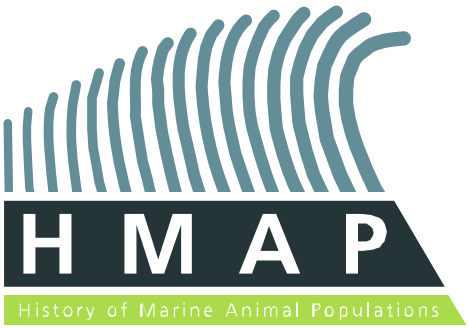
History of Marine Animal Populations

Annual Report

August 2006



Poul Holm

With contributions by

Joan Lluís Alegret
Karen Alexander
Maibritt Bager
Michaela Barnard
Tonnes Bekker-Nielsen
Marta Coll
Alfons Garrido
Ruthy Getwagen
Julia Lajus
Brian MacKenzie
Anne Husum Marboe
Francesc Maynou
Henn Ojaveer
Isabel Palomera
Bo Poulsen
Rene´Taudal Poulsen
Andy Rosenberg
David J. Starkey
Malcolm Tull

Contents

History of Marine Animal Population (HMAP)

Poul Holm (chair)
Roskilde University, Universitetsvej 1, PO Box 260, DK-4000 Roskilde, Denmark
Phone: +45 4674 2065 FAX: +45 4674 3000 E-mail: ph@ruc.dk

Andy Rosenberg
University of New Hampshire, Ocean Process and Analysis Laboratory, Institute for the Study of Earth, Oceans and Space, Morse Hall 142, University of New Hampshire, Durham, NH 03824, USA
Phone: 603-862-2020 E-mail: andy.rosenberg@unh.edu

David J. Starkey
University of Hull, Maritime Historical Studies Centre
Blaydes House, 6 High Street, Hull, HU1 1HA, UK
Phone: +44 1482 305114 FAX: +44 1482 305116 Email: D.J.Starkey@hull.ac.uk

Tim Smith
1774 Sterling Drive, Redding CA 96003, USA
Phone: 530-510-1890 E-mail: cachalotproject@gmail.com

Malcolm Tull
Murdoch Business School, Murdoch University, Murdoch, Western Australia 6150
Phone: (61-8) 9360 2481 Fax: (61-8) 9310 7725 Email : m.tull@murdoch.edu.au

Project Manager(s) Name

Anne Husum Marboe
Roskilde University, Department for Environment, Society and Spatial Change
Universitetsvej 1, PO Box 260, DK-4000 Roskilde, Denmark
Phone: +45 4674 2903 Fax: +45 4674 3050 Email: marboe@ruc.dk

Karen Alexander
Department of Natural Resources, College of Life Science and Agriculture, University of New Hampshire, 56 College Road, 215 James Hall, Durham, NH 03824, New Hampshire, USA
Phone: +(603) 862-4482 E-mail: karena@cisunix.unh.edu

Michaela Barnard
University of Hull, Maritime Historical Studies Centre
Blaydes House, 6 High Street, Hull, HU1 1HA, UK
Phone: +44 1482 305115 FAX: +44 1482 305116 Email: m.g.barnard@hull.ac.uk

Education and Outreach Network Liaison

Anne Husum Marboe
Roskilde University, Department for Environment, Society and Spatial Change,
Universitetsvej 1, PO Box 260, DK-4000 Roskilde, Denmark
Phone: +45 4674 2903 Fax: +45 4674 3050 Email: marboe@ruc.dk

Website: http://www.hmapcoml.org

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

See separate reports from the HMAP projects in appendices.

'Ocean's Past - Multidisciplinary Perspectives on the History of Marine Animal Populations'. An International Open Science Conference held at Kolding, Denmark, 24-27 October 2005. With 100 leading and young scientists from 22 countries representing many facets of the history of marine animal populations, the OCEANS PAST conference was a big success.

Early Human Impact on Megamollusks 2005 Workshop (EHIM 2005). The aim of the Early Human Impact on Megamollusks workshop was to assess our current state of knowledge on the interaction between human societies, the environment and the marine mega mollusk populations during the Holocene, in different regions of the world. The focus of the workshop was the responses of mollusk populations to prehistoric exploitation and natural environmental changes, as well as the diverse ways in which the interaction with these organisms shaped human cultures/societies. Conference proceedings are in press.

Long-term effects of climate variation and human impacts on the structure and functioning of New Zealand shelf ecosystems. In late March 2006 the New Zealand National Institute of Water and Atmospheric Research (NIWA) was contracted by the New Zealand Ministry of Fisheries to undertake a project titled "Long-term effects of climate variation and human impacts on the structure and functioning of New Zealand shelf ecosystems". This project funded for NZ$ 888,000 over the next three years will determine the effects of climate variation and human activities on the coastal and shelf ecosystem since Polynesians first arrived in New Zealand less than 1000 years ago. The project will be coordinated by Dr Alison MacDiarmid and involves a team of 25 NIWA and non-NIWA researchers over a wide range of disciplines. The project started in august 2006 with a kickoff workshop in New Zealand.

Decline of World's Estuaries and Coastal Seas Has Accelerated in Last 150-300 Years.
New Study Tracks Human Impact on Coastal Marine Ecosystems From Roman Times to Present Day.
Published in Science. HMAP researcher Heike K. Lotze was lead author on a study that reported that the decline of the world's estuaries and coastal seas has accelerated in the last 150-300 years. Lotze and her colleagues found that in areas where conservation efforts have been implemented in the 20th century, signs of recovery are apparent.

An Environmental History of North Sea Ling and Cod Fisheries, 1840-1914. *René Taudal Poulsen* successfully defended his PhD-dissertation "The exploitation of the North Sea marine resources - An Environmental History of North Sea Ling and Cod Fisheries, 1850-1914." at University of Southern Denmark Monday the 28 November 2005.

Situated within the field of marine environmental history, the dissertation presents a study of the Swedish longline fisheries for ling (*Molva molva*) and cod (*Gadus morhua*) in the Skagerrak and the North Sea, 1840-1914.

This dissertation documents significant changes in the North Sea ecosystem on a centennial scale. The North Sea offered nineteenth century fishermen catching opportunities which are no longer available. Ling was highly abundant in the Skagerrak and the north eastern North

Sea in the nineteenth century but the population has declined on a centennial scale, most probably due to fishing.

The dissertation merges ecological, economic and social analyses and demonstrates that the social and economic dynamics in fisheries cannot be understood without accounting for ecology. Gradually, declining stock abundances forced nineteenth century Swedish fishermen to venture to more distant fishing grounds. Ecology was a significant driver of change in the North Sea fisheries.

Historical Exploitation of the North Sea herring stocks

Bo Poulsen successfully defend his PhD dissertation "Historical Exploitation of the North Sea herring stocks - an environmental history of the Dutch herring fisheries, c. 1600-1860" at University of Southern Denmark Thursday the 2 February 2006.

In short, the purpose of this study is to increase our understanding of the driving forces in pre-modern resource exploitation. Within this, the goal is to make distinction between human and natural impacts on the marine ecosystem through analyses of relevant sets of historical source material.

This leads to a starting point of formulating three overarching questions.

1. What were the main forces stimulating changes in the exploitation of North Sea herring in the period of c. 1600-1860. In other words, what were the dynamics of this particular historical system?
2. What was the role of the natural environment in this?
3. What caused the long term decline of the Dutch herring fisheries?

Dutch decline - events and conjunctures

The historical system of herring exploitation consists of interactions between a very dynamic natural system and a highly dynamic anthropogenic system. One of the most stable trends is the steady long term decline of the Dutch North Sea herring fisheries, which has been addressed in much previous historical research. This, the first marine environmental assessment, presents a new interpretation of the historical development of the Dutch herring fisheries in light of the proposed system of exploitation, c. 1600-1860. For the sake of highlighting the main dynamics the entire period of investigation has been roughly divided into segments of c. 50 years.

In the period c. 1600-1650 The Dutch herring industries were at their prime, dominating European herring production and trade. Privateering and warfare were the major obstacles in this period.

Subsequently, during the phase c. 1650-1710 the Dutch industry suffered major blows, primarily due to the Anglo-Dutch wars and the War of Spanish Succession.

In the next period c. 1710-1760 the North Sea become a peaceful sea, but now different challenges prevented the Dutch from full post-war recovery. The gradual implementation of high tariffs on the import of salted herring in European states affected this export oriented industry. The growth of the Norwegian and Scottish herring industries were both filling gaps in the market, especially in the Baltic market after the contraction of the Dutch industry. A likely dynamic for this change is an environmental shift in relative spatial potential to the benefit of the shore based herring industries.

Dutch decline only continued in the following period of 1760-1814. The spatial distribution of available abundance of the North Sea herring shifted further away from the Dutch interest, with the rise of the great Bohuslen herring period, 1756-1808. On the political scene the revolutionary wars and the Napoleonic period frequently kept Dutch herring vessels from engaging in high sea herring fisheries during the periods 1780-81 and 1795-1813.

Meanwhile, mercantilist policies continued to impede the export oriented herring producers, and several competing herring companies were established in the states around the North Sea in attempt to subsidise the home industries.
1815-1850 was an absolute low point in the history of the Dutch herring fisheries. The catch rates were less than half of what they had been in the preceding two centuries, and Scottish as well as Norwegian herring fisheries gained a comparative spatial advantage from shifts in the spatial distribution of herring. In this period it can be said that the environmental side of the system had its most negative impact on the Dutch herring fisheries.

Dutch decline – structural change
Structurally, the demand for salted herring declined from c. 1650 and this structural development lasted at least until the end of the Napoleonic wars. In the first half of the 19th century, society also changed rapidly following the industrial revolution. Possibly the opening of new overseas markets and improved inland transportation via railroads and canals stabilised the per capita consumption of salted herring, but this last issue would require further analysis.

From the point of view of fishing strategy, the shortening of the herring season from c. 1750 onwards, coinciding with the introduction of the hoekerbuis had a negative impact on the annual Dutch catches of herring. The tight organisation and stable institutional framework, hardly changed during the investigated period, and are found to have positive as well as negative effects on the industry.

Contribution on Dutch North Sea Maritime Economies

van Voss, L. H., & Holm, P. (2006). Close encounters with the Dutch *Ricchezza del Mare secc. XIII-XVIII: Istituto Internazionale di storia economica "E Datini" Prato*, Serie II - Atti delle "Settimane di Studi" e altri Convegni. (s. 147-178). Firenze: Le Monnier

Two HMAP publications in Frontiers in Ecology August 2006 Issue

Rebuilding US fisheries: progress and problems.
Andrew A. Rosenberg, Jill H Swasey, Margaret Bowman. Frontiers in Ecology and the Environment 2006; 4(6): 303-308.

Ten years after the US Congress mandated an end to overfishing and restoration of depleted fish populations through passage of the Magnuson-Stevens Fishery Conservation and Management Act of 1996, 82% of fished stocks still suffer from the effects of overfishing, and overfishing still occurrs in 45% of them. Out of 67 stocks with 10 year rebuilding plans mandated by the law, only 3 have been completely rebuilt, while 9 more are recovering. The fact that biomass is increasing in 32 stocks shows that ending overfishing usually leads to recovery, however, complying fully with Magnuson-Stevens has been difficult. Failure of recovery plans can be attributed to several factors, including: excessive delay in formulation, during which overfishing continues; high fishing mortality after implementation; lack of monitoring, unwillingness to revise a flawed plan; or, alternately, resetting the recovery time table after revision. The Magnuson-Stevens Act's strong mandates have bogged down in process at the expense of results, when, clearly, positive results are key to recovering the fisheries.

Conservation implications of historic sea turtle nesting beach loss.
Loren McClenachan, Jeremy BC Jackson, Marah JH Newman. Frontiers in Ecology and the Environment 2006; 4(6): 290-296.

McClenachan, Jackson and Newman employ 163 historical sources to map the loss of nesting sites and the long-term decline in populations of green turtles and hawksbill turtles in the Caribbean over the last 1000 years. Today, twenty percent of historic nesting sites are completely gone, and another 50% support only remnant nesting populations. Modern populations of green and hawksbill turtles in the Caribbean have declined over 99.5% from numbers once described as "infinite," and the loss of these prolific grazers has seriously degraded sea grass beds and coral reefs. While populations of nesting green and hawksbill turtles have risen on protected beaches over the past 30 years, those results are still sobering when compared to historic levels of abundance and distribution. Conservation plans should build on recent success by affording protection even to marginal nesting beaches in order to restore both turtles and marine habitat in the Caribbean.

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

See separate reports from the HMAP projects in appendices.

