexts, despite its documented value. The group identified a number of issues and considerations associated with the application of MHE results, and a partial list is given below in bullet and outline form.

**Potential data limitations:**

- Historical time series may not be comparable to more recent data due to mismatches in spatial or temporal coverage. Many historical data sets may be limited in their sample size, but have highly defined spatial coverage. Conversely, current data collection and modelling methods commonly aggregate data across broader spatial scales, potentially smoothing over localised changes so they are hard to document or compare with older datasets.
- Over time, differences in sources or collection (e.g. scientific sampling vs. commercial records, changing sampling techniques or organizations) may occur. Available historical data may have been recorded in a completely different form compared to contemporary data, especially given that much historical information and findings are qualitative (e.g. oral testimonies/memories, archaeological data, drawings and paintings, etc.) whereas current convention focuses on more quantitative sources.
- Historical time series commonly contain missing data or variables, or there may be other uncertainties associated with historical datasets. As a result, historical ecologists commonly have to make assumptions about various aspects of the data, or levels of uncertainty surrounding the data, which may have implications for our ability to accurately interpret changes observed over time. Despite these challenges, the working group noted in discussions that sometimes observed changes are large enough, i.e. orders of magnitude, to be robust to uncertainties in data or assumptions (e.g., in cases of loss of populations, local extinctions).

**Challenges in applying historical data to management:**

- A common argument is that no new knowledge is presented – e.g. "we know the cod/turtles/oysters/seagrass disappeared long ago, so you have not shown anything new."
- Some population modelling approaches may be too narrow in terms of the type of data that can be used, or our thinking may be constrained due to existing model frameworks presently in operational use (e.g. perhaps parts of the scientific community is too focussed on data rich cases and may not be aware that historical ecology could contribute to data-limited cases, especially in a

long-term historical perspective? Are we focused on specific kinds of data, approaches, and questions?)

- There is a prevalent belief that historical knowledge presented is unable to contribute “realistically” to management strategies and plans (e.g. “we can’t go back to that kind of system because it involves too much money and effort” and “systems are different now”…)
- Causes of declines and disappearances may be unknown or cannot be attributed solely to human impacts “with a high enough degree of certainty” (natural variations also important). Alternatively, sometimes multiple human impacts co-occurred but resolving which ones were most important is not possible. If a human impact cannot be definitively demonstrated, how can managers and authorities implement actions to bring about recovery? What actions or approaches should be used in such cases? Consider application of Precautionary Approach and/or reversed burden-of-proof?
- A communication gap exists between MHE and application/governance; a lack of application may be due to a lack of knowledge / awareness of historical results by those making decisions, or a lack of knowledge about where relevant ecological data and information can be found.
- Relevance: Lack of clarity around where historical information is important and informative for policy, and who benefits (or loses most) by its inclusion.

**Opportunities for engagement:**

- MHE colleagues need to be proactive, i.e., attend workshops, working group meetings, etc., where decisions and policies are being made, and present their results.
- Application to management may be more straightforward in a conservation context for endangered, non-commercially exploited species (e.g., some fish species, whales, seals, turtles) than in fisheries management context. This does not mean that historical data shouldn’t be applied to fisheries management, but that it may be more complex to apply.
- Identifying what kinds of knowledge or results are most readily accessible and applicable to management and policy is necessary to facilitate uptake of historical data.
    - e.g., is it easier to use MHE knowledge to document changes in past abundances than changes in distributions of a species; or to document past species assemblages or community size structures vs. abundance of a single species?
    - e.g., will historical information on a charismatic or commercially important species hold more ‘sway’ over decision-makers?
- MHE data can be used to “look forward” i.e., given the historical data we know exists, what are the implications for future data collection? Is it too costly to monitor populations and systems and enforce regulations to ensure they stay recovered? Any evidence yet for declines->recoveries->new decline due to human impacts?

The working group felt that these issues could be brought to the wider marine ecological and fisheries communities, which would increase community and stakeholder awareness of both the difficulties associated with implementation of MHE knowledge and the opportunities a historical perspective can provide. To this end, the working group will prepare a manuscript, led by Brian MacKenzie, based on its discussions to be submitted for peer-reviewed in a journal as a Perspective, Opinion or Food-for-Thought article. The article will be intended as primarily a multi-authored WGHIST and OPP WG1 product though with potential input and contributions from colleagues outside WGHIST and OPP1.

