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

4–7 September 2018

Brest, France

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

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Executive summary

The ICES Working Group on the History of Fish and Fisheries (WGHIST), chaired by Ruth Thurstan, UK, and Emily Klein, USA, brings together researchers from multiple disciplines to discuss and undertake research into the timing, scale, and drivers of social-ecological change in marine and fisheries systems over multi-decadal to centennial time-scales. The 2018 WGHIST meeting convened in Brest, France, 4–7 September, and was hosted by the Université de Bretagne Occidentale, the Institut Universitaire Européen de la Mer, and the Laboratoire des sciences de l'Environnement MARin. Twelve participants attended in person, representing ten institutions across seven countries in Europe and North America. Three participants from Ireland and the United States attended remotely for part or all of the meeting.

The meeting opened with a public symposium and evening reception at the Université de Bretagne Occidentale, attended by approximately 45 people. WGHIST members also took part in a pre-meeting field trip to the Station Marine de Concarneau, the oldest marine station still operating in Europe, and several visits to government archival collections over the course of the week.

In addition to these activities, the 2018 meeting focused on progressing the WGHIST Terms of Reference (ToRs). Members presented and discussed on-going and recently completed research related to the ToRs, additional sources of metadata to be included in the ICES Data Centre online portal, opportunities to enhance the visibility of historical data to ICES scientists and the wider scientific community, and ongoing and potential future multi-author manuscripts.

1 Administrative details

Working Group name

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

Year of Appointment within current cycle

2018

Reporting year within current cycle (1, 2 or 3)

1

Chair(s)

Emily Klein, USA

Ruth Thurstan, UK

Meeting dates

4–7 September 2018

Meeting venue

Brest, France

2 Terms of Reference

a) Collection and assembly of metadata on marine social-ecological systems through time, and further development of data products and best practices that encourage the use of these resources.

b) Review outcomes of WKIHSD meeting and peer-reviewed research from the historical ecology community, and from these consider preparing brief over-views of key historical in-formation for sub-mission to ICES Ecosystem and/or Fisheries Overviews.

c) Evaluate changes in marine ecological and social-ecological systems through time via cross-disciplinary collaboration, and demonstrate the importance of this knowledge for contemporary science and management.

d) Continue to use non-traditional data sources and approaches for advancing our knowledge of change and dynamics in marine ecological and social-ecological systems through time.

3 Summary of Work plan

Year 1	In Year 1, WGHIST will work with the ICES Data Centre to explore the opportunities for developing data products that encourage use of and enhance the visibility of historical and long-term data (ToR a). Work on the proposed manuscripts (ToRs c, d) will also commence during the Year 1 meeting, as will identification of historical

	data/literature for the ecosystem overviews (ToR b). Potential areas of interest already identified by WGHIST members for ToRs c and d include: quantifying changes in ecosystem services over time, detailing fishing technology change and cumulative impacts upon fishing efficiency, and invoking cross-disciplinary knowledge to expand our understanding of linked social-ecological system change through time. Post-meeting work will involve soliciting contributions from the wider WGHIST membership list and continued development of manuscripts. WGHIST will also support WKIHSD with data resources and expertise (ToR a). The WGHIST 2018 meeting will also re-establish links with the ICES SIHD and other WG with expertise relevant to WGHIST aims, through invitation of SIHD and WG Chairs to the WGHIST meeting, whether in person or remotely, and by the WGHIST Chairs remaining in communication with SIHD and other WG throughout the year. These efforts aim to strengthen cross-disciplinary ties and enhance communication and learning among ICES WGs. Links with external groups (e.g. Oceans Past Initiative) will also be maintained to enhance interdisciplinary learning and collaboration.
Year 2 and 3	In years 2 and 3 WGHIST will continue to develop digital tools for historical metadata, explore opportunities for improving the accessibility of historical data for use by the scientific community, and develop protocols for best practise when using historical data, potentially in collaboration with the ICES Data Centre and other WGs. While these tools will be finalised in year 3, it is our hope that progress will be ongoing throughout years 1 and 2, including the provision of digital updates to the ICES community during this time. If so, this will afford WGHIST members and the wider ICES community multiple opportunities to make use of these tools and feedback to the Chairs and Data Centre on these tools, thus enabling the tools to be improved over this iteration. Years 2 and 3 will also see progress on the proposed manuscripts and ecosystem overviews, and the WGHIST chairs will work to maintain and enhance connections with SIHD and other relevant WG, as above. Year 2 will forward manuscript and guidelines in our ToRs, which will be circulated among WGHIST members in between the metings. This circulation may include scientists and practitioners with targeted expertise outside WGHIST. In both years, specific research from WGHIST will be used to expand this work. Deliverables will then be completed in Year 3.

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

In 2017/2018, the following scientific papers/book chapters were published or submitted, which benefited or resulted from discussion or collaborations developed during previous WGHIST meetings and correspondence:

Caswell B, Klein ES, Alleway HK, Ball J, Cardinale M, Eero M, Engelhard GH, Fortibuoni T, Henta-ti-Sundberg J, Jones P, Kittinger JN, Krause G, Lescrauwaet A-K, MacKenzie B, McKenzie M, Ojaveer H, Pandolfi JM, Raicevich S, Sundelöf A, Thorpe RB, zu Ermgassen PSE, Thurstan RH. Something old, something new: Lessons from history for today's blue growth agendas. **Submitted**.

Currie JC, Sink KJ, Attwood CG, Atkinson LJ, Engelhard GH. 2018. Reconstructing the past: design and function of Granton otter trawl gear at the turn of the twentieth century, as used in South Africa's first trawl surveys (1897–1904). Maritime Studies: 1–16.

Danto A, Mazé C, Ragueneau O. 2018 "L'océanographie éco-politiste de la Mer en action. Carnets de terrain d'une ethnographie multisite des modes de gouvernement de la Mer au croisement des sciences sociales du politique et des sciences de la nature. Social Sciences Information. FMSH Ed. 57(3): 448-475. https://doi.org/10.1177/0539018418794329.

Danto A. 2018. "La pêche à l'anguille (Anguilla anguilla). Regards croisés sur les mutations de pratiques de pêche d'une espèce vulnérable en Atlantique français et Baltique allemande". Norois. 246: 75-92. https://journals.openedition.org/norois/.

Ragueneau O, Raimonet M, Mazé C, Coston-Guarini J, Chauvaud L, Danto A, Grall J, Jean F, Paulet Y-M, Thouzeau G. 2018. "The impossible sustainability of the Bay of Brest? Fifty years of ecosystem changes, interdisciplinary knowledge construction and key questions at the science-policy-community interface". Frontiers in Marine Science. 5(124): https://www.frontiersin.org/articles/10.3389/fmars.2018.00124/full.

Danto A, Collias E. 2018 "Grande Brière Ramsar Site, France" in The relationship of indigenous peoples and local communities with wetlands. G Oviedo and M Kenza Ali, eds. Ramsar Convention Secretariat. 61pp. https://www.ramsar.org/sites/default/files/documents/library/indigenous_peoples_local_communities_wetlands_e.pdf

5 Progress report on ToRs and workplan

WGHIST participants at the 2018 meeting included fisheries scientists, historical ecologists, historians, and paleoecologists (a list of participants is provided in Annex 1). Meeting participants discussed options to maintain quality metadata on sources of historical and long-term data, and to develop related digital tools and opportunities to enhance the visibility of historical data to ICES scientists (ToRs a, b). The meeting also included presentations of current and completed research (ToRs c, d). Research discussed covered temporal periods from the medieval period to modern day fishery statistics. Summaries of research presented are provided in Annex 2.