Charting long-term patterns of catch and fishing effort provides managers and policy makers with information on which to base future projections as to the impact of changes in environmental variables such as climate and oceanographic conditions, and in anthropogenic factors like technology, politics and consumption habits.

Reports missing from Caribbean, Megamullusc, New Zealand, world whaling projects.

See also appendix by Dr Inge Bødker-Enghoff for paleoecological study of the Black Sea.

3. WORK PLANNED FOR 2007

1. See separate reports from the HMAP projects in appendices.

2. Overall HMAP milestones in attached spread sheet.

3. Special Session about Historical Perspectives for Gulf and Caribbean Fisheries
at the 59th Gulf and Caribean Fisheries Institute meeting in Belice. This special session is been organized by Jeremy Jackson, Loren McClenachan, Diego Schapira and Juan M. Posada, Símon Bolívar Universty, with economical support from Environmental Defense and NOAA. http://www.gcfi.org/Conferences/59th/Belize59.htm

4. Early Human Impact on Megamolluscs volume
The volume gathers together the papers presented at the Early Human Impact on Megamolluscs workshop, the genuine HMAP initiative, held on the Island of Margarita, Venezuela, between 25th and 28th, 2005. The workshop brought together worldwide-recognized specialists in archaeology, anthropology, experts in biology, mollusks' fishery, and paleoclimatologists, from Japan, New Guinea, India, South Africa, Brazil, Chile, Venezuela, Panama, USA, Canada, Denmark, England and Israel.

5. Next phase: Early Human impact on Megamolluscs

Later this month I will be intensifying the discussion and consulting with EHIM network members in order to identify and formulate a proposals of synthesising project(s) related to the history of the human impact on marine molluscs in a global perspective to be submitted to HMAP before the end of 2006.

6. Human-environment interactions in the Mediterranean Sea since the Roman period until the 19th century: an historical and ecological perspective on fishing activities

H M A P – Mediterranean and Black Sea
On the 27th-29th of September 2006 a three days workshop for thirty participants is going to be held in Chioggia, Venice, Italy.
The workshop is organized by Prof. Ruthy Gertwagen (Coordinator and teams leader of HMAP Mediterranean and the Black Sea) in collaboration with Dr Otello Giovanardi and Dr Saša Raicevich. (Local Organizers: ICRAM, Central Institute for Marine Research, Chioggia, Italy).
The workshop aims to display the fishing activities since the Late Roman period until the 19th century (at the latest) in order to examine what changes in Mediterranean marine animal populations and ecosystems had already occurred in the past and to which extent, and if these changes can explain what we observe today.

7. Human-environment interactions and marine animal population dynamics in Venice's Lagoon and the Northern Adriatic Sea (VeLNA), from the 12th century to the modern period
Proposal submitted to Niarchos Foundation by: Prof. R. Gertwagen (Chairman and Coordinator of the HMAP Mediterranean Sea and Black Sea Project
Projected Project **first phase** for five years, starting from January 2007 and ending in January 2111.

8. TV-documentaries:

"Time-Depth Divers" *(working title for global and regional productions)*
Transgressing scientific research efforts to bring past eras into the present day.

See appendix.

4. EDUCATION & OUTREACH

Oceans Past – Multidisciplinary Perspectives on the History of Marine Animal Populations Open Science Conference in Kolding, Denmark 24-27 October 2005. The conference and the international press release launched in collaboration with Darlene Trew Crist and Terry Collins attached good media attention and the conference was covered in 14 countries and 9 languages.

A public exhibition of images relating to the HMAP project in general, particularly the role of women in North Sea fishing communities, was held at Blaydes House, Hull, in May 2006.

See appendix on Image Database preliminary proposal

5. GEOGRAPHIC EXPANSION

Fourth HMAP Centre established at Asia Research Centre at Murdoch University
HMAP has extended its institutional base through the establishment of a centre at Murdoch University, West Australia. This is directed by Dr Malcolm Tull and will promote HMAP activities in South East Asia.

Three new HMAP projects in South East Asia region
launched at the SE Asia HMAP Centre. The three projects are:
Shark fishing in Indonesia
Historical whaling in the Philippines: origins of 'indigenous subsistence whaling', mapping whaling grounds and comparison with current known distribution
The Evolution and Development of the Taiwanese offshore tuna fishery- 1913- 2006

Project descriptions

Shark fishing in Indonesia

Malcolm Tull, Murdoch University

Overview

While catches of sharks have long been an important source of income to Indonesia's artisanal fishers, the historical development of shark fishing is largely unrecorded. The aim of this project is to collect historical data on fishing effort and shark catches since the early years of the 20th century. The research will help establish the economic and social importance of shark fishing to artisanal communities and provide baselines for the development of management plans. The research will also address the HMAP hypotheses.

Background Information

Sharks have been caught in Indonesian waters for thousands of years but have never represented a major part of the total catch: for example, from 1950 to 2003 they averaged less than two percent of the total catch. For both artisanal and industrial fishers sharks are primarily a bycatch rather than a target species. However, catches grew rapidly from the 1970s onwards and by the beginning of the 21st century Indonesia was the world's leading shark producer. This expansion is due to the growing demand for shark fins in Singapore, Hong Kong and mainland China. Shark fin exports have provided a valuable source of foreign exchange earnings but exports peaked in the early 1990s and by 2003 were about US$10m or about half the peak level.

This expansion has put increasing pressure on stocks. Due to their delayed sexual maturation and low fecundity rates, sharks are especially vulnerable to overfishing. Fishers have encountered declining yields in the central and western areas of Indonesia's EEZ and have been forced to fish the eastern waters more intensively and, increasingly, venture into Australia's territorial waters. Currently, there are no effective management controls in Indonesia's shark fishery so in order to avoid a 'tragedy of the commons' management measures need to be introduced.

Aims of this research

1. The project aims to trace the development of shark fishing in Indonesia and provide new base line data on fishing effort and shark catches.
2. This project aims to trace the development of shark fishing in Indonesia and provide new base line data on fishing effort and shark catches.
3. This project aims to assess the historical importance of shark fishing to artisanal fishers and their families.
4. This project aims to address the HMAP hypotheses.

Methodology

A comprehensive literature search will be undertaken (including where possible from the colonial era) of archival and library sources. Interviews will be undertaken in Indonesia with key industry informants and stakeholders to help understand the development of the industry.

Expected Outcomes

The project will result in a much greater understanding of the historical development of shark fishing in Indonesia and assist policy makers involved with the development of management plans for the shark fishery. Expected outputs will include conference papers and journal articles.

Historical whaling in the Philippines: origins of 'indigenous subsistence whaling', mapping whaling grounds and comparison with current known distribution

Jo Marie V. Acebes, University of Oxford

Concise project description

The history of whaling in the Philippines is largely undocumented. Some coastal communities have a hunting tradition and the origins and developments of this 'indigenous whaling' practice are unknown. This project aims to determine the origins and development of 'indigenous subsistence whaling' and to map the historical whaling grounds of local peoples and foreign whalers. The historical distribution of whales based on local knowledge and whaling records will be compared with present known distribution. The knowledge acquired will provide baselines for current and future conservation and management measures.

Background information

The Philippines has a rich cetacean diversity. There are 22 species of cetaceans, five of which are large whales and four of which (Sperm whale, Minke whale, Bryde's whale, and Humpback whale) have been commonly targeted for hunts by whalers. Although recently, there have been an increasing number of studies done on present distribution and abundance of these species, none has been conducted to determine the extent of their historical exploitation and distribution. Whaling has been a tradition in some coastal communities in the Philippines. Pamilacan island is of particular significance because this small island community hunted whales for at least a hundred years (Dolar, 1994). The hunters of

Pamilacan used a large hook, a method unlike any other known. It is not certain where this tradition originated. With the fear of dwindling whale stocks in the Bohol Sea, the Philippines Bureau of Fisheries passed a national fishery legislation to stop this tradition. Unfortunately, without knowing its origins. There are other areas known to have a whaling practice but their origins and present status are unknown. Some evidence also shows that during the era of modern whaling, 'Yankee' and European whalers came to the Philippines to hunt mainly sperm whales and presumably other baleen whales such as humpback whales. Townsend's logbooks indicate sperm whales caught in the Bohol and Sulu Seas while Slijper et al. notes humpback whales in Northern Luzon (Townsend 1935; Slijper et al. 1964). The extent or degree of this whaling is not known. More recently (in the 1980s), Japanese were known to hunt within Philippine waters, species and numbers not known. Although fishery laws exist to protect cetaceans in the Philippines and large areas have been designated as marine protected areas, the management and conservation of these species and habitats have little baseline data to work on.

Objectives of the project

1. This project aims to determine the origins and development of 'indigenous subsistence whaling' in the Philippines. Particular attention will be given to Bohol and Camiguin where published information indicates whaling has been practiced for at least a century (Dolar, 1994).

2. This project also aims to determine the historical whaling grounds in the Philippines, both by indigenous peoples and foreign whalers.

3. Furthermore, the project aims to determine the historical distribution of whales based on local knowledge and whaling records and compare with present known distribution. The study will focus on the three species of whales that were hunted extensively through the 17th to 19th century (globally) and more recently (locally), namely: Bryde's whale (*Balaenoptera edeni*), Humpback whale (*Megaptera* novaeangliae) and Sperm whale (*Physeter macrocephalus*).

Summary of methodology

Historical research will be conducted by looking into town records, museum and library archives, whaling logbooks/records and accompanying maps, and published journals. Valuable information can also be obtained from trade and customs records and newspaper articles. Key informant interviews will also be conducted with former whale hunters, community elders and leaders, indigenous coastal community residents and local government officials. The software ArcGIS version 9 will be used to map the historical whaling grounds and distribution of particular species of whales.

Justification of the proposed project

The study of whales in the Philippines has not come easy given the vast coastal and marine area. Increasingly more surveys are being conducted to determine present status and distribution of particular species. However, the necessary baseline to compare it with is non-existent. Fortunately, there are sources of extant information for several species: the historical whaling records and indigenous knowledge. This is a neglected area of study that the project aims to focus on. And despite the possibilities of bias and error in whaling records, these represent a major source of data available to scientists to derive understanding necessary for the development of wise management policies (Tillman and Donovan, 1983).

This study is also significant and timely because it aims to expose the origins and development of a highly debated form of traditional resource use by a community, 'indigenous or aboriginal subsistence whaling.'

Expected Impacts

The results of this project will have an impact on the management of whale populations in the Philippines particularly in areas that will show evidence of declining numbers or shrinking or shifting distributions. The data gathered will be an important input to the management plans of existing marine protected areas as well as proposed areas.

Relevance of proposed project to conservation

Acquiring knowledge of historical distribution can provide appropriate baselines for current conservation (Lourie and Vincent, 2004). This will provide a better understanding of the status of the large marine vertebrates and the potential and current impacts of their absence or presence in the marine ecosystem.

Furthermore, the exposition of the origins and development of these whale hunts is needed to ensure conservation of whale populations (Reeves, 2002). By understanding how this practice of resource use evolved and progressed or shifted, managers can potentially design better management strategies.

The Evolution and Development of the Taiwanese offshore tuna fishery- 1913- 2006

Henry Chen, Murdoch University

Motivation

A number of maritime studies have been made on the history of Taiwan's tuna fishery; however, to date they have only focused on aspects of the life and work of the fishers and their fishing communities. None of the studies undertaken thus far have been from the angle of ecological history. The purpose of my research is to fill this gap.

Background Information

The tuna longline fishery was introduced to Taiwan in 1913 by the Japanese, and then developed along separate lines in Kaohsiung (??Takao) and northern Taiwan. The tuna longline fishery in northern Taiwan was initially very prosperous because it was located close to the main market, Japan. However, it was soon replaced as a centre for the industry by its counterpart in Kaohsiung. Kaohsiung's tuna fishery grew at a rapid pace for two reasons: firstly, the southerly location of Kaohsiung's Fishing Port meant it was in close proximity to Southeast Asia where the waters were rich in tuna resources. Secondly, the production of bait for the tuna fishery proliferated on a large scale among local fish farms. The tuna longline fishery of Taiwan further developed in postwar period. Kaohsiung then became the undisputed centre of distant water longline fishing. In the 1970s, however, Donggang (??) also emerged as another offshore longline fishing centre in Taiwan. All of these fishing ports played very important roles in the historical development of Taiwan's offshore tuna fishery.

Aims of this research

A. This research aims to trace the development of longline fishing techniques and their long-term impact on Taiwan's offshore tuna fisheries.

B. This research also aims to link impact of quantitative and qualitative changes in offshore tuna resources to changes in the character of Taiwan's fishing communities.