### Outline for stock assessment improvements with historical data

#### Giacomo Chato Osio

In the context of fisheries stock assessment, there are different aspects of historical data that can improve the way models capture past, present and future population dynamics. A key piece of information on a fish stock is its unexploited biomass, which can give perspective on the stock productivity as well as current depletion level. Past productivity can be also useful in identifying levels and dynamics that a stock can attain under reduced fishing mortality, for example, and recovery plans. However, identifying the 'unfished biomass' is one of the tricky tasks of fisheries science, as the early phases of fisheries development are rarely documented, or are not documented with the coverage and precision commonly applied in current fisheries monitoring and sampling.

Aside from proxies of or virgin biomass, there are multiple sources of information that can emerge from a historical ecological context that can be integrated into contemporary stock assessment, either by extending assessments further back in time or by improving different aspects of the assessments. The incorporation of historical data from different sampling types and with precision levels unlikely not comparable with contemporary data, comes with potential benefits, but also clear modelling challenges. Integrating data rich in information but poor from a standardization or comparability point of view can be challenging in terms of models, and can easily require development of ad-hoc methods that accommodate non-conventional data. Nevertheless, if a sound incorporation of data can be performed, there can be positive trade-offs between investment of modelling time and gain in assessment robustness.

We outline here types of data that can extend and improve assessments:

- Total catch is information fundamental to reconstruct going back in time, as close to virgin biomass as possible. These estimates can be used in fairly simple models but also incorporated into more advanced age-structured models if information on fish size is available.
- Fishing capacity / fishing effort can be entered into stock assessment models such as surplus production models, but even alone can provide the background information for reconstructing the fishing history of a stock and comparing the relative levels of effort in relation to catches.
- Knowledge of fishing gear and technology is fundamental to understand efficiency of gear and its change over time and to correctly build fishing effort that

will account for large changes in technology. This is key in conjunction with fishing effort to properly standardize catch per unit of effort (CPUE) information.

- Areas of operations of the fishery are necessary over long time periods to contextualize historical catches compared to contemporary catches. The rule that in the old days fishermen were fishing in shallower waters and over a smaller area of the sea often holds.
- Experimental/scientific fishing surveys can give valuable insights about CPUE in early exploitation phases, in addition to describing catch composition and biodiversity.
- Fish size being related to demographic structure and fisheries exploitation can be used to split aggregated catches.
- Discarding rates often change over time and are useful to document total fisheries removals.
- Commercial catch structure

The information described can be used as background information to inform stock assessment decisions, can be used alone or integrated into stock assessments. Since there are several assessment models with different underlying assumptions and data needs, it is difficult to detail which information could be incorporated in which model (see ICES Stock Assessment), but in general in age-structured models there are benefits derived from using long time series:

- Fleet selectivity can be better estimated by having old series with complete length distributions.
- Stock recruitment, the extension of time series with age/length data might allow the fitting robust stock/recruitment models, which are key for statistical catch at age models and for management oriented short term forecasts from stock assessments.
- Population dynamics at low exploitation levels can be incorporated in assessment models via reconstruction of time series and can be important for projecting stock status of stocks recovering from high exploitation.
- Relation with climate variability can only be detected via correlation of long time series of environmental variables with stock components like recruitment. These can help identify productivity phases in relation to climate.

These are some areas where stock assessments could benefit from backward extension of the input data. There are other advantages deriving from recovering historical fisheries data that could be directly beneficial to monitoring aspects of the MSFD Descriptors. Benefits could include the following:

- Reconstructions of historical fish distributions and habitats (D1)
- Trends in biodiversity (D1)
- Biomass reference points (D3)
- Trends in fish size (D3.3)
- Distribution of eradicated species (D1)

## Theme 3. Data rescue, digitization, and future development (ToR b)

### Update on ICES Metadata file progress, and alignment with other European metadata efforts

Ann-Katrien Lescrauwaet

WGHIST aims to increase access to historical metadata and data for the purpose of increased analysis in support of assessment of historical reference conditions and natural variations in marine ecosystems, which can be used as baselines for evaluation of current ecosystem health.