As in previous years, WGHIST participants used social media and other platforms during the meeting to engage with the ICES and wider scientific community as well as the public under the hashtag #WGHIST. This hashtag was tweeted/retweeted on Twitter close to 300 times during and in the 2 months following the 2018 meeting, with the majority of these (>200) during the meeting and in the week following. A paragraph on the activities of the working group was also highlighted on the ICES Facebook page. In addition, co-chairs Klein and Thurstan presented the work of WGHIST and ICES at the public symposium held at the Université de Bretagne Occidentale immediately prior to the WGHIST meeting, and at the 2018 Oceans Past VII conference in Bremerhaven, Germany. At the latter, Klein presented the aims of WGHIST as part of the conference opening plenary, and Thurstan on the recently submitted paper stemming from the previous iteration of WGHIST.

5.1 Progress on ToR a)

Collection and assembly of metadata on marine social–ecological systems through time, and further development of data products and best practices that encourage the use of these resources

Chairs Thurstan and Klein reviewed the historical metadata uploaded to the ICES Data Portal, and the meeting attendees identified additional sources of metadata and discussed ideas for future digital products that could stem from the existing metadata. For example, of continuing interest is the engagement of WGHIST metadata in the ICES Spatial Facility. Highlighting the existence of historical datasets on the Facility can deepen the wealth of knowledge available to users of ICES data, and demonstrate the prevalence of long-term information. Chairs will discuss furthering this and other options with the ICES Data Centre during 2019. To ensure historical resources are visibly connected, WGHIST and the ICES Data Centre staff have already created an icon to denote historical data (Figure 1), and this will be further used to identify and link with the already uploaded metadata.

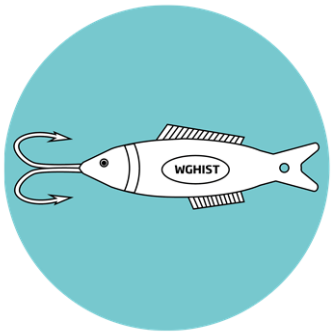

Figure 1. WGHIST logo, also used to denote historical resources on the ICES Metadata Catalogue.

The group also discussed the importance of encouraging further digitization of historical and long-term sources, and of promoting best practices in the application of these data. WGHIST members also remain focused on finding ways to make such resources more accessible to a larger audience, but alongside clear instruction to guide the use of such resources by the wider community. These goals will be progressed over this iteration of WGHIST in collaboration with ICES staff as appropriate.

5.2 Progress on ToR b)

Review outcomes of WKIHSD meeting and peer-reviewed research from the historical ecology community, and from these consider preparing brief overviews of key historical in-formation for submission to ICES Ecosystem and/or Fisheries Overviews

Due to a lack of nominations, the planned WKIHSD meeting was not held in 2018. The potential for a future meeting was discussed, and members decided to: 1) cancel the current WKIHSD; 2) update the WGHIST historical databases (Annex 4); 3) explore alternative approaches to initiate interest from ICES-affiliated stock assessment scientists; and 4) eventually generate new ToRs in collaboration with identified, interested stock assessment scientists. Chairs, Thurstan and Klein, have commenced these actions. Regardless of the outcome of WKIHSD or an alternative, WGHIST members continue to be interested

in enhancing the evidence base around historical data and stock assessment (i.e., how can historical data enhance stock assessment and associated decision making?) and forwarding concrete outcomes. Hence, during 2019, a manuscript will be planned and WGHIST members invited to participate (actioned by the Chairs).

WGHIST members also felt that the inclusion of historical data into ICES Ecosystem and/or Fisheries Overviews would be a positive step towards enhancing the visibility of historical data. The next steps were identified and the Chairs assigned actions to progress prior to the 2019 meeting, including reaching out to individuals within ICES on ways to best contribute to these endeavours in the coming year.

5.3 Progress on ToR c)

Evaluate changes in marine ecological and social–ecological systems through time via cross-disciplinary collaboration, and demonstrate the importance of this knowledge for contemporary science and management

Attendees shared completed and ongoing research for this ToR. Work under this theme represented (1) examples of research into social-ecological changes through time, as well as (2) the importance of this understanding for contemporary science and policy.

Under (1), **Bennema** is exploring the impact of trawling upon deep-sea oyster beds of the North Sea. While the former distribution and timing of decline of coastal oyster populations is relatively well understood, gaps still exist in our understanding of the distribution and declines in deep-sea oyster beds, which is crucial to oyster restoration projects. **McKenzie *et al.*** are in the initial stages of exploring social-ecological links and feedbacks between demersal and fishing communities upon the advent of bottom trawling. **Jordaan** presented on the last decade of historical research and what this has revealed about Northwest Atlantic marine ecosystems. **Caswell** discussed her research on how long-term anthropogenic impacts including nutrient enrichment and deoxygenation affect the structure and functioning of the marine benthos, work that increases our understanding of over what timescales these changes will impact the delivery of ecosystem services. **Ojaveer *et al.*** explored the drivers behind the long-term dynamics of the Artic copepod (*Limnocalanus macrurus*) in the Baltic Sea, while **Buckley** demonstrated how historical data had provided evidence for the spatial contraction of spawning grounds for Spanish mackerel (*Scomberomorus commerson*) in the Great Barrier Reef. **Dias** described her work examining the spatial and temporal changes in anadromous forage fish in the Northwest Atlantic and the impact of biomass loss of small anadromous species on marine food webs, while **Danto** presented his work on historical changes in European eel populations (*Anguilla anguilla*), a research project based on an inventory of fishermen's local ecological knowledge, and on historical ecological work on the presence and life cycles of eels in the Loire River basin, to observe how this knowledge is or is not taken into account in scientific studies and management measures. **Iglesias** described how newspaper, scientific surveys, and popular reports had helped him and colleagues map and understand prior distribution and life history of the Bramble shark (*Echinorhinus brucus*, formerly known as the Spinous shark) throughout European waters.

Almost all participants described how their research was or could be linked to contemporary science and policy. Of particular note, **McKenzie** spoke of his recently published book, *Breaking the Banks*, which highlights how New England fishing lobbies have successfully leveraged a highly romanticised and simplistic representation of their fisheries to lobby for fewer regulations and increased subsidies. **Buckley's** historical data sheds light on the very beginnings of the first Great Barrier Reef commercial fishery and has been incorporated into the most recent Spanish mackerel stock assessment for the East coast of Australia (published in 2018). **Dias** denoted how she used historical baselines to test management strategies for anadromous forage fish, while **Iglesias'** work has the potential to enhance our understanding of a data deficient species and clarify the level of loss for such populations, with clear implications for identifying and conserving species at currently very low levels given past abundances.

5.4 Progress on ToR d)

Continue to use non-traditional data sources and approaches for advancing our knowledge of change and dynamics in marine ecological and social-ecological systems through time

WGHIST members represent a range of disciplines, and many work with sources and approaches not traditionally used in marine or fisheries science. ToR (d) aims to highlight the non-traditional tools and methods that members use to examine past ecosystems and socio-ecological trends over time. These descriptions may prove useful for other researchers, including those working with contemporary data and especially in data-poor systems.