Methodology

A. Archival research. Both the colonial and postwar governments annually published macro-statistical material on Taiwan's fishing industry. Also, several major Japanese and Chinese fisheries journals published important data on the industry. They are now located in the Academia Sinica, National Taiwan Library and National Taiwan University. Important quantitative and qualitative data about the evolution and development of the offshore tuna fisheries can be obtained from these libraries and repositories.

B. Fieldwork. Marine scientists, fishermen and relevant people in the fishing communities will be interviewed about the nature of the industry and their life experience.

Expected Impacts

This research will improve our understanding of the relationship between natural marine resources, in this case the tuna fish of the China Sea and the development of Taiwanese offshore fishing communities. Also, it will draw vital attention to issues related to the protection of marine ecosystem and particular species of fish.

Funding has been obtained from the New Zealand Ministry of Fisheries to launch an HMAP case study in New Zealand under the direction of Dr Alison McDiarmid.

In late March 2006 the New Zealand National Institute of Water and Atmospheric Research (NIWA) was contracted by the New Zealand Ministry of Fisheries to undertake a project titled "**Long-term effects of climate variation and human impacts on the structure and functioning of New Zealand shelf ecosystems"**. This project funded for NZ$ 888,000 over the next three years will determine the effects of climate variation and human activities on the coastal and shelf ecosystem since Polynesians first arrived in New Zealand less than 1000 years ago. The project will be coordinated by Dr Alison MacDiarmid and involves a team of 25 NIWA and non-NIWA researchers over a wide range of disciplines. The project starts in mid 2006 with a kickoff workshop.

Project Update: Taking Stock – Assessing the influence of humans on the structure and functioning of New Zealand's marine ecosystem over the last millennium.

New Zealand is at a very early stage of examining the historical impact of humans on its marine ecosystem. New Zealand's isolation in the south-west Pacific Ocean meant that humans arrived to permanently settle only about 700 years ago. Thus, compared to every other continental landmass human occupation of New Zealand has been very short and the effects of marine exploitation have occurred over a very compressed period of time. This makes the New Zealand situation particularly interesting from a global perspective.

The possibility of initiating a project to examine effects of humans on NZ's marine ecosystem were first mooted by scientists at the National Institute of Water & Atmospheric Research (NIWA) late in 2002 and further stimulated by a visit by CoML representatives Kristen Yanciruk and Prof. Vera Alexander in January 2003. We sent an observer, Dr Ashley Rowden, to the Hull HMAP workshop in 2003 and in mid March 2004 NZ held its initial HMAP pilot workshop. Twenty experts from eight institutions in fields as diverse as

ecosystem modeling, fisheries assessment, marine mammal and sea bird ecology, 18th and 19th centuary whaling history, marine climate change, sedimentology and the archaeology of pre-European Mâori fishing and shell-fishing and sea mammal hunting attended. They met at NIWA in Wellington over 1.5 days to review the current state of knowledge, work out the best approach to address this question, identify links to existing research projects and determine how to best interact with international efforts to address similar questions.

The outcome of the workshop was very positive with all participants agreeing to collaborate to move the project forward. There was much discussion of the appropriate scale and depth range to focus on. It was agreed that the project would cover the entire shelf and start with two regions of contrasting historical Mâori population density and consequent exploitation to prove that the modelling approach was feasible for five time periods over the last 1000 years. The team identified funding opportunities within New Zealand and two applications have made for multi-year funding.

The Archaeological Fish Bone Record: North-Western Europe

Investigating the origins of commercial sea fishing in medieval Europe

This study will employ zooarchaeological and biomolecular methods to investigate long-term trends in the development of intensive sea fishing and fish trade in North-Western Europe, from AD 800 to the end of the Middle Ages. It will seek to understand a rapid expansion of cod and herring fishing around AD 1000, to illuminate the development of commercial sea fishing in Europe and to indicate the appropriate chronology for future baseline research on marine ecosystems

PI: James Barrett, jhb5@york.ac.uk
Co-investigators: Wim Van Neer, wvanneer@naturalsciences.be, Michael Richards, richards@eva.mpg.de, Inge Enghoff, IBEnghoff@snm.ku.dk & Callum Roberts, cr10@york.ac.uk

More information: Fishlab

Zooarchaeology: Fish Bones: The Medieval Origins of Commercial Sea Fishing
Milestones:
January 2006: Sampling visit to Tromso, Norway, for control specimens
February 2006: Visit by Professor Anne Karin Hufthammer, University of Bergen, Norwegian collaborator
March 2006: Project meeting in Brussels
April 2006: Two postdoctoral fellows hired, project formally begins
April 2006: Visit by Dr. Leif Jonsson, zooarchaeologist, Swedish collaborator
May 2006: Sampling visit to Bergen, Norway
June 2006: Sampling visit to Norwich, England
June-July 2006: Sampling of York material
July 2006: Sampling visit to Tallinn, Estonia
July 2006: Visit by Dr. Daniel Makowiecki, Polish Academy of Sciences, Polish collaborator
July 2006: Visit by Sheila Hamilton-Dyer, zooarchaeologist, English collaborator August 2006: Conference paper at the International Council for Archaeozoology Congress, Mexico City

6. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
INCOFISH A Strategic Research Project funded by the European Union	David J Starkey (UHull) Poul Holm (URoskilde) Henn Ojaveer (UTartu)	This EU-funded strategic research project has an historical dimension (workpackage 2: 'Shifting Baselines') in which an HMAP approach is being applied to specific coastal ecosystems off South America, Africa, South East Asia and Europe. Three of the eight institutions engaged in this workpackage (Roskilde, Estonian Marine Institute and Hull) are also partners in the HMAP initiative.
MARBEF Marine Biodiversity and Ecosystem Functioning - A Network of Excellence funded by the European Union	Poul Holm (URoskilde) Brian MacKenzie (DIFRES) Henn Ojaveer (UTartu) David Starkey (UHull)	Theme 3: Socio-economic importance of marine biodiversity. This research project aims to understand the economic, social and cultural value of marine biodiversity and hence develop the research base required to support the sustainable management of marine biodiversity including, for example, the monitoring of the health of marine ecosystems, the management of aquaculture, the conservation of marine biodiversity, the history of marine resource exploitation, and the leisure use of marine ecosystems Three of the institutions engaged in this workpackage (Roskilde, Estonian Marine Institute and Hull) are also partners in the HMAP initiative.
Stellwagen Bank National Marine Sanctuary	Stefan Claesson	Social and Ecological History
National Science Foundation	Karen Alexander	Synergistic effects of social

		and ecological change
Seacoast Science Center	Gwynna Smith	Exhibit host
Avery Point Marine research Center, University of Connecticut	Matt McKenzie	Education and research
French Consulate in Washington	Karen Alexander	Consultation on developing marine environmental history
Island Institute, Rockland, Maine	W. B. Leavenworth	Outreach to fishing communities, education
New Hampshire Sea Grant	Karen Alexander	Gulf of Maine inshore cod catch project
Marine and Coastal Management (South African Government)	Dr Lynne Shannon	Co-supervisor student
South African National Research Foundation	Renee le Roux	Co-funding students
University Of Cape Town	-	Pays salary PI
Danish Black Sea Centre	Pia Guldager Bilde	Black Sea Project
CONWOY	B. R. MacKenzie, P. Holm	CONWOY is a Danish – funded research project on climate change and ecosystems. It is supporting some HMAP research in the North and Baltic Seas.
DIFRES (Danish Institute for Fisheries Research)	B. R. MacKenzie	DIFRES is supporting CoML-HMAP via significant contributions of scientist staff time for research and supervision of student projects.
Estonian Marine Institute, University of Tartu	H. Ojaveer	Estonian Marine Institute is supporting CoML-HMAP via contributions of scientist staff time for research.
Karl Ernst von Baer Museum, Estonian Agricultural University	E. Tammiksaar	The museum contributes with knowledge in Estonian fisheries history in previous centuries
LATZRA (Latvian Fish Resource Agency)	R. Gaumiga, D. Uzars	LATFRI is supporting CoML-HMAP via contributions of scientist staff time for research.
University of Latvia	G. Karlsons	University of Latvia is supporting CoML-HMAP via contributions of scientist staff time for research.

b. Links to CoML Ocean Realm Projects

Project Name	Liaison or Cross-over	Nature of Relationship

	personnel	
NaGISA	Robin Rigby / Anne Husum Marboe Robin Rigby / Charles Griffith	History of Nearshore Biodiversity initiative Future collaboration
CReefs		
GoMA	Andy Rosenberg	SSC member
POST		
COMARGE		
CeDAMar		
CMarZ		
TOPP		
MAR-ECO		
CenSeam		
ChEss		
ArcOD		
CAML		
ICoMM		

c. Links to CoML National and Regional Implementation Committees (NRICs)

NRIC	Liaison or Cross-over personnel	Nature of Relationship
Australia		
Canada		
Caribbean	Patricia Milosovitch	Shared workshop in Kenya (South West African Shelf)
China		
Europe	Henn Ojaveer David J Starkey	Executive Committee member, Facilitation of HMAP-related work in Europe (through co-funding of workshops) Committee member
Indian Ocean	Mohideen Wafer	Collaboration, data sharing (South West African Shelf)
Japan		
South America		
Sub-Saharan Africa	Charles Griffith	Also act as chair of this NRIC
USA	Andy Rosenberg	Coming chair

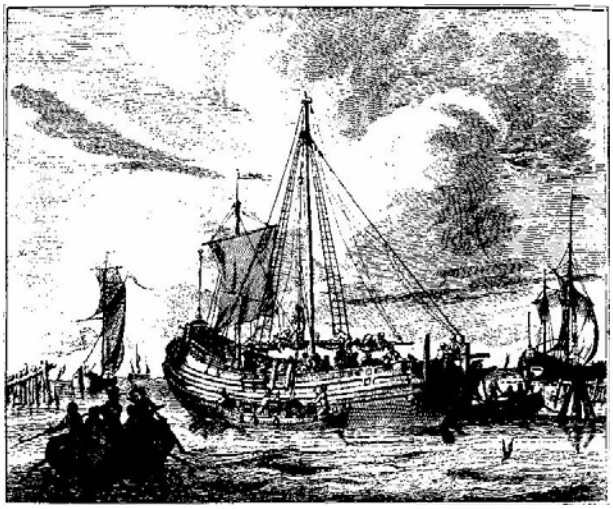
d. Liaisons to CoML Cross-Cutting Groups

Project Name	Liaison Name & Institution	Nature of the Relationship
OBIS	Michaela Barnard (UHull)	Ex-officio, OBIS Technical Committee
FMAP	Heike Lotze (UDalhousie) Andy Rosenberg (UNH) Brian MacKenzie, Danish Institute for Fisheries Research	Partner Partner Collaboration with Ransom Myers re. Bluefin tuna
SCOR Tech Panel		

E&O	Anne Husum Marboe (URoskilde)	Network Liaison
Barcoding		

e. Effectiveness of the Partnerships and collaborations

HMAP is not well represented in the OBIS management and advisory structure.



Dutch Herring Buss (from Bo Poulsen: ***Historical Exploitation of the North Sea herring stocks)***

Fishing vessels used in the North Sea ling fisheries in the nineteenth century (from René Taudal Poulsen: ***An Environmental History of North Sea Ling and Cod Fisheries, 1840-1914***)

Group of fishbones from section 7-8, column ALF 004 (from Inge Bødker Enghoff: ***Paleoecological study of the Black Sea***)

The snout of a pipefish from section 5-6, column ALF 004, part of a series of single photos of the different body parts from snout to tail. (from Inge Bødker Enghoff: ***Paleoecological study of the Black Sea***)

History of Marine Animal Populations in the White and Barents Seas

Daniel Alexandrov
Gagarinskaia ul. 3, 191187 St. Petersburg, Russia
Phone: +7 (812) 272-5752 FAX: E-mail: d_alexandrov@eu.spb.ru

Julia Lajus
Gagarinskaia ul. 3, 191187 St. Petersburg, Russia
Phone: +7 (812) 579-5689 FAX: +7 (812) 579-5689 E-mail: jlajus@eu.spb.ru

http://www.hmapcoml.org

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

History of Atlantic salmon populations is the main focus of studies by our group. During the period under report we continued to collect new data on salmon catches for the 17-18th centuries from several archival collections keeping in:

- Russian Archives for Ancient Documents (RGADA), Moscow
- State Archives of Arkhangelsk Region (GAAO), Arkhangelsk
- Archives of the St. Petersburg Institute of History, Russian Academy of Sciences (SPb IRI RAN), St. Petersburg.