As a follow-up to the ToR "Provide metadata descriptions (to the ICES Data Centre) of historical datasets (in the ICES region) that are potentially useful for establishing population and biodiversity baselines, in particular for the Marine Strategy Framework Directive (MSFD)", the following decisions and actions were taken by the Working Group:

- The fields (column headings) to describe each record (line) consist of the following list:

| |
|---|
| Dataset Title (where possible should include taxonomic reference, geographical reference and time span) |
| Case study region (regional sea) |
| Record Type (archive, statistical table, logbook,..) |
| Data Source |
| Species or Taxonomic groups |
| *Aphia_ID according to the World Register of Marine Species 'WoRMS': www.marinespecies.org* |
| Number of species reported |
| Type of observation (landings, catches, environmental data,..-) |
| Span of years: year of first record, year of last record |
| Temporal resolution: annual, monthly, daily, |
| Fishing region (e.g. Stellwagen bank, North Adriatic Sea, ..) |
| *Marine Regions ID according to www.marineregions.org* |
| Country of landing |
| Spatial resolution: ICES typology, by port, geographical coordinates, etc. |
| Data owner/data provider |
| Contact: name, e-mail address |
| Access policy: Open Access, access by request, etc. |
| Web-link |
| Status or progress: in process of digitilisation, on paper etc. |

| |
|---|
| Notes 'Description of the dataset': additional notes, limitations etc. |
| Date of first entry of the dataset in the metadata file: date |
| Last updated (date) |

- A list of 99 dataset descriptions are included in the metadata file (September 2014), with a broad coverage in the Baltic, Mediterranean, North Sea and Atlantic (North, Northeast and South); the highest number of datasets relates to the North Sea (33) and Mediterranean Sea (30). 24 datasets are 'Open Access', 32 are of 'Access by request', while another 12 are being digitized for Open Access sharing in next phase.

| **Number of dataset descriptions, by regional sea and by data policy** |
|---|
| Atlantic Northwest |
| Access by request |
| Data currently unavailable, metadata available on HMAP Data Page |
| Open Access |
| blank |
| Baltic Sea |
| Open Access |
| (blank) |
| Icelandic waters |
| public archive |
| (blank) |
| Mediterranean Sea |
| Access by request |
| Open Access |
| (blank) |
| North Atlantic |
| North Sea |
| Access by request |
| Open Access |
| Open Access, after visit to SAHFOS |
| public archive |
| published |
| to be Open Access |

| |
|---|
| (blank) |
| Northeast Atlantic |
| Open Access |
| South Atlantic |
| to be Open Access |
| TOTAL number of datasets |

- The data descriptions were screened for uptake in the data systems and data products of (Eur)OBIS and EMODNET-Lot Biology. The datasets that contain biogeographic data and/or contain taxonomic or geographic references are of particular interest for OBIS and EMODnet-Biology. The data-owners of these datasets were contacted to explore sharing this data in wider context.
- EMODnet frequently provides small funds to support digitalisation of datasets that contain biogeographic records on marine species. For more information contact: simon.claus@vliz.be

**Participants are highly encouraged to:**

- Contribute by including data descriptions of historical datasets in the metadata file, available from the WGHIST SharePoint.
- Invite colleagues and peers to contribute to this file or contact A.K. Lescrauwaet (annkatrien.lescrauwaet@vliz.be) or WGHIST chairs for more information.
- To create a citation for their data (e.g. through itp.vliz.be or other itps): according to format "data creator (year published), title".
- To publish and share their data e.g. by submitting it to an internationally acknowledged data centre (recognition by ICSU Word Data Centre); creating a Digital Object Identifier DOI. Consider, where possible, a 'Creative Commons licence', allowing data to be freely downloadable.
- Data management teams of OBIS (http://www.iobis.org), EMODNET (www.emodnet.eu), VLIZ (www.vliz.be) and others, are at our service to support us in this process, while the data creator is at all times free to decide on data policy and access to data.