During the 2018 meeting, attendees highlighted several non-traditional data sources and approaches they had recently used or were currently using. For example, **Hentati-Sundberg *et al.*** are using industry magazines to explore the timing of different technology introductions to the commercial fishing community. **Buckley *et al.*** used fisher interviews and newspapers to determine changes in catch rate, fishing effort and fishing locations of Spanish mackerel, which have now been incorporated into stock assessment. **Iglesias** digitised international archives to find historical articles describing catches of bramble shark. He and colleagues used these alongside other non-traditional sources, such as historical popular media and photographs. **Coston-Guarini** is commencing a project examining how shipworm infestations in 18th century Europe altered the historical trajectories of different countries at that time, using documentary and museological collections, as well as modelling the effects of shipworm infestation on the navigability of ship hulls. **Graham** spoke to the group about an on-going NOAA project, *Voices of the Fisheries*, which is collating and archiving oral histories from people involved in United States fisheries. This archive houses ever-growing sources of information that have the potential to be accessed and analysed by researchers.

WGHIST members are also applying new methods and analytical approaches. At the 2018 meeting, **Coston-Guarini** discussed her work comparing 3D morphometrics (surface scans) of mollusc specimens with the neutral shell shapes generated *in silico* by morphodynamic models, to develop a new understanding of growth responses at the individual-level. The ultimate aim of this research is to suggest new ways to synthesize fundamental ideas about variability, growth and form, ideas which have not been revised since the early 20th century. **Ojaveer *et al.*** employed empirical dynamic modelling to

uncover dynamics and understanding not possible with traditional approaches for time series data.

Additional sources of data were also highlighted to the group during trips to local and regional archives and libraries. For example, the Marine Station de Concarneau houses archival texts of naturalists and past scientists of the station, as well as an extensive ichthyology collection. The Service Historique de la Defence holds centuries of government maritime archives, while the Les Ateliers des Capucins and L'Agence Française de la Biodiversité at Brest both host impressive collections of historical texts on natural history and fisheries, as well as historical information about the growth of marine science in France and Europe over time.

These works emphasise the broad range of interests and expertise available through WGHIST members. In addition to this ongoing research, there is an increasing global body of research examining the utility of neglected or unconventional data sources in natural resource management. These sources have great potential to provide additional insight alongside traditional data, encourage interdisciplinary work, and deepen understanding in data poor or limited systems.

6 Revisions to the work plan and justification

Not applicable.

7 Next meetings

2019: Falmouth, Cornwall, U.K.
Hosts: Ruth Thurstan, University of Exeter

2020: Copenhagen, Denmark.
Hosts: ICES Secretariat

Annex 1: List of participants

Name	Institute	Country (of institute)	Email
Emily S. Klein (Co-Chair)	Southwest Fisheries Science Center Farallon Institute	USA	emily.klein04@gmail.com
Ruth H. Thurstan (Co-Chair)	Centre for Ecology and Conservation, College of Life and Environmental Sciences, University of Exeter	UK	r.thurstan@exeter.ac.uk
Adrian Jordaan	Department of Environmental Conservation, University of Massachusetts Amherst	USA	ajordaan@eco.umass.edu
Ann-Katrien Lescrauwaet	Flanders Marine Institute	Belgium	annkatrien.lescrauwaet@vliz.be
Bryony Caswell	School of Environmental Science, University of Hull	UK	B.A.Caswell@hull.ac.uk
Floris Bennema	MarHis	The Neterherlands	f.p.bennema@xs4all.nl
Henn Ojaveer	Estonian Marine Institute, University of Tartu	Estonia	henn.ojaveer@ut.ee
Jennifer Guarini	The Entangled Bank Laboratory	France	j.guarini@entangled-bank-lab.org
Anatole Danto	Université de Rennes	France	anatole.danto@orange.fr
Jonas Hentati-Sundberg	Institute of Marine Research, Swedish University of Agricultural Sciences	Sweden	jonas.sundberg@slu.se
Matthew McKenzie	Dept of History and Maritime Studies Program, University of Connecticut	USA	Matthew.McKenzie@uconn.edu
Remote attendees:			
Bia Dias	University of Massachusetts Amherst CAPES Foundation, Brazil	USA	bdossantosdi@umass.edu
Sarah Buckley	Sea Fisheries Protection Authority	Ireland	sarah.buckley@sfpa.ie

Invited guests

Samuel Iglesias, *Marine Station de Concarneau*

Molly Graham, *NOAA Affiliate, Voices of the Fisheries*

Annex 2: Summaries of presented work

Deep Sea oysters *Ostrea edulis* in the central North Sea

Floris Bennema

Fisheries biologists in the BENTHIS group developed a scientific basis to quantify the impact of bottom trawling on the seafloor and the benthic ecosystem. One of the approaches was the study how fishing gear affects the seafloor, the other was to find tools to estimate the sensitivity of benthic communities in the North Sea. This led to the conclusion that the sensitivity of the benthic community can be estimated from the biological traits of their constituent species. Historical study on long-term changes in North Sea benthic communities opens the possibility to test these sensitivity-estimations.

Early 20th century (1900–1906) fishery expeditions data on macrofauna are only partly disclosed and analyzed. These data sets seem to be a promising source on the North Sea benthic communities in times trawling had had less impact on the sea-bed. Knowledge on this closer-to-pristine situation will deepen our knowledge on the biological bandwidth of this ecosystem thus enabling us to define sharper targets in natural recovery and protection projects.

At present my study concentrates on the 'deep-sea' oysters *Ostrea edulis* in the central North Sea. In From 1860 to 1914 an area of about 34 000 km^2 was depleted of its oyster beds by English, Dutch and German fishermen. The natural impact of the disappearance of this biogenic structure is unclear yet. Based on old maps, texts and expedition data one can draw a map delineating the area in the central North Sea with a high coverage of oyster beds. Successively this delineation can be tested by the combination of data on oyster ecology and of ecological gradients in the North Sea. Study on the western border of the area continuous, data on the other borders are quite convincing.

Breaking the Banks: representation and realities in New England fisheries, 1866–1966

Matthew McKenzie, University of Connecticut

New England fisheries scholars often identify 1905, the year the first steam trawler was launched in the region, to mark the beginning of New England's fisheries industrialization. Analysis of late nineteenth century Gloucester vessel ownership patterns and crew nativity, as well as studies of the horizontal integration and subsequent indictments of Boston's haddock trawl vessel owners, however, highlight that mechanization and industrialization are not necessarily the same process.

Fishing vessel lists and memorials to lost vessels reveal two important features in Gloucester's schooner fishery between 1866 and 1908. First, following the repeal of salt subsidies, Gloucester's schooner fleet consolidated into fewer and fewer hands as competing firms struggled to vertically integrate to dominate the market. This patterns mimics closely management decisions taken by other heavy industries bucking the boom and bust economic cycles wracking the US economy throughout the period. Second, pub-

lished memorials reveal a vast majority of those working on Gloucester's schooners were not American born; another pattern consistent with other American heavy industries at the time. Canadian born fishermen made up roughly 90% of the crews working aboard Gloucester vessels, while Americans made up a similar proportion of vessel owners. While still propelled by sails, and still fishing from dories, Gloucester's fishery after 1866 was managed toward profit maximization and market domination just like many modern American industries.

As indictment records reveal, Boston's fresh fish market actors followed similar trends, this time using total control of Boston's single fish pier to extort kickbacks from fishing vessels seeking to sell in the city. From those illegal payments, Boston's fish dealers amassed substantial surplus capital they then used to drive out competition, leverage lopsided from the city in the construction of the Boston Fish Pier, and eventually, drive up fish prices during World War I. These profits also allowed for the construction of the first steam-powered dragger, F/V *Spray*, in 1905, and four more otter trawlers before the war.