These data partly filled the gaps in our database and gave us more detailed picture, providing additional information for biological and socio-economic analysis of salmon fisheries in the area.
Group of historians under the supervision of Dr. Zoya Dmitrieva started to collect and analyse data on fish prices for the 17-18th centuries (mostly salmon, cod and halibut). The large amount of data on prices are available, the database is under elaboration. In our previous studies it was shown that price for salmon has significant negative correlation with the level of catches (Lajus J. et.al., 2001). Thus the goal of this study is to try to reveal the level of catches for the periods of time (decades, years) for which we have no direct data on catches. Such analysis will facilitate our understanding of influence of different factors, climatic and socio-economic, on salmon.

The importance of climate in the dynamics of salmon populations was shown in our most recent paper published in the end of 2005 by international per-review journal *ICES Marine Science:* we got positive correlation between catches of Atlantic salmon, cod and halibut in the 17th –18th centuries with temperature. The general description and analysis of notable fluctuations of catches, average weight and ratio of different seasonal forms of salmon occurred during the 17 - 18th centuries is provided in the paper submitted to the journal *Fisheries Reseach.* Comparison of historical with more recent data has shown that population dynamics were most probably driven by natural factors before the 20th century.

We continue to gather materials on the **inshore cod and halibut fisheries** in the Barents Sea in the 17-18th cc., mostly on the base of the monastic sources, to put more solid base under our preliminary conclusions on the possible positive correlations of catches with the temperature, which we made after analysis of one case study – cod and halibut fisheries of the Solovetsky monastery on the Kildin island (published in the same paper in ICES Marine Science).

The subproject on the **history of the populations of the White Sea herring** is finished by submitting a research paper to the journal *Fisheries Research* and improving the database of catches and GIS. The material obtained is also included into PhD Thesis by Yaroslava Alekseeva (Institute of Oceanology, Russian Academy of Sciences, Moscow).
Collection of data on **unusual inshore migrations of marine mammals** along the Barents and Norwegian Seas coasts that occurred in the 19th – beginning of 20th cc. and their analysis to study climatic conditions and fluctuations of fish stocks in these periods in connection with the migration of marine mammals are accomplished. Norwegian data were collected by Yaroslava Alekseeva, Institute of Oceanology, Moscow during her research visit to the Institute of Marine Research in Bergen financed by Norwegian Research Council. Results of these studies form a chapter in Y. Alekseeva's PhD Thesis.

PhD Thesis. Yaroslava Alekseeva. Working title: Influence of anthropogenic and climatic factors on the abundance and distribution of marine animal populations in the Russia European North in the 19th – beginning of the 20th centuries. Accomplished, be defended in 2007.
Main objectives of the work were to reveal the periods of drastic changes in fish abundance (salmon, cod, herring) and unusual migrations of marine mammals in the 19th – beginning of the 20th centuries and analyze the main factors (climatic and anthropogenic) which caused these changes. The data analyzed proved the conclusion that while the fishing effort continuously grew up during the period under study it was still too low to influence significantly the fish populations. Only in several places the first signs of overfishing of salmon became apparent by the turn of the 19th and 20th centuries. The studies shown that during the 19th – beginning of the 20th centuries there were two pronounced periods – in 1800 – 1809 and 1877 - 1903, when marine mammals (white whales, Greenlandic seals, narwhales and others) were observed to migrate to more southern regions than usual. These periods are characterized also by decline of abundance of commercial fish species – salmon, cod, herring – in the inshore fisheries of the Russian North and Norway. These periods coincide with the decline in average temperatures. The changes in migration of marine mammals observed in 1970-80 are in the same range as historically known.

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

Results of our project provide the baseline information on the White and Barents Sea ecosystems and could be used by biodiversity conservation organizations and central and local administrations, fisheries communities and NGOs in their attempts to revive the salmon rivers and to organize sustainable use of inshore marine resources. The conclusions on the important influence of climate on the dynamics of the salmon populations in pre-industrial period could facilitate better understanding of its dynamics during last century, when both climatic and anthropogenic factors became apparent and should be taken into consideration when making the prognosis on the future of exploitation of Atlantic salmon.

Co-operation with biodiversity conservation agencies:

Julia Lajus participated in WWF Fisheries Conference, Murmansk, 18-19 August 2005.

Dmitry Lajus participated in the conference «Inexhaustible use and conservation of natural resources of the Northern Karelian cost: role of municipalities and public organizations", organized by the project of WWF and Biodiversity Conservation Center (Moscow), Chupa, Karelia 16-17 Sept 2005

Paper published in Conservation of the Wild Nature, journal of the Biodiversity Conservation Center sponsored by McArthur Foundation (Moscow) – see below.

3. WORK PLANNED FOR 2007

In the upcoming year we plan to continue the following studies:
- for the history of the Atlantic salmon population we plan to continue the synthesis of all obtained materials for more than ten locations and write a paper for the international per-review journal; using newly obtained data on prices will provide the necessary information on the level of catches for the periods in the 17^{th} – 18^{th} cc., for which we have no direct data;
- for the history of the cod and halibut populations in the Barents Sea we plan to accomplish a database and write a paper with detailed analysis of the data obtained;
- for the history of the White Sea ecosystem we will continue gathering of scientific and archival data of changes in this ecosystem in the 20^{th} c. and write a paper;

Other papers under preparation are listed in the last section of this report.

We plan to start studies of the historical changes in the fisheries communities and their modes of use of marine resources. Alexei Kraikovski discovered in the State Archives of the Arkhangelsk Region (GAAO) very detailed set of data on fisheries communities of the White Sea cost for the late 18^{th} century which could be taken as a baseline for such a study.

Significant efforts will be undertaken to continue comparative studies across the projects, first of all for the history of the Atlantic salmon populations.

4. EDUCATION & OUTREACH

One-semester course "Man and the Sea" for undergraduate students (group of 20) at State St. Petersburg University – 24 hours (D.L. Lajus with participation of J.A. Lajus).
4 hours are fully devoted to the presenting of agenda and results of the HMAP program.

Use of historical data for tracing effect of climate on fish populations. Lecture for undergraduate students (about 30), Berry College, GA, USA, April 2006. (D.L. Lajus).

Overview of HMAP White and Barents sea project. Lecture at the laboratory seminar, University of New Hampshire, USA (about 15 participants), 10 March 2006 (D.L.Lajus).

Results of our studies were presented at the following conferences:
"*Oceans Past*" Conference, Kolding, Denmark, 23-26 Oct 2005:

Julia Lajus. The early ideas of using historical data for the understanding of the dynamics of marine animal population.

Alexei Kraikovski. Atlantic salmon in the Russian North, 17^{th} – 18^{th} centuries: legends on the enormous fish riches are not supported by the historical catch records.

Dmitry Lajus. Use of historical data on the White and Barents Sea fisheries to study the effect of climate on fish populations.

Vadim Mokievsky. Historical anthropogenic changes in the Barents Sea ecosystem: an overview, the problem of scaling and added impact of climate variation.

Alexei Yurchenko. People, Seals and Diamonds: the Case of Seal Hunting in the White Sea (poster).

"Thinking Through Environment". VIII Turku Methodological Conference & VI Nordic Environmental History Conference, 15-17 Sept 2005:

Alexei Kraikovsky, Daniel A. Alexandrov and Julia Lajus. Misreading Remote Nature: Anthropological Insights in Environmental History.

Julia Lajus. Modernization and changing attitudes from 'nature's economy' to 'calculable resources' in fisheries.

International Conference on the History of the Nordic Countries. Arkhangelsk, 12- 21 Sept. 2005

Alexei Yurchenko. People, Seals and Diamonds: the Case of Seal Hunting in the White Sea; and Current problems of the seal hunting in the White Sea.

Articles for the broader audience:

Lajus D.L, Lajus J.A. 2005. [How study of fisheries can help to improve its management]. *Okhrana dikoi prirody* (Conservation of the Wild Nature, journal of the Biodiversity Conservation Center sponsored by McArthur Foundation), 4(34): 10-12 (In Russian).

Lajus J., Kraikovski A., Lajus D., Yurchenko A. [Oceans past]. *Gagarinskaia Tri*. Newsletter of the European University at St. Petersburg. Dec 2005, N 4 (16), pp. 8-10.

5. GEOGRAPHIC EXPANSION

The geographical scope of our project significantly increased in the past year. We started the comparative project "Towards a historical ecology of the North Atlantic: comparing the population dynamics of Atlantic salmon and other commercial fish species based on Russian and American historical catch data", for which Dmitry Lajus got Fulbright Scholarship. He spent 6 months of 2006 (January – July) working in collaboration with the HMAP team of University of New Hampshire, USA comparing historic White and Barents Sea salmon fisheries with those in the Gulf of Maine.

Comparing salmon fisheries in the White Sea and Maine from 1860s to the 1930s in future might allow to investigate the effects of climate, human population pressure, habitat alteration, industrialization (dams) and pollution on Atlantic salmon. Statistical analysis of synchrony in the fluctuations of salmon catches on both sides of the Atlantic could be done on the period from 1870s to the present, involving also Canadian data.

The approaches and first results of the comparative project were presented on the workshop on Atlantic salmon at the University of New Hampshire 11 July. Future plans for the collaboration were discussed.

We intend to increase the geographical scope of salmon studies in future. As a first step we plan to apply for funding for the organization of workshop on the history of the Atlantic salmon populations (end of 2007 – beginning of 2008).

6. PARTNERSHIPS & COLLABORATION

None to report.

7. INPUT TO COMMUNITY DATABASE

a. Publications

Lajus D.L., Lajus J.A., Dmitrieva Z.V., Kraikovski A.V., Alexandrov D.A. 2005. Use of historical catch data to trace the influence of climate on fish populations: examples from the White and Barents Sea fisheries in 17th - 18th centuries. *ICES Journal of Marine Sciences*, 62 (7): 1426-1435.

Lajus D.L., Dmitrieva Z.V., Kraikovski A.V., Yurchenko A.Y., Lajus J.A., Alexandrov D.A. 2005. [Historical data as a source of information on population dynamics of Atlantic salmon in the White Sea basin: methodology and case studies]. In: *Problems of rational use and conservation of natural resources of the White Sea. Proceedings of the 9th International conference, 11-14 October, Petrozavodsk, Karelia Republic*, p. 187-191. (In Russian).

Lajus D.L., Lajus J.A., Dmitrieva Z.V., Kraikovski A.V., Alexandrov D.A. 2005. [Use of archival data on history of fisheries to study effect of climate on populations of commercial fish of the White and Barents seas in the 17-18th centuries]. In: *Biological resources of the White Sea and inland water bodies of the European North. Proceedings of the 6(27)th International conference 5-10 December 2005, Vologda, Russia*, Part 1, p. 247-249 (In Russian).

Lajus D.L, Lajus J.A. 2005. [How study of fisheries can help to improve its management]. *Okhrana dikoi prirody* (Conservation of the Wild Nature, journal of the Biodiversity Conservation Center sponsored by McArthur Foundation), 4(34): 10-12 (In Russian).

Lajus D.L., Alekseeva Y.A., Lajus J.A. Herring fisheries in the White and Barents Sea in the 18th - beginning of the 20th cc: factors effecting the catch fluctuations. *Fisheries Research*, submitted

Lajus D.L, Dmitrieva Z.V., Kraikovski A.V., Lajus J.A., Yurchenko A.Y., Alexandrov D.A. Historical records of the 17 – 18th century fisheries for Atlantic salmon in northern Russia: methodology and case studies of population dynamics. *Fisheries Research*, submitted.

Kraikovski A.V., Dmitrieva Z.V., Lajus J.A. Monastic fisheries and their role in mastering the Russian North, sixteenth - middle of the eighteenth centuries, in preparation, estimated submitting date – end 2006.

Kraikovski A.V., Dmitrieva Z.V., Lajus D.L., Lajus J.A., Alexandrov D.A. Atlantic salmon in the Russian North, 17th – 18th centuries: legends on the enormous fish riches are not supported by the historical catch record, in preparation.

Alekseeva Y.I., Lajus D.L., Lajus J.A. Unusual migrations of marine mammals in the Barents and Norwegian seas, in preparation.

b. Project Participants (Personnel Report)

Project Leader Prof. Daniel Alexandrov – Center for Environmental and Technological History, European University at St. Petersburg, 3 Gagarinskaia str. 191187, St. Petersburg, Russia, d_alexandrov@eu.spb.ru
Marine environmental history, history and sociology of science. English, Russian.

Project Co-ordinator Dr. Julia Lajus - Center for Environmental and Technological History, European University at St. Petersburg, 3 Gagarinskaia str. 191187, St. Petersburg, Russia,
jlajus@eu.spb.ru
Marine environmental history, history of fisheries science and oceanography. English, Russian.