## Theme 4. Social, cultural, and economic dimensions of marine ecosystems through time (ToR d)

### Integrating human dimensions into marine historical ecology: challenges and opportunities

**Peter Jones**

Marine historical ecology (MHE) is primarily concerned with the scale and rate of change in marine ecosystems as a result of anthropogenic activity. Yet the study of what might be described as the 'human dimension' of this dynamic interaction (the social, cultural and economic drivers that lie behind such change) has not yet found a settled place within the new discipline. This is unsurprising. Up to now, MHE has been dominated by ecologists and natural scientists who have used historical data as a way of pushing back the baselines in our understandings of ecosystem change. Perhaps the most obvious example of this is the work of HMAP and its contribution to the Census of Marine Life. Even though HMAP involved the work of historians alongside that of natural scientists, its approach was largely to use historical data to provide retrospective models of ecosystem abundance and functioning, rather than to qualitatively examine the relationship between human communities and those ecosystems (which, it could be argued, is the distinctive strength of history as a discipline).

The HMAP model for MHE is, of course, central to addressing the many crises facing the world's oceans; but it cannot be the whole story. If we wish to take MHE forward in order to contribute substantially to the integrated assessment and management of ecosystems in the future, we need to fully understand not only the 'what' of historical ecosystem change, but the 'how' and the 'why' as well, which involves asking searching questions about the human dimension. A growing body of scholarship has emerged over the past twenty years which addresses these questions, for example, the work of William Leavenworth, Poul Holm, W. Jeffrey Bolster and Bo Poulson. But too often in the past this work has been seen as distinct from that of MHE, most commonly coming under the category of environmental history. Despite much goodwill and a serious intention to collaborate, humanists and scientists have yet to find a common language in marine historical ecology.

The answer, I would suggest, is relatively straightforward, and it lies in a closer collaboration between the natural sciences, the social sciences and the humanities at the level of research outputs. Rather than simply paying lip service to each other's disciplines, the only way to bridge the deep divide between them is to work on the production of outputs which are genuinely cross-disciplinary (i.e. co-authored or investigated with equal weight by researchers from different but complementary disciplines) and to find sympathetic fora where such outputs would be welcomed. The online journal *PLoS One* is one possible example, but in the long term it may be desirable to establish a new journal specifically to host such cross-disciplinary collaborations in MHE: a *Journal of Marine Historical Ecology*, for example. Despite the difficulties and challenges inherent in fostering truly cross-disciplinary research, ICES WGHIST working groups are already providing vital symposia for negotiating new agendas and future directions in MHE.

## History of interrelations between human society and the marine environment: potential research questions

### Alexei Kraikovskii

The problem of representation and perception of the marine environment as well as of the marine harvesting and the fishermen is among the most important and promising research perspectives in the history of the interrelations between the human society and the marine environment. This perspective opens the opportunity to use the widest range of sources like texts and narratives, visual materials and media of all sorts. The possible research questions could be:

1 ) How did the society see the marine environment and the fishermen through history?

2 ) What groups of interest (and perhaps some specific elements of environment) we can determine in this process of construction of representations?

3 ) How did the people involved into the marine harvesting represented themselves (if did) and to what extent this self-representation coincided with the image they had in the eyes of the educated society (scientists)?

4 ) What can those representations tell us about the ecosystem (if they can)?

To what extent those images and representations were (and perhaps still are) the part of ecosystem management and decision-making?

## Marine environmental history approaches to integrating human elements into ecosystem assessments

### Matthew McKenzie

One of the most pressing challenges facing global fisheries analyses is the need to understand the human consequences of management actions. Certainly not new in the twenty-first century, recent revelations of declining global stocks, combined with grinding and persistent declines facing well-established fisheries highlight the need for ecosystem-based management to consider human agency in more sophisticated ways than has been done in the past.

Traditionally, human elements have been included in fisheries management considerations in two ways. In research, economic analyses have brought to light far-reaching and complex mechanisms that affect fisheries markets for both producers and consumers. Predicating analyses upon the sound and well-established principles and in market decision-making, economists have integrated into their quantitative studies a wide array of forces shaping human behaviour; and using assumptions about human economic decision-making, have produced important results that have pushed fisheries analyses far.