In both cases, industrialization - a term historians define as a redefinition of previous relationships between labour, management, the productive process - and natural resources, took place without the application of machinery to that productive process. While still using old methods, Gloucester fleet owners and Boston fish dealers made decisions based upon new expectations of profitability, industrial consistency and continuity, and power over workers and captains. These new attitudes began long before mechanization, and need to be considered as such.

Relationships between public perception and industrial realities also shaped management. Following the war, otter trawling expanded, and soon dominated the vast majority of New England's landings. Persisting romantic popular visions of Gloucester's schooner fishery, however, masked the industry's industrialization and mechanization. As biologist William C. Herrington published warnings to the industry to cease targeting juvenile haddock, using declining LPUE figures to support his case, most New Englanders continued to see their fisheries as timeless, artisanal, anti-modern, and sustainable.

The disconnect between popular perception and industrial realities continue to frame the region's understanding if its fisheries. Recent fisheries disputes reveal how appeals to tradition and heritage take front stage in public responses to quota cuts, marginalizing the groundfish fisheries' dire biological condition and overcapitalization. Such a disconnect has shaped historian's views, too, as no long term historical study yet has tackled the region's fisheries past following 1905.

Understanding the meaningful differences between industrialization and mechanization, as well as divergences between public perception of the fisheries and their industrial realities, represents an important filter to engage and integrate historical data into current analytical efforts. More broadly, this study highlights the need to properly understand the context from which date emerge, the debates and discourses that produced them, and the concerns of the people and ecosystems which they describe.

What a decade of historical ecology research has revealed about the Northwestern Atlantic ecosystem

Adrian Jordaan, University of Massachusetts

This provides a summary of ecological research completed over the last decade addressing changes in the Northwestern Atlantic ecosystem using historical data. The primary focal area constitutes the Northeastern US States and adjacent Bay of Fundy (Canada). To do this, a variety of methods and fishery catch data from a variety of sources. For all historical data, original copies were digitally photographed and transcribed.

Habitat loss

We have detailed freshwater habitat loss due to damming degrading access between freshwater and marine ecosystems (Hall *et al.* 2011, 2012; Mattocks *et al.* 2017). European expansion starting in the 1600s brought mills and increased populations throughout coastal areas and inland, and in a period from 1750-1850 a fundamental re-scaling of suitable habitat for anadromous fish. Increasing numbers of dams also leads to other landscape changes including de-forestation, however forests have returned to the New England landscape (Foster *et al.* 2002) while freshwater systems remain highly fragmented and provide limited access to habitat for anadromous fish. In addition, a number of species losses (Foster *et al.* 2002; Lotze and Milewski 2004) has altered the ecological interactions with unknown consequences.

Marine catch and export trends

The earliest available fishery time series spans 1804-1893 collected Massachusetts and Maine Fish Inspector reports, followed by U.S. Fish Commissioner Reports annual landings in Maine and Massachusetts by gear type in after 1886. The Massachusetts General Court required inspectors to send written reports to the Secretary of State detailing fish inspected each year. Massachusetts and Maine Fish Inspector reports provide fisheries export data as a proxy for fish harvested from the Gulf of Maine during the 19th century. These records indicate rapid shifts from nearshore/riverine to offshore fisheries precipitated by climatic impacts of the little ice age and Tambora volcanic eruption and gear innovation (Alexander *et al.* 2017) and reduction in the geographic extent of anadromous fish export (Hall *et al.* 2011). All this work support the habitat-based analyses that demonstrate loss of particularly smaller anadromous fish including river herring and American shad.

Catch records, observed in weirs

Inshore catch defined as river-based seines and coastal pound nets, seines, and weirs, and offshore catch used vessels to deploy gear, primarily purse seines. Coastal weirs and other fixed nets are treated as better proxies for fish population size since "effort", particularly the motorization of vessel power and fishing equipment, is not directly involved in fish capture. Weirs have been declining as a proportion of the catch for decades, thus less effort is being in the contemporary period. Regardless, the data suggest a contraction in the number of species caught and particularly of smaller "forage fish" such as Atlantic herring, river herring and American shad (Table 1). Menhaden have been demonstrated to be partially restricted from the Gulf of Maine region due to the loss of larger higher swimming capacity individuals (Jordaan *et al.* In Review). Current confidentiality regula-

tions limit a deeper analysis of this data with consideration of finer scale spatial scales and filled data gaps.

Table 1. Average historical and annual weir harvest from South of Cape cod in live pounds with species ordered in decreasing numbers for the historical data. These values are not corrected for the number of pockets or hauls made and simply reflect the possible and relative catch within the two time periods. Historical data transcribed by W. Leavenworth, and contemporary data from the Massachusetts Division of Marine Fisheries.

Species	Scientific name	1876–1895	1989–2012
Atlantic Herring+	*Clupea harengus*	2701688	0
Squid*+	*Doryteuthis pealeii* and *Illex illecebrosus*	892325	349705
Atlantic mackerel+	*Scomber scombrus*	672422	320403
Atlantic menhaden+	*Brevoortia tyrannus*	605592	0
River herring+	*Alosa aestivalis* and *A. pseudoharengus*	360908	0
Scup+	*Stenotomus chrysops*	340906	117738
Butterfish*+	*Peprilus triacanthus*	256363	10919
Other edible fish or bait fish*+	Various	126713	0
Flounders	Various	43462	3011
Tautog+	*Tautoga onitis*	25505	1347
American shad	*Alosa sapidissima*	11237	NR
Black sea bass+	*Centropristis striata*	10439	6958
WeakfishV	*Cynoscion regalis*	9575	0
Bluefish+	*Pomatomus saltatrix*	5698	27616
BonitoV	*Sarda spp.*	866	0
Eels*V	Various	501	NR
Atlantic tomcod (frost fish)*	*Microgadus tomcod*	411	NR
Striped Bass	*Morone saxatilis*	406	NR
King mackerel (kingfish)*V	*Scomberomorus cavalla*	238	0
Atlantic spanish mackerelV	*Scomberomorus maculatus*	167	0
Atlantic cod*V	*Gadus morhua*	146	NR
Horse Mackerel (Tuna)*	*Euthynnus alletteratus, various*	77	NR
Dogfish*V	*Squalus acanthias, Mustelus canis*	67	NR
Atlantic salmonV	*Salmo salar*	2	NR

*Some years not reported in historical data, + Some or the Vmajority years not reported in contemporary data due to confidentiality, NR no record

Ecosystem change

Ecosystem changes are documented in the section of Dias (this volume). The purpose of ecosystem models is to translate long-term changes in abundances of anadromous fish to an ecosystem impact, and eventually into potential fisheries landings, as to provide estimates of lost ecosystem services. Time-series and empirical dynamic modelling approaches can also provide a comparison of contemporary and historical data. The Bay of Fundy produced a number of fisheries time-series of landings that demonstrated nonlinearity existed in prior fisheries mechanization property of ecosystems (Klein *et al.* 2016).

A reduction in deterministic dynamics post industrialization suggests fisheries population models may become less predictive in exploited populations (Klein *et al.* 2016).

Conclusions

There has been a century long degradation and lost connectivity among what are considered distinct ecosystems through biologically-mediated (age/size truncation, species loss) and habitat-mediated (damming) mechanisms. Fish catches are less predictable now, consistent with smaller populations, but this change is reducing access to reliable fisheries for coastal communities and leaving managers with less predictive capacity in stock assessments. Ultimately, it will be important to recognize historical changes and avoid depending on 1950 baselines for management, in either expected yield or special extent of species presence, as historical data suggests significant changes prior to this date. In exploited and degraded systems, shifts in climate can stimulate rapid changes in human-nature interactions such as fisheries, since smaller populations are likely to fluctuate more under environmental forcing and with fisheries targeting smaller age/size demographic also depend on recruitment-based production.