Dr. Dmitry Lajus – Department of Ichthyology and Hydrobiology, Faculty of Biology, St. Petersburg State University, 29 16-ia linia V.O. 199178, St. Petersburg, Russia,
dlajus@yahoo.com
Marine biology, ichthyology.

Dr. Zoya Dmitrieva - St. Petersburg Institute for History, 7 Petrozavodskaia str., 197110, St. Petersburg, Russia. History of Russia (17-18th cc.), archival studies, marine environmental history. German, Russian.

Dr. Alexei Kraikovski - Center for Environmental and Technological History, European University at St. Petersburg, 3 Gagarinskaia str. 191187, St. Petersburg, Russia,
karl@eu.spb.ru
History of Russia (17-18th cc.), archival studies, marine environmental history. English, Russian.

Dr. Vadim Mokievsky - Institute of Oceanology, Russian Academy of Sciences, 36 Nakhimovsky prospect, 117851, Moscow, Russia, vadim@ecosys.sio.rssi.ru
Marine biology, historical ecology. English, Russian.

Yaroslava Alekseeva – PhD candidate in biology, Institute of Oceanology, Russian Academy of Sciences, 36 Nakhimovsky prospect, 117851, Moscow, Russia, a-ja@list.ru
Ichthyology, marine mammal biology, historical ecology. English, Russian.

Baltic HMAP

PI Henn Ojaveer
Full Mailing Address: Estonian Marine Institute, University of Tartu, Vana-Sauga 28, 80031 Pärnu, Estonia
Phone: (372) 44-33800 FAX: (372) 44-33800 E-mail: henn.ojaveer@ut.ee

CO-PI Brian R. MacKenzie
Full Mailing Address: Danish Institute for Fisheries Research, Department of Marine Ecology and Aquaculture, Kavalergården 6, DK-2920 Charlottenlund, Denmark
Phone: (45) 3396-3403 FAX: (45) 3396-3434 E-mail: brm@difres.dk

CO-PI Maibritt Bager
University of Southern Denmark, Niels Bohrs Vej 9, DK-6700 Esbjerg, Denmark
Phone: +45 35 55 27 25 E-mail: bager@hist.sdu.dk

http://www.hmapcoml.org

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

Activities

During the past year, the main emphasis has been put to creation of several new datasets, incl. by amending the already existing ones with new information (especially for cod). In addition, interpretation of the data has started and several manuscripts have been submitted or are close to submission.

We have achieved fairly good regional coverage of the Baltic Sea extending from Bothnian Bay in the north and Gulf of Finland and Gulf of Riga in the east to the southern Baltic Sea. In all these covered sub-areas, archival data allow us to improve knowledge for several commercial fish (both marine species, freshwater fish living in the Baltic Sea and migratory species) and their exploitation sometimes even back to the 1500s.

In addition, new research activity was recently initiated: 'Fisheries Technology in the Baltic Region c. 1850-2005'.

Results

The following section provides selected highlights based on the published/submitted manuscripts.

Development and analysis of new long-term temperature data series for last 140 years has shown that surface temperatures in the North and Baltic Sea are now at record highs. Rate of warming differs seasonally and has been highest in summer. Frequency of extremely warm and cold years, winters, and summers has all changed: warm summers and mild winters have increased while cool summers and cold winters have decreased).

Archaeological evidence of fish fauna in the Atlantic warm period (ca. 7000-3900 BC) shows that many fish species in waters around Denmark (North Sea, Skagerrak, Kattegat, Baltic Sea) were of "southern" origin. Comparison with contemporary data from surveys and commercial landings shows that many of these species are now re-appearing as temperatures rise. Notably cod was very abundant in the Stone Age period even though temperatures were

2-4 degrees warmer than late 20th century temperatures. This finding suggests that a commercially important cod populations can be maintained in the North Sea-Baltic region even as temperatures rise due to global warming, provided that fishing mortalities are reduced. The archaeological material could be useful for interpreting the likely consequences of future climate change on the fish fauna in marine ecosystems near Denmark.

One of the most important commercial species in the Baltic Sea is cod. Biomass of the species in late 1500s and early 1600s likely was very large because of presence of cod fishery in northern Baltic (SW Finland) at this time. Contemporary ecological knowledge (tagging, research, CPUE, surveys) shows that cod only reach this area when biomass is high. Further research on cod was performed with respect of catches and economic values, time series of indicators of fishing effort and qualitative information on developments in fishing technology for the period of 1880s until 1938. It can be concluded that the assembled cod data for the period reveal biologically meaningful variations in the state of the cod stock and that some of the variations in the catches of different countries (e.g. decline in the late 1920s; increase in the late 1930s) were caused by factors other than fishery developments. These factors probably include ecosystem-induced variations in cod population dynamics and need further investigation.

During the late 17th century (1675-1696), fishing in the Gulf of Riga was carried out on small or medium sized boats by means of various fishing techniques: traps, seines, fences, spears. Herring, flounder and eelpout were the major target species. Compared to the nowadays situation, herring catch was substantially shifted later, to the summer (June-August), presumably due to cold climate at this time. Demersal fisheries (on flounder and eelpout) were mainly dependent on fishermen and/or market demands. During the late 17th century, removals of fish biomass out of the basin was at least 200 times less than at the end of the 20th century whereas the main target fish species was still the same – herring.

The history of the bluefin tuna fishery in northeastern Europe has been compiled and documented. The fishery started in the early 1900s, peaked in the 1950s but then collapsed and has not recovered. The development of the fishery was mainly due to increases in effort and demand. Historical reports and archaeological evidence shows that the species had been present in these waters for 100s of years. The reasons for the failure to reappear (e. g., overfishing, environmental or ecosystem changes) are being investigated.

Although the available archival data on Russian fisheries in the south-eastern part of the Gulf of Finland and inflowing rivers for the period the 15-20th centuries are rather fragmentary, the main trends in development of fisheries are evident. Migratory fish species, such as sturgeon, Atlantic salmon, brown trout, whitefish, vimba bream, smelt, eel, lamprey were the most important commercial fish in the area, because they were abundant, had high commercial value and were easily available for fishing in rivers. Clear trend of moving of the main fishing areas to downstream parts of rivers and to the sea. Due to intensive fishing, populations of many migratory species, first of all sturgeon and Atlantic salmon, considerably declined and lost their commercial significance. Marine fish, firstly the Baltic herring increased their importance later, in the 19th century.

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

The following three major items can be outlined:

1. To improve knowledge of magnitudes of variability, relative roles of major ecosystem changes such as loss of top predators, eutrophication, fishing, and climate variability and change;
2. To improve scientific basis for developing and implementing ecosystem-based fisheries management;
3. To contribute to scientific basis for predicting consequences of climate change on fish community and fisheries of Baltic Sea.

3. WORK PLANNED FOR 2007

1. Continuation of editing a special issue of Fisheries Research dedicated to HMAP-related papers (guest co-editors Henn Ojaveer and Brian MacKenzie); expected publication in late 2007 or early 2008. The volume will include contributions from the Baltic, North, Barents and White seas;
2. Continuation of writing manuscripts based on the work done during previous years. One of the planned papers will be major synthesis paper of the Baltic Sea based on archival studies in various Baltic countries;
3. Performing of extended Virtual Population Analysis (VPA) with biomass estimates for Baltic cod to ca. 1945;
4. Participation and presentations at international conferences and expert groups (especially ICES WG/SG meetings);
5. Completion of the research on 'Fisheries Technology in the Baltic Region c. 1850-2005';
6. Processing of further sediment cores from the Baltic Sea by taxonomic experts and trained students (e. g., identification of species from bones).

4. EDUCATION & OUTREACH

1. One Ph. D. student (M. Eero) is being trained within the project with funding from non-CoML sources;
2. Two undergraduate students have received training in processing paleo-oceanographic samples for fish remains;
3. Oral presentations and posters and at international and national conferences and expert groups (e. g., fishery and ecosystem advisory groups);
4. Teaching in universities.

The following teaching materials have been produced:

Bager, M, Holm, A.D., Dried fish and fish stock; in Nyt fra IHKS I Esbjerg, nr. 8., 2005. Newsletter from the department of History, University of Southern Denmark. Target group: senior high school teachers and persons with historical interest.

Bager, M, Holm, A.D., Dried fish – the use of experimental history in order to understand the ocean in previous times. Interview in Danish National Radio, DR Nordjylland 14.07. 2005. Taget group: ordinarily radio audience.

Bager, M., lecture: The ocean in a marine environmental perspective, Malmö högskola. 11.10.2005. Taget group: undergraduate students.

Bager, M., lecture: Marine environmental history and the Baltic Sea, University of Copenhage 29.11.2005. Taget group: senior high school teachers in history and biology.

5. GEOGRAPHIC EXPANSION

The current project is geographically limited to the Baltic Sea. Thus, this item seems to be not relevant as the whole Baltic Sea is covered by Baltic-HMAP activities

6. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
EU FP6 project MARBEF	Brian MacKenzie, Henn Ojaveer, Poul Holm, David Starkey	Joint meetings and workshops, transfer of expertise and knowlege
EU FP6 project INCOFISH	David Starkey, Poul Holm, Henn Ojaveer	New archival research, joint publications
CONWOY	B. R. MacKenzie, P. Holm	CONWOY is a Danish – funded research project on climate change and ecosystems. It is supporting some HMAP research in the North and Baltic Seas.
DIFRES (Danish Institute for Fisheries Research)	B. R. MacKenzie	DIFRES is supporting CoML-HMAP via significant contributions of scientist staff time for research and supervision of student projects.
Estonian Marine Institute, University of Tartu	H. Ojaveer	Estonian Marine Institute is supporting CoML-HMAP via contributions of scientist staff time for research.
Karl Ernst von Baer Museum, Estonian Agricultural University	E. Tammiksaar	The museum contributes with knowledge in Estonian fisheries history in previous centuries
LATZRA (Latvian Fish Resource Agency)	R. Gaumiga, D. Uzars	LATFRI is supporting CoML-HMAP via contributions of scientist staff time for research.
University of Latvia	G. Karlsons	University of Latvia is supporting CoML-HMAP via contributions of scientist staff time for research.
European University at St Petersburg, Department of History	Julia Lajus, Alexei Kraikovski	European University at St. Petersburg is supporting CoML-HMAP via

		contributions of scientist staff time for research.

b. Links to CoML Ocean Realm Projects

None to report.

c. Links to CoML National and Regional Implementation Committees (NRICs)

NRIC	Liaison or Cross-over personnel	Nature of Relationship
Australia		
Canada		
Caribbean		
China		
Europe	Henn Ojaveer	Facilitation of HMAP-related work in Europe (through co-funding of workshops)
Indian Ocean		
Japan		
South America		
Sub-Saharan Africa		
USA		

d. Liaisons to CoML Cross-Cutting Groups

Project Name	Liaison Name & Institution	Nature of the Relationship
OBIS		
FMAP	Brian MacKenzie, Danish Institute for Fisheries Research	Collaboration with Ransom Myers re. Bluefin tuna
SCOR Tech Panel		
E&O		
Barcoding		

e. Effectiveness of the Partnerships and collaborations

The European RIC has recently decided to co-finance two HMAP workshops in Mediterranean and Arctic. Based on the financies available for the European RIC, this should be considered as relatively major contribution for further development of HMAP-related activities in Europe.

7. PUBLICATIONS

Bacevicius, E. and Karalius, S. 2005. A survey of the data on swordfish(*Xiphias gladius* L.) in the southern and southeastern Baltic Sea. Bulletin of the Sea Fisheries Institute, Gdynia, 2 (165).

Bager, M. and Holm, P. Dried fish – a study of the production of dried fish 1500-2006. Accepted for publication in Nordnytt (in Danish)

Bager, M., Sondergaard, M. K., MacKenzie, B. R.Bornholm fisheries 1500-1911. Submitted to Fisheries Research.

Bager, M. and Holm, P., The Sea as research area – Marin environmental history in Denmark, in: Miljøhistorie over grænser, red. Fredrik Björk, Per Eliasson, Bo Fritzbøger 2006. Accepted (in Danish).

Eero, M., MacKenzie, B.R., Karlsdottir, H.M. and Gaumiga. R. Development of international fisheries for cod (Gadus morhua) in the eastern Baltic Sea during 1880-1938. Submitted to Fisheries Research.

Enghoff, I.B. and MacKenzie, B.R. The Danish fish fauna during the warm Atlantic period (ca. 7,000-3,900 BC): forerunner of future changes? Submitted to Fisheries Research.