Anthropologists have also informed fisheries analyses in important and fundamental ways. Focused upon fishing communities as a whole, these explorations trace ties of connectivity linking fishermen, families, and employers through (at the very minimum) the productive structures that bring fish into the market. Like economic analyses, these studies look far beyond the productive process to explore how cultural and social structures influence fishing communities, identities, and regional cultural affinities.

Fisheries analyses—and the feasibility today that we might even consider ecosystem-based management regimes—rest upon these findings as much as the biological and ecological studies that undergird the field. As the examples mentioned above suggest—though hardly definitively—our analyses still fall short of where we need them to be. One way we can move ahead is to take new looks at how we do what we do. One question we can ask is, do economics and anthropology alone integrate human elements sufficiently in current analytical processes?

From historical perspectives, economics and anthropology—through no fault of anyone—leave some aspects of human behaviour un-considered. In brief, economic analyses assume human decision-making can be modelled upon economic principles. At the same time, anthropology—by focusing on fishing communities often in isolation of the larger society—does not pick up exogenous forces that shape, frame, and condition human uses of marine resources.

By no means a comprehensive solution, marine environmental history (MEH) analyses hold promise to help fill in these gaps. On the most basic level, by identifying and providing a methodology to critique sources from the past, MEH promises to bring into consideration new data points, that may lack the statistical rigor of contemporary data sets, still offer important insights into changing marine ecosystems. For example, historical sources can often support rigorous statistical and other analyses – sometimes holding greater spatial and temporal detail than currently used information – or via the application of creative and novel approaches. MEH methods also help evaluate the durability of current and past data streams, and provide means to uncover how humans responded to changing conditions over time.

Historical studies offer broader insights beyond historical data identification and source criticism. Historians tend to focus on local forces shaping human behaviour, their ties and responses to more distant changes, and how cultural values blend in with people's rational understandings of, for example, economics. Furthermore, rather than see fishing communities in isolation, historical studies integrate those people within a larger milieu shaping human experiences and responses to change at a given time. In other words, historians see fishing not as a global phenomenon whose practitioners' motivations can be exported across space and time, but rather as an intensely local—though not isolated—endeavor.

Consequently, historians exploring human responses to change across space and time study a different suite of variables that might offer new ways forward in current efforts to better manage global fisheries. The focus upon local circumstances is perhaps most promising. Fisheries economic value has long provided means by which some have been able to exercise control over others. And, in turn, those others have pushed back. Such tensions are important. They often create power relationships that organize onshore spaces (such as fish piers, processing plants, exchange routes), and by extension, offshore fishing operations. Struggles over fishing's benefits moves beyond economic motivations: ethnic, religious, racial, and national identities divided as much as unite fishing communities across a region—and sometimes even within a community. Economically irrational, these divisions have often played more important roles than financial analyses might suggest. Individually, the identity of fishermen themselves also introduced irrational decision-making. While perhaps economically unsound, fishing identity in many communities brings social and cultural capital from the rest of the community. More importantly, such capital also resonates far beyond the fishing community in question.

Ultimately, historical studies reveal the importance of local conditions shaping fishing behaviours. Often, those conditions bear with them political consequences, and herein lies a third means by which MEH may enhance current management research. If all fishing is local, so to is politics. Historians also focus upon how past fishing operations shaped, politically, both the regulatory and the scientific contexts that conditioned fishing as a whole.

MEH is hardly a panacea for contemporary fisheries management challenges. Furthermore, MEH draws upon a variety of perspectives to uncover past human relationships to the marine environment. The discipline's strength lies in its ability to incorporate diverse disciplinary approaches. Combining history's own tools and approaches with those of ecology, biology, economics, and anthropology, the field brings perspectives and methodologies that could enhance current efforts.