Management actions effect adjacent ecosystems, with landscape changes affecting coastal ecosystems through the loss of forage species and limiting migrations. Ecosystems have become fragmented, which has resulted in less productive coastal seas It appears that F_{ECO}, the fishing mortality rate to support ecosystem functioning, will be a significantly lower value than F_{MSY}, the fishing mortality that supports maximized yield. Important links between ecosystems should be considered for effective cross-boundary (ecosystem-based) management. These changes would require adjustments to the current management framework and models that provide the basis for decision-making.

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Decades to millennia of marine ecosystem change

Bryony Caswell, University of Hull

My ongoing research describing changes in marine benthic systems over decadal and millennial timescales considers how long-term anthropogenic impacts including nutrient enrichment and deoxygenation affects the structure and functioning of the marine benthos. This work employs monitoring data collected in the UK by water companies in the 1980s-2000 (Caswell *et al.* 2018), and assess present-day measurements of ecosystem health using uses millennial scale data (Caswell *et al.*, under revision). It provides information on how and over what timescales these changes will impact the delivery of ecosystem services, including fisheries, under future climate scenarios and anthropogenic nutrient enrichment. Specifically, aligns with ToR C by evaluating changes in ecological systems through time.

My present and future research will explore the use exceptionally preserved ancient communities to ask: what was the structure of past marine communities and ecosystems? What is the true scale of natural variability? And, can this data inform the current baselines of ecosystem health? Fossil assemblages have the potential to show whether our indices for ecosystem health are describing the full and relevant range of natural ecosystem states. This is crucial because these indices underpin our assessments and understanding of the resilience of ecosystems and their ability to continue to deliver many of the ecological functions and ecosystem services upon which society depends. This work may inform ToR C by *evaluating change in marine ecosystems through time and demonstrating the importance of historical* (and palaeontological) *data for contemporary science and management*. It may also contribute to ToR D by *continuing to use non-traditional data sources and approaches to advance our knowledge of ecosystem change and dynamics*.

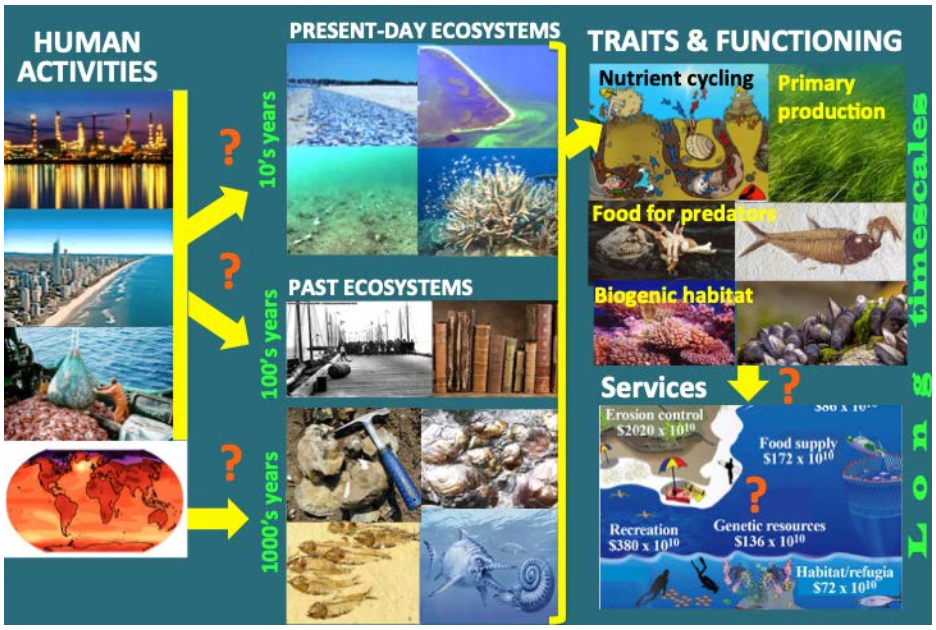

Figure 1. Conceptual diagram of the possible contribution of a range of long-term data to our understanding of ecosystem functioning and service delivery.

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Multidecadal dynamics of the Arctic copepod *Limnocalanus macrurus* in relation to the environmental variability in the Baltic Sea

Heli Einberg[1], Riina Klais[2], Gunta Rubene[3] Georgs Kornilovs[3], Ivars Putnis[3] and Henn Ojaveer[1]

[1] *Estonian Marine Institute, University of Tartu, Lootsi 2a, 80012 Pärnu, Estonia*

[2] *EcoStat Ltd., Ladva 6, 50705 Tartu, Estonia*

[3] *Institute of Food Safety, Animal Health and Environment, Fish Resources Research Department, Daugavgrivas 8, LV-1048 Riga, Latvia*

The Arctic *Limnocalanus macrurus* is a prominent representative of large copepods which performs several essential functions in both freshwater and marine pelagic ecosystems. Being a cold stenotherm species, its distribution is primarily confined to deeper water layers. The species is considered as a glacial relict in the Baltic Sea, being the largest widely distributed copepod species (up to 3mm in length) in its northern part - Gulf of Bothnia, Gulf of Finland and Gulf of Riga. All these basins are characterised by relatively harsh climate conditions in winter and relatively low salinity, hosting therefore several glacial relicts. However, the ecology of *L. macrurus* in the Baltic Sea is very poorly documented.

In this study, we were aiming to: i) establish multidecadal abundance dynamics of *L. macrurus* and associated environmental and biological factors in the Gulf of Riga (Baltic Sea) that have been previously suggested to influence population size of this copepod species; ii) identify the key environmental variables potentially affecting *L. macrurus* abundance dynamics and the nature and size of the effect; iii) look for the evidence of non-stationary links between the key environmental variables and interannual abundance variability of *L. macrurus*, and iv) investigate the non-linear interactions between the explanatory variables to shape the interannual abundance dynamics of *L. macrurus*.

Data of *L. macrurus* abundances, derived from the database of the Institute of Food Safety, Animal Health and Environment, BIOR, were obtained from seven stations in the Gulf of Riga (Figure 1), covering time period between 1958 and 2016.

The preliminary results indicate that:

- Abundance of *L. macrurus* has displayed profound long-term pattern since the late 1950s: very high abundances before the 1980s, then nearly disappearance in the 1990s and recovery in the 2000s;
- The main environmental parameters explaining the interannual variability in abundance of *L. macrurus* in May were (in the declining order of importance)

last year's herring spawner biomass (SSB), winter severity and water temperature last August;

- Abundance of *L. macrurus* consistently declined on the gradient of increase of herring SSB, while only mildest winters appeared to have negative effect on *L. macrurus*;
- Non-stationary relationships exist between the main environmental parametres and the abundance of *L. macrurus*, with shifs between statistically significant and non-significant temporal relationships (at 15-years long temporal subsets based on sliding window correlation analysis).