Gaumiga, R., Karlsons, G., Uzars, D., and Ojaveer, H. Gulf of Riga (Baltic Sea) fisheries in the late 17th century. Submitted to Fisheries Research.

Lajus, J., Kraikovski, A. and Lajus, D. Coastal fisheries in the Gulf of Finland basin in the 15 – 20th centuries on the base of Russian historical sources. Submitted to Fisheries Research.

Lajus, J., Ojaveer, H. and Tammiksaar, E. Fisheries at the SE coast of the Baltic Sea in the first half of the 19th century: what can we learn from the archives of Karl Ernst von Baer. Manuscript, will be submitted to Fisheries Research in 2006.

MacKenzie, B.R. and Myers, R.A. The development of the northern European fishery for north Atlantic bluefin tuna *Thunnus thynnus* during 1900-1950. Submitted to Fisheries Research.

MacKenzie, B. R. and Schiedek, D. Daily ocean monitoring since the 1860s shows unprecedented warming of northern European seas. Glob. Change Biol. (submitted)

Ojaveer, H., Awebro, K., Karlsdottir, H.M. and MacKenzie, B.R. Swedish Baltic Sea fisheries during c. 1870-1913: spatio-temporal dynamics of catch and fishing effort. Manuscript, will be submitted to Fisheries Research in 2006.

Gulf of Maine

PI: Andrew A. Rosenberg
Ocean Process and Analysis Laboratory, Institute for the Study of Earth, Oceans and Space, Morse Hall 142, University of New Hampshire, Durham, NH 03824, USA
Phone: (603) 862-2020 FAX: (603) 862-0243 E-mail: andy.rosenberg@unh.edu

CO-PI: W. Jeffrey Bolster
Department of History, Horton Hall, University of New Hampshire, Durham, NH 03824
Phone: (603) 862-3016 FAX: (603) 862-1502 E-mail: jeff.bolster@unh.edu

Project Coordinators: Karen Alexander and Stefan Claesson
Gulf of Maine Cod Project, Nesmith Hall 101, University of New Hampshire, Durham, NH 03824
Phone: (603) 862-4482 FAX: (603) 862-0243 E-mails: karena@unh.edu; stefan.claesson@unh.edu

Karen Alexander and Gwynna Smith
Gulf of Maine Cod Project, Nesmith Hall 101, University of New Hampshire, Durham, NH 03824
Phone: (603) 862-4482 FAX: (603) 862-0243 E-mails: karena@unh.edu; mthoodhistory@gmail.com

Gulf of Maine Cod Project web address: http://fishhistory.org

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

Stellwagen Bank Historical Marine Ecology Project: Following a one year exploratory grant during which sources were identified that could provide data on long term change in the Sanctuary marine ecosystem, the Stellwagen Bank Historical Marine Ecology Project received two years of additional funding to develop, analyze, and visualize geo-referenced datasets from the best of those sources. Budget cuts at NOAA required limiting the study to the best quantitative sources from early US Fish Commission and Bureau of Fisheries studies. The project focused on:

1) scientific logbooks from early Fish Commission research vessels, 1880s-1930s, including sampling surveys, dredging surveys, and temperature and salinity measurements. Operated by the US Navy, these vessels kept meticulous sailing logs from which location can be determined with precision. While some log books have been transcribed and printed, manuscript logs are housed in NARA Washington, College Park, the Smithsonian Archives, and some regional centers (Gloucester Archives MA). Work is underway to plot available scientific data for the entire Gulf of Maine.

2) scientific fisheries bulletins, 1890s-1930s. These data sheets come in two forms, printed monthly summaries for aggregate landings on named fishing banks, and blank forms handed out to fishing captains by Custom's Officers. Fishing captains were asked to complete voyage summaries, including quantity and species of fish landed, size of the vessel, number of men fishing and dates at sea. Data entry has been completed for the initial set of bulletins that were located in NARA, Waltham MA. Mapping and analyzing changes in landings over time is poised to begin. Other bulletins were located in NARA College Park. They are being digitized, and data entry should begin in early fall.

3) fishermen's interviews, 1890s. Extensive interviews with fishermen were conducted by the US Fish Commission. The interviews examined so far pertain to the mackerel fishery, but other species and other fisheries come up in discussion. The fishermen interviewed generally had been on the water all their lives and they describe changes they had witnessed over the last half century. Quantitative and qualitative data exist which can be mapped. Even more important, these fishermen give candid and personal appraisals of an important perspective on fisheries at the dawn of mechanization in the US. Potential for pubic outreach is great. Stellwagen Bank National Marine Sanctuary is considering developing a program "Through the Eyes of a Fisherman" based on these data.

4) laws and regulations, 1890-1935. A comprehensive database of all fisheries laws and regulations in Massachusetts for this period has been compiled. The laws and regulations provide descriptions of environmental and anthropogenic factors that directly affected fisheries of the Stellwagen sanctuary and Massachusetts Bay. The database also provides a record of government fisheries management efforts in the late 19th and early 20th centuries. Combined with the above landings data, we hope to be able to measure the impact and effectiveness of historic regulatory measures.

Because the quality of Stellwagen Bank's environment is contingent upon conditions throughout the Gulf of Maine, mapping ocean species and characteristics over the entire Gulf is being done for some datasets. Maine Fish Commission reports were digitized in March, and catch data is being tabularized. Data on landings of commercial species in the Northeastern Gulf from 1870s through 1930s can be useful to reconstruct elements of the entire ecosystem.

Cod Project: The project's goals are to establish biological reference points and geographical distribution for the mid 19th-century cod population in the Gulf of Maine, to identify New England fishermen's knowledge systems during the age of sail, and to understand motivations for decision making and risk taking at sea 150 years ago. Biological indicators for 19th-century cod populations being estimated and compared to their modern counterparts, and social and economic systems that operated within the fishery are being examined. These goals will be accomplished through:

1) retrieving fisheries data from 19th-century logbooks, fishing agreements and license records,

2) identifying and tracking fishermen in US census records,

3) database design and management,

4) metric derivation, mapping, statistical analysis, and historical explication, and

5) comparing historic and modern biological, environmental, economic and social conditions.

Landings and Effort: Logs from the Massachusetts Customs Districts of Salem/Beverly (701 logs from 1852-1866), Newburyport (233 logs from 1848 to 1861) and Barnstable (112 logs from 1850 to 1863), and the Maine Districts of Frenchman's Bay (524 logs from 1861 to 1865), Machias (96 logs from 1852 to 1865), Penobscot/Castine (46 logs from 1859 to 1866) and Bath (43 logs from 1862 to 1865) have been evaluated for seasonal fishing location. All Maine logs have been digitized, the process is underway for the Salem/Beverly logs. Drafts of Daily Catch Records, transcripts of landings and analysis of fishing effort (where applicable), have been produced for all Maine logs. All 524 Frenchman's Bay logs drafts have been edited for quality control. License records for the Frenchman's Bay Customs District have been correlated with extant logs to show what portion of the entire fleet is represented, and a proxy has been developed to scale landings from the logs to total effort for the whole fleet. Entry into the online database should be complete by the end of August.

Daily landings datasets are currently being analyzed and modelled, and geographic distribution of landings mapped in GIS.

The aggregated weight of cod landed by the Frenchman's Bay fleet alone between Monhegan and Grand Manan within 40 miles of the coast in 1861 comes to approximately 12,500mt, roughly equivalent to the biomass of 125 blue whales. These fish, averaging 7.5 lbs, were caught by 223 Frenchman's Bay schooners and boats averaging just 45 tons. Preliminary landing maps indicate that the most prolific grounds within this region were around Mt Desert and out to Mt Desert rock, including Frenchman's Bay and Blue Hill Bay. Landings from Machias, Penobscot-Castine and Bath vessels have so far not been included in this total. Frenchman's Bay fishermen handlining and tub trawling, mostly in small vessels within sight of land, caught more cod in 1861 than were landed in the entire Gulf of Maine in 1998, 1999, and 2000 combined (4156, 1646, 3730 respectively for a total of 9532mt). Catch alone shows the Mid-coast Gulf of Maine between 1852 and 1866 supported enormous primary production in a region almost devoid of cod today.

Mapping: The award of a Mia Tegner grant in May, 2004, allowed Stefan Claesson to geo-reference charts of fishing grounds identified by name in G. B. Goode's *Fisheries and Fishery Industries of the United States*, sec. III (1888), Walter Rich's *Fishing Grounds of the Gulf of Maine* (1929), and unidentified spawning grounds in Ted Ames "Atlantic Cod Stock Structure in the Gulf of Maine" (2004). These charts were based on locations and names provided by experienced fishermen in the late 19th- and early 20th-centuries. Each chart from a particular source was geo-referenced by its navigational coordinates, lined up and overlapped. The outlines of the fishing banks and grounds were rasterized and centroids plotted that correspond to the names of the grounds. Fishing grounds from one source constitute one layer. Additional layers include: a metadata layer with catch and other geographic distribution data from Goode, bathymetry, LMEs, NAFO zones, fishing ground names, names and locations of ports, and contemporary nautical charts with depth contours.

Mapping individual vessel catch per day and course tracks began with the Scotian Shelf fishery because some of those data correlated to navigational coordinates. The Beverly fleet usually recorded daily observations of latitude and longitude while underway, and occasionally made observations on the Scotian Shelf. Gulf of Maine skippers were more laconic in their record keeping. Only about 30% of Frenchman's Bay logs have detailed enough descriptions of the fishing grounds to establish the precise location of catch each day, although Machias logs are more descriptive. Inshore skippers likely treated fishing trips as Americans do the drive to work. Some fishing vessels went home for church, the 4th of July, for local elections, and to get in their hay. Most vessels ducked into nearby ports during bad weather. Many fares were short, routine, and didn't require diligent navigation. In Gulf of Maine logs for which catch can be easily geo-referenced, captains occasionally noted the names of individual fishing grounds in daily entries, although often locations at sea were identified by landmarks on shore. Many vessels fished in one area for an entire fare, providing excellent geographic specificity.

Unfortunately, locations in Maine logs often referred to ranges and bearings on observed landmarks, not the named fishing grounds given by G. B. Goode (1887) and Walter Rich (1929) [mapped in a GIS dataset developed with a Mia Tegner Grant in 2004], or with coordinates as Scotian Shelf, Grand Banks and Bay St. Lawrence skippers provided. In addition, fishermen often identified fishing grounds by nearby islands or other coastal landmarks. This is problematic when many bays north of Portland ME contain some locations with exactly the same name. Rich locates "Duck Island Grounds" near Boone

Island, but the "Duck Island Grounds" the Frenchman's Bay fishermen refered to is the one near Mt. Desert. There are three "Long Island Grounds," two of which are in Blue Hill Bay, and four "Middle Grounds," including Stellwagen Bank (called Middle Grounds since the 1600s and is still called that by fishermen today). Catch aggregated quite well by season and day, but Goode's and Rich's named fishing grounds failed to describe most fishing locations. Understanding spatial context in historical terms was essential to interpreting the Maine logs.

W.B. Leavenworth developed a method of mapping vessel position based on sailing knowledge and dead reckoning. A set of zones where vessels were most likely to have fished was developed based on the context of the logs. Each fishing zone contains named fishing grounds. In this way, a set of nested locations has been developed which is being drawn in GIS. The smallest division is the named fishing ground, like Martin's Ground in Frenchman's Bay. MYSQL Place Names aggregate catch on Martin's Ground, within the Frenchman's Bay fishing zone, in the Southern Bay of Fundy area, or within the region stretching from Monhegan to Grand Manan. The Monhegan to Grand Manan region appears to encompass the range of all but a handful of Frenchman's Bay, Machias and Penobscot vessels. Most interesting of all, the fishing zones appear to conform to patterns of movement the fishermen employed year after year. Addition of fishing grounds identified in the log, but not mentioned in Goode or Rich should be completed and entered into fishing ground layer by the end of August. Fishing zones have been rubbersheeted and added as another layer to the GUS dataset. These zones, much smaller than individual banks on the Scotian Shelf, are currently being used for modeling abundance and distribution.

Choice and Decision Making: For schooners from offshore fleets like Beverly, vessel size and homeport are good indicators of fishing strategy. Small vessels under 35 tons generally fished coastal Gulf of Maine grounds, while schooners over 50 tons fished the grounds further from shore. The size of Massachusetts offshore schooners correlated well with fishing banks. Large schooners over 50 tons from Newburyport, MA, generally fished the Labrador. Very large schooners over 80 tons from Beverly, MA, generally fished the Grand Banks, while those ranging from 50 to 80 tons from Beverly fished the Scotian Shelf. For Massachusetts communities and the offshore banks, vessel tonnage is a good proxy for effort and fishing pattern. This straightforward correlation was not true for Maine vessels licensed to fish for cod. Maine skippers behaved very differently from Massachusetts Banks fishermen when it came to deciding where to fish. Insufficient data has been found thus far to evaluate the inshore Massachusetts fisheries in the 19th century.