# Annex 3: Collaboration with Oceans Past Platform (OPP)

## EU COST Action on Oceans Past Platform

**Henn Ojaveer**

The Action aims to measure and understand the significance and value to European societies of living marine resource extraction and production to help shape the future of coasts and oceans. The Integrative Platform will lower the barriers between human, social and natural sciences; multiply the learning capacity of research environments; and enable knowledge transfer and co-production among researchers and other societal actors, specifically by integrating historical findings of scale and intensity of resource use into management and policy frameworks. The oceans offer rich resources for feeding a hungry world. However, the sea is an alien space in a sense that the land is not. Fishing requires skills that must be learnt, it presupposes culinary preferences, technical ability, knowledge of target species, and a backdrop of material and intangible culture. The Action asks when, how and with what socio-economic, political, cultural and ecological implications humans have impacted marine life, primarily in European seas in the last two millennia. The Action calls on historians, archaeologists and social scientists as well as colleagues from the marine sciences to engage in dialogue and collaboration with ocean and coastal managers. The Action will develop historical descriptors and indicators for marine and coastal management.

OPP consists of the following five Working Groups:

- WG1: Trends in Production and Consumption (see below)
- WG2: Coastal settlements (aim to pool and enhance existing knowledge regarding four critical issues that combines demographic, economic and environmental dimensions)
- WG3: Aquaculture (aim: to collect and develop knowledge on aquaculture's impact on ecosystem goods and services and distribution of social and economic costs and benefits over time, as well as on the shifting perceptions and management of aquaculture)
- WG4: Changing values (economic and cultural) of marine life to society (aim: by documenting the changing relationship of society and marine life to develop a comparative
- trans-disciplinary and integrative understanding of the human-ocean system and overall changes in society)
- WG5: Gendered seas (aim: to understand how men and women have used, governed, and changed their marine environment over time).

The most relevant to WGHIST is Working Group 1. The aim of the WG1 is to use archaeological, historical and more recent catch history information to establish integrated trends in exploitation of key marine species through linking:

- trends with technological development
- trends with societal developments such as colonialism, past & present policy measures

- the role of marine science insights for production and consumption

WG1 has the following topical focus areas:

- Multi-centennial fishery and consumption of charismatic species: case study of tuna in the Mediterranean Sea
- Historical ecology of commercial demersal species: case study in the North Sea, incl. spatial trajectories, fleet/gear dynamics, development and testing of indicators
- Forage fish (such as herring, stickleback) in various marine ecosystems over different time-periods: centennial-scale exploitation and consumption trends, technology development, assessment of trajectories of fishing power.
- Conspicuous marine consumption: case study of oysters in European northen seas since the 15th century

In addition to the four topical focus areas, WG1 also:

- Develops methods to synthesize the quantitative and qualitative historical evidences to reconstruct changes in exploited populations and ecosystems over time (lead: Adriaan Rijnsdorp);
- Facilitates the collection and inventory of open data sources through standardization of protocols (lead: Ann-Katrien Lescrauwaet)
- Makes explicit how Marine Historical Ecology can guide management (lead: George Engelhard)

Geographic focus areas:

Based on the research interests of participants and also considering the data/information availability, the following areas were considered as a primary focus: North Sea, Baltic Sea and the Mediterranean Sea

Countries involved:

Representatives of the following countries participate in WG1 activities: Australia, Belgium, Denmark, Estonia, France, Great Britain, Germany, Ireland, Italy, Netherlands, New Zealand, Russia, Sweden and USA.

## Annex 4: Recommendations

| Recommendation | Addressed to |
|---|---|
| 1. WGHIST recommends and welcomes participation of members from ICES Strategic Initiative on the Human Dimension. This participation will ensure involvement of competencies available in ICES to better integrate social and economic data in WGHIST work. | ICES Strategic Initiative on the Human Dimension |
| 2. WGHIST recommends participation of scientists experienced in fish stock assessments (including members from SI on Stock Assessment) at future meetings to effectively feed historical data into stock assessment methods and use the obtained results in an advisory/management context. | ICES Strategic Initiative on Stock Assessment |
| 3. WGHIST recommends continued liaison with DIG and the ICES Data Centre to ensure that the WGHIST metadatabase is integrated into the ICES website in a way that ensures the metadata information is available to the science community. | ICES Data Centre |