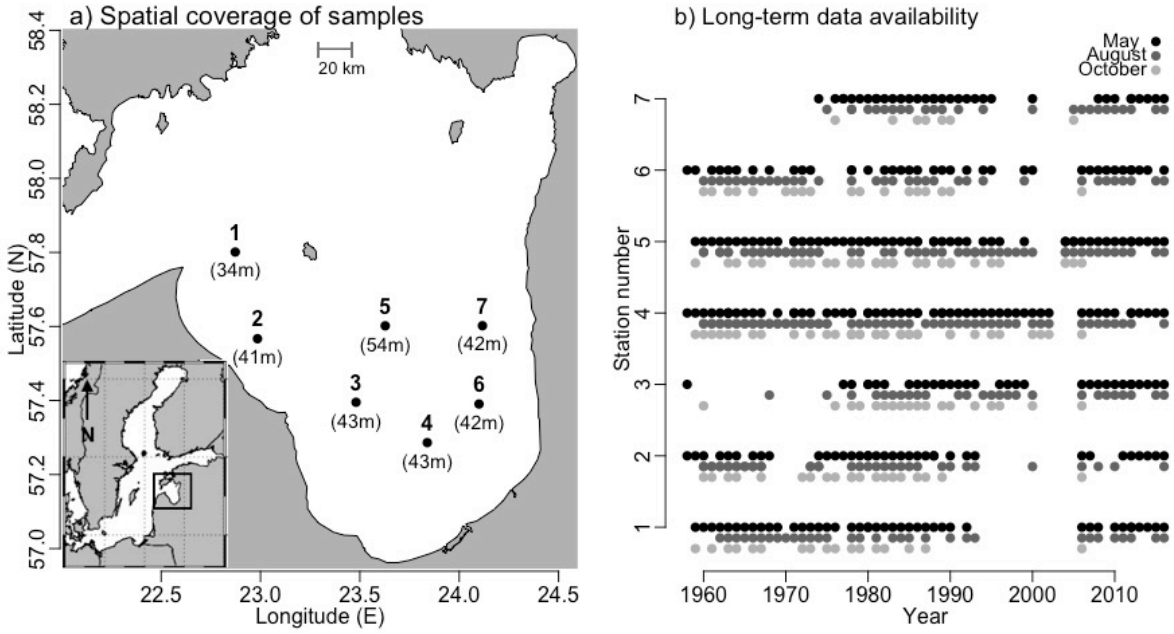

Figure 1. Location of sampling stations in the Gulf of Riga and availability of data during 1958–2016.

Converting anecdotes into quantitative data: Newspaper archives and fisher perspectives can improve assessments for fish stocks

Sarah Buckley[1], Ruth Thurstan[2], Michael O'Neill[3], John Pandolfi[4]

[1]*Sea Fisheries Protection Authority, Ireland*

[2]*University of Exeter, UK*

[3]*Agri-Science Queensland, Department of Agriculture and Fisheries, Australia*

[4]*University of Queensland, Australia*

We investigated the possibility of converting fisher perceptions into quantitative estimates of catch rates and fishery changes over time. Second, we looked at the possibility and effect of incorporating fisher estimates into stock assessments. We used the East Coast Spanish mackerel (*Scomberomorus commerson*) as a case study. The fishery commenced many decades prior to monitoring and formal data recordings of the fishery, meaning that data for informing the stock assessment is lacking. 221 Spanish mackerel fishers of the commercial and recreational sectors along the East Coast of Australia were interviewed about their memories of change in the fishery during their careers and experience of fishing. Fishers' memories generated data on catch rate trends, gear and technological innovations, social and regulatory changes spanning the past seven decades for both the commercial and recreational fisheries. Long-term quantitative estimates of standardized catch rate, spatial expansion, fishing power, fleet size, fisher population characteristics and responses in fisher behaviour to management were produced from fisher perceptions. Mean fishing power increased for both commercial and for recreational sectors between 1940 and 2013. During the same period, a significant decrease was observed in standardized catch rates, which accounted for fishing power, fishing effort and spatio-temporal data structure for both commercial and recreational fisheries. Our subsequent investigation into variations in catch rate revealed significant differences between regions and seasons in both sectors, congruent with the observed differences in fleet size of commercial and recreational fisheries. Similar perceptions of the impact of and adaptations to governance changes between the commercial and recreational sectors were evident. Possible recall bias was examined by comparing fishers' recollections of catches with recorded catch to verify the accuracy of fisher recollections. The recollections of catches remained within the distribution of recorded catch.

Various types of data sources available were evaluated and it was deciphered that the data from both newspaper archives and fisher recollections were reliable sources of data to be incorporated into the latest stock assessment. Our research on newspaper archives provided information on occasional estimates of total landings of Spanish mackerel per annum in the early period of the fishery and the year the fishery commenced. Fishers' perceptions provided mean decadal catch rates of Spanish mackerel and standard errors (no fishing power adjustments), and; annual uptake rates of fishing gear technology and gear effects to allow calculation of changes in annual fishing power. The fishing power adjustments standardized catch rates for the contemporary period for both the commercial and recreational sectors of the fishery. The information filled knowledge gaps on past trends, which was important for analysing changes in the fishery. The historical information on fishing power and catch rates were important data input into the stock as-

sessment. The influence of the historical information on stock assessment was evaluated by comparing results 'with' and 'without' the data. This aspect of the stock assessment was a clear difference to the previous assessment. Use of the historical data was shown to be beneficial to map early trends in the fishery. The assessment combined the data in an annual age-structured population model tailored for the biology and management history of Spanish mackerel. Population modelling of the data estimated that Spanish mackerel population size in 2016 was between 30–50% of original biomass estimated at the start of the fishery in 1911 (best estimate around 40% biomass). The annual harvests in the last decade were similar to the recommended sustainable levels of 400–800 tonnes, but there was no evidence to suggest any building of population size or improving catch rates. Measures of fishing pressure were above the level required to build higher fish population size such as 50–60% biomass. The results suggest annual harvests of around 550 tonnes (across all sectors) will build the biomass towards the 60% for better economic yield and quality of fishing (higher catch rates), then fishing pressure will need to reduce for a period of time to build the fish population to a higher biomass.

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Incorporating historical baselines to test management strategies for anadromous forage fish

Beatriz Dias[1,2] and Adrian Jordaan[1]

[1]*University of Massachusetts Amherst, Department of Environmental Conservation,*

[2]*CAPES Foundation, Brazil.*

Small pelagics or forage fish are critical links between lower and high trophic levels in marine food webs. Recently more attention has been paid to the management of forage fish, including anadromous river herring (Alewife *Alosa pseudoharengus*, blueback herring *A. aestivalis*) and American shad (*A. sapidissima*) due to their status and historically significant role. However, little is known about the impact of biomass loss of small anadromous species on marine food webs, nor the implications of their recovery. Fisheries policies were implemented to protected anadromous forage fish, which made them notorious choking species in Atlantic herring (*Clupea harengus*), and mackerel (*Scomber scombrus*). In addition, changes in habitat connectivity, by dam removal and implementation of fish passages, are taking place throughout Northern New England watersheds, USA. We used Ecopath with Ecosim simulation tool to analyze management strategies that focused on anadromous forage fish, using historical data on river to ocean connectivity, in addition to different levels of fishing effort. We ran our simulation on a one-hundred-year span, accounting for the impact of bycatch in Atlantic herring fisheries and virtually increased connectivity as two means of promoting recovery. Our preliminary results show that several upper-trophic species benefited from the increase of anadromous alosine biomass. The combined landscape-driven biomass and changes on fishing effort were responsible for an order of magnitude changes of biomass for mid- and upper-trophic level species. We recommend the use of historical data to understand marine ecosystem dynamics and to track the ecosystem responses to historical baselines. As we progress, we aim to explore historical baselines from different focus (e.g., habitat connectivity, productivity, and fisheries) to draw the best approaches to recover anadromous forage fish to its former ecological prominence.