Vessel size influenced fishing patterns by limiting the safe operating range and carrying capacity of smaller vessels. Small boats fished in bays and estuaries close to harbors of refuge. Since cargo capacity was limited, they probably unloaded catch to their shoreman every few days. Large vessels were more seaworthy, could hold more men, gear, supplies and cod. They could travel farther from home, but they didn't have to. While large Massachusetts vessels invariably ventured far to Canadian waters on extended fares, this was not the case in Maine.

In Frenchman's Bay ME, very large vessels fished inshore grounds alongside very small vessels. For instance, the AGENORA, 104 tons out of Surry, caught 8275 cod – over 40% of its total catch that year – near Duck Island just south of Mt. Desert. In fact, the AGENORA fished in the same locations as the 22 ton JAMES MONROE out of Tremont. Some vessels, regardless of size, did not appear to venture more than 30 miles from their homeport. Many did not venture out of sight of land on a clear day. This meant that tonnage is not an adequate proxy by itself for fishing strategy for Frenchman's Bay vessels. While safety at sea limited

the geographic range of small fishing vessels, no easy diagnostic correlation exists for larger ones. Furthermore, landings do not correlate to vessel size either. Some small vessels caught more cod in a season than large vessels did. For instance, the 12 ton boat NYMPH with a crew of 3 out of Cranberry Isles caught 15,819 cod in 1862, while the 88.9 ton OLIVE BRANCH with a crew of 9 from Tremont only brought home 4,122 cod that year. Vessels that caught less than 20,000 cod averaged 43.25 tons, with a standard deviation of 21.47. Vessels that caught over 20,000 cod, however, averaged just 58.25 tons, with a standard deviation of 25.48. For the Maine fishery, tonnage cannot be used to estimate catch, effort or fishing location for vessels without logs.

Currently, fisheries data can be aggregated in terms of vessel tonnage, home port, number of men, year, fare, day, spatial location [fishing ground, zone, area, region], and weight of catch. Sociological data on the fishermen such as residence, house number (from US Census), age, occupation, head of household, wealth and residential proximity to other crewmembers can be correlated to fishing strategy. We have completed Census databases for over 4000 Frenchman's Bay, Machias, and Bath, Maine, fishermen, shoremen, and owners. Fishing strategy can be correlated to the economic strategy of an individual or household, or the average age of fishermen to catch, vessel size and fishing grounds. Boys as young as eight fished for the entire season. Some vessels sailed with one or two adults and three or four boys under the age of 15. Census data showed that some vessels were captained by boys as young as 17. Often, however, an older man, usually the boy's father or uncle and an owner of the vessel–shipped aboard as a fisherman. Young captains may have been put in charge to learn the ropes, but identifying how decisions were made when an owner sailed as a fisherman becomes more complicated. A girl, Alva Dolliver, fished with her father, Hiram, and women cured cod and owned schooners.

Here is an example. The Grant family of Blue Hill Bay [Frenchman's Bay Customs District] schooner captains consisted of Francis, Larkin, Osman, Jasper, Joseph and Thomas. All these captains fished in the same fishing zones. Moses Grant, the patriarch of the family and its wealthiest member, sailed as a fisherman in 1861 and 1862. In 1861, the 35 ton HOLBROOK, [Joseph Grant, master, age 46; Moses and Osman fishing] landed 22,588 cod in 83 days fishing for $1497. Thomas Grant's wife, Paulina [Plina in the records], owned the HOLBROOK. In 1862, the 92 ton FLORIDA, [Osman Grant, master, age 19; Moses fishing] landed 12,922 cod in 49 days fishing for $1560. The FLORIDA caught fewer cod than the HOLBROOK, but its fishermen worked half as hard and made up the monetary difference with the bounty payment. The economic strategy of this family was not to maximize profit by fishing as hard as possible, but to meet a target income of around $1500. The Grants probably invested in a larger vessel not to catch more fish, but to increase their subsidy [a bounty for cod fishing amounting to $4.00/ton of vessel to be divided between the owners and crew, and paid out from 1792 to 1866]. Although this is "bounty catching" – FLORIDA clearly fished for cod, but only caught fish on 41% of the 120 days required by law--their catch was still creditable. The 28% reduction in effort expended compared to the HOLBROOK satisfied an economic strategy based on targeting a level of profit and minimizing effort afloat. Among the Grants, the seasonal division of income among owners, shoreman and crew probably had little meaning, since they were all one family. Not only is this economic model uncommon today, it was becoming uncommon in the 1850s and 60s. Individual Maine fishermen who wanted to maximize their personal income may have moved to Beverly, Marblehead or Gloucester MA, a demographic shift that should be evident as we learn more about these men. Several Beverly vessels were campaigned seasonally by Maine crews from Bucksport, and at least one Beverly vessel was skippered by a Waldo county captain. Work has begun on databases for Castine, Maine, and Beverly Massachusetts,

fishermen. Census records are yielding surprises. We have found boarding houses for fishermen in Bath, Maine, more like urban Cape Ann, Massachusetts, than the village fisheries of Frenchman's Bay, Maine. In addition, one Beverly fishing schooner appears to be crewed entirely by shoemakers, indicating that a mixed economy could operate among urban factories as well as among rural farms.

Ecosystem Effects: To a much greater extent than in the offshore fisheries, Gulf of Maine captains observed and noted the relationship between baitfish like herring (spelled phonetically "herron") and menhaden ("pogies"), and cod. Many logs contain descriptions of observed estimates of "bate" and "fish" (meaning cod). Signs of baitfish were important to fishermen for two reasons. First, most of the Maine inshore fleet caught their own bait whenever they could. Alternately, they dug clams, or bought bait from weirs that lined the rivers and bays. Catching or digging bait cut costs. Secondly, fishermen appear to relate the abundance of bait to the abundance of cod and alter fishing strategy accordingly. These data will allow us to plot the spatial location (presence/absence) of baitfish as well as cod in the region day to day over a season.

During the 1860s, Maine fishermen became alarmed at the decline in cod and bait species along the coast, so much so that Maine instituted the first Fish Commission in the US designed to investigate declining fish species. The US Fish Commission followed less than a decade later. The Maine Fish Commission published reports from 1867 to the 1970s on the state of all Maine commercial and sport fisheries. We were able to locate a nearly complete run of Maine Fish Commission Reports in the Bangor Public Library. Those reports have been digitized, and all tabular data on all marine species and fishing effort, aggregated by county and year, have been entered into searchable databases. This accomplishes several things. First, cod landings from the Customs House logs can be linked to later, more general landings reports for the inshore Maine cod fishery. In addition, landings form the inshore fishery can be linked with and compared to landing for the offshore fishery reported in the US Fish Commission (see Stellwagen Bank Report above). Since landings off the coast of Maine reported by the US Fish Commission only take into consideration the fishing grounds around Grand Manan, we believe that the true extent of this small boat cod fishery off the Maine coast has been grossly underestimated.

Equally important, Maine Fish Commission and other Maine Government reports list the locations of factories and dams. A factory and dam database – including height and type of dam; type of factory, water usage and pollutants discharged – is being constructed that will allow us to correlate industrial expansion with fisheries health. With information on multiple species, we can begin to look at overall productivity along the Gulf of Maine coast, and the effect of human activity on productivity. The magnitude of cod landings in 1861 may indicate changes in overall ecosystem productivity with respect to today. The addition of multiple species data from the Maine Fish Commission reports may improve our understanding of productivity in the past.

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

Our estimate for the cod population on the Scotian Shelf in 1852 showed that estimates of carrying capacity are not merely theoretical limits. On the other hand, the Frenchman's Bay study shows that in 1861 one fleet of relatively small hook-and-line vessels along one stretch of the Maine coast landed cod comparable to current MSY estimates for the whole Gulf of Maine. Distribution of landings show that inshore grounds dominated. Coastal productivity must have been great to support such a robust cod population. Population estimates and

landings aggregates from the past show what this region was once capable of producing. These figures suggest goals for restoring marine ecosystems, even if such goals are not entirely realistic. With additional data on other species, it may be possible to investigate productivity, diversity and complexity in the 19th-century Gulf of Maine.

The past records different modes of human engagement with marine ecosystems, and can serve as a social laboratory of mutual interaction. Understanding fishermen's traditional knowledge systems, including knowledge of marine species and fishing grounds, and acceptable profit and risk, show how people changed with changes in the marine environment, changes often wrought by technological advances and industrialization. The Scotian Shelf study showed that a traditional hook and line fishery could cause local depletions of fish stock. However, the Frenchman's Bay study suggests that, in a mixed economy where fishermen did not fish to maximize profit, but set an income goal and fished to minimize effort, cultural and economic circumstances may have limited catch. Understanding this different economic system, and knowing what abundance the ecosystem was once capable of producing, may help managers and stakeholders create effective regulations which preserve fishing communities while improving marine ecosystems in the Gulf of Maine.

Craig McDonald, Director of the Stellwagen Bank National Marine Sanctuary, a partner institution with the Gulf of Maine Cod Project, is working on a paper about the practical application of historical data provided by GMCP to management decisions in the Sanctuary. To our knowledge this is the first such paper in preparation, and Stellwagen Bank the first Marine Sanctuary to consider incorporating historical data into practical management decisions.

3. WORK PLANNED FOR 2007

Stellwagen Bank Project will complete data entry, map, in GIS, change over time in the distribution of fish species from US Fish Commission and Bureau of Fisheries scientific surveys, and statistical bulletins before 1940. In addition, oceanographic data from the early scientific records will be mapped, giving the best possible overview of ocean conditions in the Gulf of Maine. While research efforts will highlight Stellwagen Bank, data on the entire Gulf of Maine will be mapped.

The Cod Project will complete analysis of catch and effort, and decision making and risk taking among fishermen, for the Frenchman's Bay fleet in the Gulf of Maine, 1861-1865. Daily Catch Records from the Machias, Castine and Bath Customs Districts will be added to the database and modeled individually. Work will continue on Beverly, although we do not anticipate finishing next year. As databases are completed, GIS maps of landings and effort will be produced.

Dmitry and Julia Lajus of the White and Barents Sea Project in Russia spent 6 months at UNH investigating sources for a comparative study of salmon in the Gulf of Maine and in the White Sea at the end of the 19th-century. Their interests prompted us to locate the rest of the Maine Fish Commission reports. These Reports will allow us to correlate inshore and offshore cod fisheries (with the US Fish Commission Reports), and expand our scope of interest to include other marketable fish and shellfish in the Gulf of Maine. By linking logs, statistical bulletins and fish commission reports, we hope to investigate productivity in the Gulf of Maine at the beginning of industrialization. While quantitative data entry on fisheries

is complete, much qualitative data remains to be incorporated, as well as information about dams and factories, which even then were recognized as harming fisheries.

4. EDUCATION & OUTREACH

Presentations to the general public at regional historical societies. Attendance ranged from 20 to 50 persons:

"19th-Century Codfishing in the Gulf of Maine," Pemaquid Historical Society, Pemaquid, ME (W.B. Leavenworth), Jul 2005 [based on the Frenchman's Bay study];

"The Decline of New England Cod Fisheries," Massachusetts Historical Society, Boston, MA (W.B. Leavenworth) Sep 2005 [based on the Scotian Shelf and Frenchman's Bay studies];

"Ship in the Forest," Old Berwick Historical Society, South Berwick, ME (W. B. Leavenworth), Mar 2006 [the synergy between cutting timber for shipbuilding, farming, and the health of the fisheries];

"Ship in the Forest," Boothbay Historical Society, Boothbay, ME (W. B. Leavenworth), Jul 2006 [the synergy between cutting timber for shipbuilding, farming, and the health of the fisheries].

Websites:

Gulf of Maine Cod Project: www.fishhisstory.org

[The public portal of the project website is currently available, and generates mail.]

Museum Exhibits:

From Abundance to Aquaculture: Changes in New England's Fisheries, (July, 2006) permanent exhibit displayed by the Seacoast Science Center, designed by Gwynna Smith [panel exhibit designed for the general public and school children in particular].

All Hands Employed–An Alliance of the Past and Present for the Future of the Fisheries, (in prep.) exhibit to be displayed at the National Archives and Records Administration, New England Regional Center, Waltham, MA, designed by Gwynna Smith [general public].