Historical ecology, local ecological knowledge, western science and public policies: the eel case (*Anguilla anguilla*)

Anatole Danto, CNRS, Université de Rennes 1, IEP de Rennes, UMR 6051 ARENES & RTPi ApoliMer, UMR 7372 CEBC, Brest, France

This research project focused on the European eel (*Anguilla anguilla*), which is in critical danger of extinction (Annex 3 of CITES). Based on an inventory of fishermen's local ecological knowledge by ethnographical field survey (semi-directive interviews, life story), and on historical ecological work (private and public archives of institution of management, of fishermen and of scientist and local naturalist), conducted on the presence/absence and life and seasonal cycles of eels. The social-ecological system is the end of the Loire River basin, between Angers and the Atlantic Ocean. It observes how this knowledge is or is not taken into account in scientific studies and management measures.

Materials, sources and data on marine environment and fisheries: some research opportunities from national to local (France / Bretagne / Brest)

Anatole Danto, CNRS, Université de Rennes 1, IEP de Rennes, UMR 6051 ARENES & RTPi ApoliMer, UMR 7372 CEBC, Brest, France

This presentation is a methodological conference on the structuring of archives dedicated to marine sciences in France, in the broad sense, and to specialized libraries. It presents the research tools available to researchers, as well as the various sources, materials and collections open to consultation, in their diversity.

The story of the early extirpation of the Bramble shark (*Echinorhinus brucus*, *Echinorhinidae*) exhumed by an integrative historical ecology approach

Samuel P. Iglésias[1] & Frederik H. Mollen[2]

[1]*Institut de Systématique, Evolution, Biodiversité (UMR 7205), Muséum national d'Histoire naturelle, CNRS MNHN UPMC EPHE, Sorbonne Universités; Station de Biologie Marine, Place de la Croix, 29900 Concarneau, France. [iglesias@mnhn.fr]*

[2]*Elasmobranch Research, Rehaegenstraat 4, 2820 Bonheiden, Belgium. [frederik.mollen@gmail.com]*

Because the sea is not transparent as the sky is, we cannot count the fishes as we count the birds, and disappearance of a fish species can pass totally unnoticed. Marine biodiversity is suffering of an acceleration of the erosion process caused by overexploitation, and large sharks are among the worst affected by defaunation due to their life history characteristics. In European waters the singular Bramble shark (*Echinorhinus brucus, Echinorhinidae*) was suspected to be threatened but lack of population trend prevents its assessment; consequently the species is currently unregulated and listed 'Data Deficient' by IUCN. The newly 'integrative approach' promoted by Historical Marine Ecology shows extraordinary power to highlight past species-collapse unnoticed by modern fishery surveys. An exhaustive research, including modern digital tools, permeated to exhume over

300 historical Atlantic records of Bramble shark individuals, mostly overlooked by science. The semi-quantitative treatment of these qualitative data for over three centuries' evidences this ground shark was commonly exploited in European waters for food and lighting oil. Its significant collapse early in the 20th century is highly correlated with the advent of steamers and dramatic growth of fishery performances in the 1880s. It appears the species was locally common up to the late 19th century; presenting bathymetric seasonality with an evidenced estuarine affinity. Our results demonstrate the early disappearance of such a large and charismatic species can go totally unnoticed. We consider the Bramble shark is currently extirpated for decades from most European countries. Only rare individuals may now be still present in restricted areas. The Atlantic E. brucus is evidenced to be critically endangered and fishery regulation will probably not avoid its total extinction without additional determined policy endorsing strong spatial protection measures.

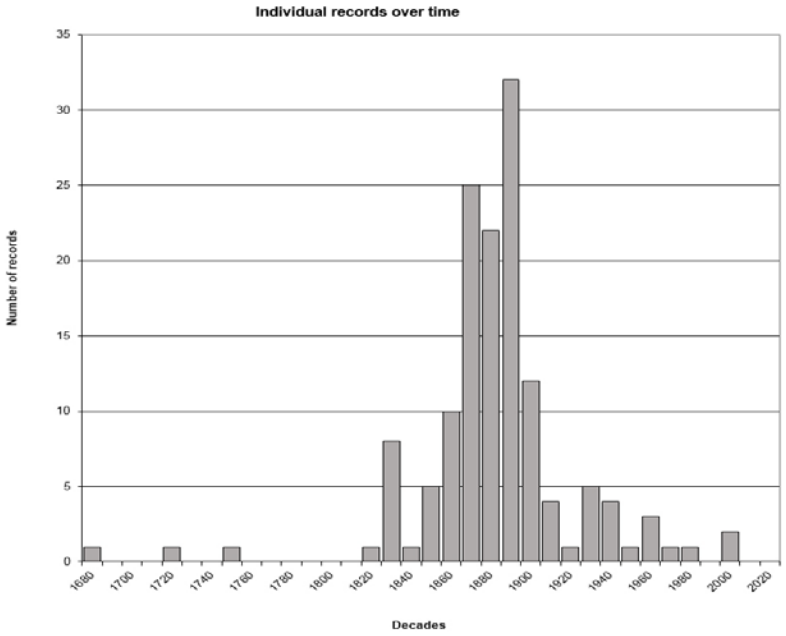

Figure 1. Evolution of the number of individual records of Bramble shark in the Eastern Atlantic between 1680 and 2018. The sharp increase in reports in the 1860s and the collapse at the beginning of the 20th century are directly correlated to the motorization of ships from 1865 and to the increased fishing performance.

Historical emergence of fishing technologies

Jonas Hentati Sundberg, Swedish University of Agricultural Sciences

The effect of increasing efficiency from technological innovations in fisheries is well known. Classic examples include the onset of bottom trawling, the use of advanced fish finding equipment and mechanized onboard processing facilities on fishing vessels. A comprehensive overview of technological innovations in fisheries have however been lacking. The work presented here outlines a general framework for identifying and analysing historical introductions of new technologies in fisheries. By using fishing industry magazines and historical book searches, a timeline of technology introductions is established, which can later be linked to quantify changes in historical fishing effort.

Revising fundamental ecological theories in light of technological and conceptual advances

J. Coston-Guarini, Entangled Bank Laboratory

My research topics are inspired by two related questions: 1. how can we use documentary and biological archives to reconstruct past ecological trends of marine systems and, 2. how what we learn from reconstructing past social-economic-ecological conditions could be used to improve the evaluation of environmental impact today. This allows me to explore and revise fundamental theories of ecology in light of new technological and conceptual advances.

At the meeting, I presented part of my work on modelling the 3D morphodynamics of molluscan shell growth which I also just proposed to the ERC Starting Grant program in October 2018. The aim is to compare 3D morphometrics (surface scans) of actual specimens with the neutral shell shapes generated *in silico* by morphodynamic models to develop a new understanding of growth responses at the individual-level. It could revise the laws of morphodynamics and biology as they were proposed by D'Arcy Thompson (and earlier workers), by proposing a new approach to reconciling the geometric principle of shell growth with constraints imposed by the environmental and biological conditions of the individual organism. This then suggests a new means to synthesize fundamental ideas about variability, growth and form at the core of biology, evolution and ecology.

Concerning the second theme, I have a new collaboration with historian and Marie-Curie Individual Fellowship Laureat Michael Serruys to examine how the socio-economic crises triggered by shipworm infestations in 18th century Europe altered the historical trajectories of different countries at that time. We will not only attempt to reconstruct the history of the infestation from documentary and museological collections, but also re-create the effects of a shipworm infestation on the navigability of ship hulls using models.

And, finally, I am involved in several projects on the behavioural ecology of benthic invertebrates, concerned with passive bioacoustics, acclerometry and valvometry, and their use as methods of detecting high frequency individual responses to environmental change, *in situ*. These projects re-examine the precepts of Tinbergen from an operational

point of view, and with the idea of renewing the theoretical foundations of individual-based and sensorial ecology.

Voices from the Fisheries

Molly Graham, National Oceanic and Atmospheric Administration, USA

The Voices from the Fisheries Oral History database is a central repository for consolidating, archiving, and disseminating oral history interviews related to commercial, recreational, and subsistence fishing in the United States and its territories. The program seeks to document the human experience of our marine, coastal, and Great Lakes environments. The database contains recordings and transcripts of eyewitness accounts from fishermen, their spouses, processing workers, shoreside business workers, scientists, marine resources managers, and others. These stories expand our knowledge and enrich our understanding of the nation's fisheries and their impacts. We work with prospective oral history practitioners to add interviews to our growing digital repository and the public to use and interact with our content for educational and research purposes. To this end, Voices offers workshops and trainings to teach the basics of how to design, conduct and disseminate life course oral histories. Additionally, we consult on project design, digitization, collection assessment and more. The Voices from the Fisheries database is a powerful resource available to the public to inform, educate, and provide primary information for researchers interested in our local, human experience with the surrounding marine environment. For more information, contact the program manager, Molly Graham at voices@noaa.gov.

Annex 3: Recommendations

1) WGHIST recommends continuing discussions between nominated WGHIST members and ICES stock assessment scientists on the feasibility of holding an ICES Workshop (or alternative) dedicated to furthering the inclusion of historical data into stock assessment methods. If forwarded, WGHIST recommends engagement of ICES stock assessment scientists or particular WGs toward agreed-upon aims (for WGHIST follow-up).

2) WGHIST recommends continued liaison with the ICES Data Centre to enhance the visibility of the WGHIST metadata on the ICES website, with a particular emphasis on indexing WGHIST metadata on the ICES Spatial Facility (for WGHIST follow-up).

3) WGHIST recommends communicating with the chairs of the Strategic Initiative on the Human Dimension to discuss opportunities for including historical perspectives within the actions/work of this initiative (for WGHIST follow-up).

Annex 4: Metadata previously prepared for proposal on stock assessment workshop

This table summarizes the metadata collected by WGHIST to demonstrate data available for a workshop on using historical resources to inform stock assessment, engaging WGHIST and stock assessment scientists.

Stock	Data on stock	Data on fishery	Additional details	Potential use	Scientist available?	Working group
Common skate (North Sea)	Survey data	Gear and vessel		Data poor species, abundance and spatial distribution baselines	Yes	WGHIST
Atlantic herring (Scotland)	Landings	Gear and vessel		Data poor species, baselines	Yes	WGHIST
Thornback ray (North Sea)	Survey data	Gear and vessel		Data poor species, abundance and spatial distribution baselines	Yes	WGHIST
Fall herring (Gulf of Riga)	Landings, surveys	Effort and gear	Age structure, weight-/length-at-age	Stock assessment targets and baselines	Yes	WGHIST
Cod (Baltic)	Landings, survey	Gear and vessel		Baselines	Yes	WGHIST
Fall spawning herring (North Sea)	Landings, survey	Effort, gear, and vessel	Age structure, size distribution, size-at-age of catch	Stock assessment targets and baselines	Yes	WGHIST
Multiple species (Bay of Fundy)	Landings, survey	Effort, gear, vessel		Baselines, abundance and spatial distribution, data poor species	Minimal	WGHIST
Cod and ling (North Sea)	Landings, survey	Effort, gear, and vessel		Biomass baselines	Yes	WGHIST

Multiple (US)	Landings, survey			Data poor species, baselines	Yes	WGHIST
Smooth-hound (Mediterranean)	Landings	Effort, gear, and vessel	Age structure, size distribution	Data poor species	Yes	WGHIST
Multiple species (S. Africa)	Landings, survey	Effort, gear, vessel	Size distribution of catch	Data poor species, baselines, distribution of species	Possible	WGHIST

Annex 5: Additional meeting detail and group photos

Advertisement of the public open session held prior to the working group meeting.

Posters and 'twitter cards' (example above) were designed by the hosts for the 2018 WGHIST meeting to announce the meeting and associated events. In addition, our hosts designed a exhibition that included contributions from WGHIST members and was on display prior to and during the WGHIST meeting. The Université Bretagne-Loire communications department inquired on information about the exhibition and events organized during the meeting, and a press release was written in response. This text and photos were published online here:

https://u-bretagneloire.fr/poles-numeriques-lorsque-colloque-sciences-et-exposition-prennent-place

WG in Historical Ecology, Annual Meeting 2018

TUESDAY, 4 September 2018 PLOUZANE campus
Rooms: "PNBI" and "Amphi D"

Start time	Activity	Location	Details
13:30	Set-up video conferencing	Amphi D (across the street from the PNBI) Public Sessions, open to all	
	Speaker		**Topic**
14:00	Direction LEMAR, Emily Klein, Ruth Thurstan		Introductory Remarks – IUEM - LEMAR, Overview of WG & Role in ICES
14:30	Isabelle Knab-Delumeau, *Département SHS, Ecole Navale* (France)		The efforts of French naval officers to prospect new fisheries in the mid-nineteenth century
14:45	Olivier Gauthier, LEMAR, Université de Bretagne Occidentale (France)		Historical databases and long-term monitoring of macrobenthic communities: some very specific problems
15:00	Anatole Danto, Université de Rennes and UBO		When science meet spolicy: historical ecology for future management of one endangered species, the Angel shark (*Squatina squatina*)
15:15	Floris Bennema, "MarHis" Leeuwarden (Netherlands)		Deep-sea oysters of the past
15:30	Kirsi Sonck-Rautio, European Ethnology department, University of Turku (Finland)		Seine fishing in the archipelago of Rymättylä. [visio]
15:45	Coffee break		Catered, open to all present
16:00	Henn Ojaveer, University of Tartu, (Estonia)		Historical baselines in marine bioinvasions: implications for policy and management"
16:15	Dmitry Lajus, Department of Ichthyology and Hydrobiology, Faculty of Biology, St-Petersburg State University (Russia)		Historical changes in fish populations of northwestern Russia. [Visio]
16:30	Matthew McKenzie, University of Connecticut (USA)		The Bottom Trawl Movement and the Transformation of North Atlantic Social-Ecological Systems, 1800-2000
16:45	Adrian Jordaan, University of Massachusetts, Amherst (USA)		What a decade of historical research has revealed about the Northwestern Atlantic Ecosystem

17:00	Bryony Caswell, Univ of Hull (UK)		Importance of deep time perspectives
17:45	Move to PNBI for exhibit viewing and “meet and greet” session		
18:00 20:00	Aperitif, cold buffet, PNBI, offered by BeBEST and DISCOVERY		

Agenda for the public open session. Speakers included WGHIST and non-WGHIST participants.

Name	Affiliation	Contribution
Luis Tito de Morais	Direction, LEMAR (IRD)	Presentation of the laboratory
Samuel Iglesias	MNHN SB CC	Visit Concarneau, scientific presentation
Gilles Chatry	IFREMER	Heritage Collections
Annaëlle Duchene	Mediathèque des Capucins	Heritage Collections
Xavier Laubie	Service Historique de la Défense de Brest	Heritage Collections
Isabelle Knab-Delumeau	École navale	Scientific presentation
Olivier Gauthier	UBO	Scientific presentation

Names of non-WGHIST participants who contributed to the meeting, either by guiding participants around archival collections, or by presenting their work at the public symposium.

WGHIST participants visiting the maritime archives at the Service Historique de la Defence, the archives at Les Ateliers des Capucins, and on a tour of the Marine Station de Concarneau.