Kiosk Exhibit: Stellwagen Bank National Marine Sanctuary Gloucester Kiosk. Images and text provided to exhibit designers by GMCP (July 2006) [general public].

Conference Papers:

"Offshore Technology Changes and Their Impacts on Inshore Species around Cape Cod, 1860-1895," Oceans Past Conference, Kolding, Denmark (M. MacKenzie, Sea Education Association), Oct 2005.

"Changing Ocean Policy in the 21st Century: can we learn from our history?" Oceans Past Conference, Kolding, Denmark (A.A. Rosenberg) Oct 2005.

"GIS Mapping and Spatial Analysis of Historical Fisheries Data" Oceans Past Conference, Kolding Denmark (S. Claesson) Oct 2005.

"New England Harvesters and Marine Ecology in the Gulf of Maine, 1850–1880," Oceans Past Conference, Kolding, Denmark (W.J. Bolster) Oct 2005.

"Subsidies and Economies of Scale in the 19th-Century New England Cod Fishery," Oceans Past Conference, Kolding Denmark (A.B. Cooper and K. E. Alexander) Oct 2005.

"Opportunities in Marine Environmental History" Ministry of the Environment, Paris, France (W. J. Bolster and A. B. Cooper) Nov 2005.

"Opportunities in Marine Environmental History" (W. J. Bolster) American Society for Environmental History Annual Meeting, Madison, Wisconsin, Apr 2006.

"Speaking For the Fish" (M. G. McKenzie) American Society for Environmental History Annual Meeting, Madison, Wisconsin, Apr 2006.

"New England Harvesters and Marine Ecology in the Gulf of Maine, 1850–1880," (W. J. Bolster) Organization of American Historians, Washington DC, Apr 2006.

"So Ends This Day: Personal Records of Life at Sea from 19-Century New England Fishermen's Logs" (K. E. Alexander) Dublin Seminar of New England History and Culture, Deerfield, MA, June 2006.

"Historical Marine Ecology in the Gulf of Maine," Ministry of Culture, Paris, France (K. E. Alexander) June 2006.

5. GEOGRAPHIC EXPANSION

GMCP is collaborating with Dmitry and Julia Lajus comparing Atlantic salmon in the Gulf of Maine and the Russian North in the late 1800s and early 1900s. The comparison is interesting for several reasons.

- The Gulf of Maine is at the southern geographic range of salmon, while the White Sea is at the northern range.
- Salmon are just one of a number of anadromous fish in Gulf of Maine streams, while in Russia no other anadromous fish exists.
- Industrialization and population pressure affected salmon rivers in the US since colonial times, but in Russia such pressure has been relatively light.

These comparisons will allow us to compare climate and anthropogenic effects in the decline of Atlantic salmon. Interest in Atlantic salmon has led us to expand our study of cod in the Gulf of Maine to include the role of anadromous fish in the coastal ecosystem. Considerable interest exists around the Gulf of Maine in understanding species interactions and ecosystem functions, and how these processes have changed over time. Historical data on landings of anadromous species from Fish Commission records, cod landings from a variety of sources, and early scientific surveys can be correlated to give a much more comprehensive picture of abundance, biodiversity and complexity than we imagined could be obtained even a year ago. We are investigating the potential for a coordinated, synthetic study of the entire Gulf of Maine marine ecosystem, focusing on productivity.

6. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
Stellwagen Bank National Marine Sanctuary	Stefan Claesson	Social and Ecological History
National Science Foundation	Karen Alexander	Synergistic effects of social and ecological change
Seacoast Science Center	Gwynna Smith	Exhibit host
Avery Point Marine research Center, University of Connecticut	Matt McKenzie	Education and research
French Consulate in	Karen Alexander	Consultation on

Washington		developing marine environmental history
Island Institute, Rockland, Maine	W. B. Leavenworth	Outreach to fishing communities, education
New Hampshire Sea Grant	Karen Alexander	Gulf of Maine inshore cod catch project

b. Links to CoML Ocean Realm Projects

None.

c. Links to CoML National and Regional Implementation Committees (NRICs)

None.

d. Liaisons to CoML Cross-Cutting Groups

Project Name	Liaison Name & Institution	Nature of the Relationship
OBIS	Karen Alexander and Gwynna Smith, UNH	
FMAP	Andy Rosenberg, UNH	
SCOR Tech Panel		
E&O	Gwynna Smith, UNH	
Barcoding		

7. INPUT TO COMMUNITY DATABASE

a. Publications

Bolster, W.J. "Opportunities in Marine Environmental History," *Environmental History*. July 2006.

Leavenworth, W.B. (July 2006) "Opening Pandora's Box: Tradition, Competition and Technology on the Scotian Shelf, 1852-1860," *Studia Atlantica: Proceedings of the 7th Conference of the North Atlantic Fisheries History Association (NAFHA).*

Grasso, G. (forthcoming, January 2007) "What Appeared Limitless Plenty: The Rise and Fall of the Nineteenth-Century Atlantic Halibut Fishery" in *Environmental History*.

Bolster, W.J.; Alexander, K. E. (forthcoming, 2007) "Using Historic Records to Determine the Abundance of Cod on the Nova Scotian Shelf, 1852-1859: An interdisciplinary approach to the environmental history of the northwest Atlantic," in J.B.C. Jackson, ed., *Marine Biodiversity: Using the Past to Inform the Future* (University of Chicago Press, forthcoming).

Alexander, K.E. (forthcoming, 2007) "So Ends This Day: Personal Records of Life at Sea from 19-Century New England Fishermen's Logs," Dublin Seminar in New England History and Culture 2006 Conference proceedings).

Leavenworth, W.B. (in revision) "Fishermen, Merchants and New England's Maritime Environment, 1630-1651," submitted to *The New England Quarterly*.

Smith, G. (in prep., working title) "All Hands Employed: An Alliance of the Past and Present for the Future of the Fisheries " for *Prologue*.

Bolster, W.J.; Leavenworth, W.B.; Alexander, K.E; Smith, G., Brennan, S. (in prep., working title) "Cod Landings in the Gulf of Maine: 1861 and 2000."

Leavenworth, W.B.; Alexander, K.E; Smith, G., Brennan, S.; Claesson, S. (in prep., working title) "Spatial Fishing Patterns in the Gulf of Maine, 1852-1865."

Alexander, K.E; Leavenworth, W.B. (in prep., working title) "The Economics of Cod Fishing in Downeast Maine, 1852-1865.

Magness, K.B. (in prep., working title) "Regulation and Ecology Awareness in late 19th-Century New England."

Leavenworth, W.B.; Alexander, K.E; Smith, G.; Brennan, S.; Rains, L. (in prep., working title) "Neighbors at Work: Demographics of Fishing in 19th-Century Maine Coastal Villages"

b. Project Participants (Personnel Report)

Research Coordinator: W. B. Leavenworth

Public Outreach Coordinator: Gwynna Smith

Research Associate: Steve Brennan

Tenure Track Appointment:
Matthew G. McKenzie, Assistant Professor of American Studies, University of Connecticut, Avery Point Campus

Graduates:
Kate Magness, MS in Natural Resources awarded August, 2005. Thesis: *Development of Fishing*
Policy in the late 19th Century Gulf of Maine.

Gwynna Smith, MA in History awarded August 2005. Thesis project: *From Abundance to Aquaculture: Changes in New England's Fisheries.*

Graduate Students:
Lesley Rains, Ph.D. Candidate in History

Stefan Claesson, Ph.D. Candidate in Natural Resources

Erika Washburn, Ph.D. Candidate in Natural Resources, University of Southern Denmark and University of New Hampshire

Emily Klein, Masters Candidate in Natural Resources

John Pastori. Ph.D. Candidate in History

Catherine Marzin, Ph.D. Candidate in Natural Resources

Undergraduate Research Assistants:
Tristan Law, History

Renée Dunn, Resource Economics

Visiting Scholars:
Dmitry Lajus, Department of Ichthyology and Hydrobiology at St. Petersburg State University, Russia, Fulbright Scholar, 2006, working on collaborative topics comparing historic White and Barents Sea cod and salmon fisheries with those in the Gulf of Maine.

Julia Lajus, Department of History and Department of Marine Biology, European University of St. Petersburg, Russia, received the Breuninger Fellowship in Environmental History, German Historical Institute, to compare US and Russian Fish Commission and Fisheries Expositions in the late 19th century.

Other:
Athena Trakadas, Ph.D. Candidate in Marine Archaeology, University of Southhampton, UK

HMAP: South West African Shelf Region

Progress Report for July 2005-July 2006

PI: Prof Charles Griffiths
Zoology Department, University of Cape Town, Rondebosch 7700, South Africa.
Phone: (27) 21-6503610 FAX: (27) 21-6503301 E-mail: clgriff@pop.uct.ac.za

CO-PI(s) no current Co-PI, manager or outreach officer

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

The first phase of the South West African shelf programme was initiated by Lance Van Sittert and later included Charles Griffiths and other co-workers. The initial aim was to describe the impacts of human activities on the Benguela ecosystem 1790- 2000. This phase ended at the end of 2002 and resulted in a series of papers (reported on earlier) and culminating in a major review of the history of the Benguela (Griffiths et al. 2004), published in Oceanography and Marine Biology, an Annual Review. Van Sittert then left the project, while Griffiths applied for a small ($10 000) additional grant to undertake Ecopath with Ecosim models of the trophic structure of the Benguela at various times in the past.

This grant was awarded in 2004 and a student appointed. Unfortunately though, this appointee proved unsuitable and left at the end of 2004, without making significant progress (but also fortunately without incurring many expenses against the budget). The project was then re-initiated in 2005 with a new student, Kate Watermeyer. The HMAP programme in this region thus currently involves just a single PI and one master's student (together with her co-supervisor, Dr Lynne Shannon).

Because of differences in both structure and history, it has been decided to develop separate ecosystem models of the Northern and Southern Benguela and to model these as they were in each of the epochs described by Griffiths et al. (2004) – the aboriginal (pre-1652), pre-industrial (1652-1910), industrial (1910-1775) and post-industrial (1975-) periods. At this point the models have been constructed for each of these epochs and comparisons between epochs and regions are being completed and model outputs examined.

The scheduled date of completion for the project remains the end of 2006 and the projected outputs are a master's thesis and two publications – one each on the Northern and Southern Benguela. It appears that these objectives are still on course and we expect them to be completed on time and within budget.

There have been no additional publications during 2005-6 that were specifically funded by HMAP, but the following historical publication by the PI is pertinent to the topic:

Kruger N, Branch GM, Griffiths CL, Field JG 2005. Changes in the benthos of Saldanha Bay, South Africa between the 1960s and 2001: an analysis based on dredge samples. Afr. J. Mar. Sci. 27:471-477.
Two conference presentations were also given at the 12 th South African Marine Sciences Symposium July 2005:
Watermeyer K, Shannon L Griffiths C Reconstructing the Benguela Ecosystem before man and at the Oceans Past meeting in October 2005:

Watermeyer K and Griffiths CL Ecopath models of the Benguela in eras past

Future funding requirements:
We do not anticipate making further funding application against the normal HMAP budget, but will be applying for funding from the proposed NaGISA/HMAP near-shore biodiversity history project in 2007. The proposed project will re-survey sites around the South African coast that were described in detail by Stephenson and Day in the 1930s.

Support form outside funders:
No additional support for this project was obtained in 2005-6 although bursary and running support was earlier obtained (2003-4) for the masters student Natasha Kruger (see paper listed above) from the South African National Research Foundation to the amount of about $10 000.

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

Our review of human impacts on the Benguela has been widely requested and cited and remains the best 'one stop' resource for literature references on this system (over 1000 references are cited). This is also the only resource that examines the combined effects of all human impacts (fishing, invasive species, pollution, mining etc).

3. WORK PLANNED FOR 2007

It is hope to complete the present study in 2006 and no new work on that project is projected. If funding is awarded for the NaGISA/HMAP nearshore history project a masters of PhD student will be appointed to carry out these surveys in 2007 and this will involve field surveys around the coast. Data collected will be entered in OBIS.

4. EDUCATION & OUTREACH

None other than conference presentations listed above

5. GEOGRAPHIC EXPANSION

No expansion envisaged

6. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
Marine and Coastal Management (South African Government)	Dr Lynne Shannon	Co-supervisor student
South African National Research Foundation	Renee le Roux	Co-funding students
University Of Cape Town	-	Pays salary PI

b. Links to CoML Ocean Realm Projects

Project Name	Liaison or Cross-over personnel	Nature of Relationship
NaGISA	Robin Rigby	Future research collaboration

c. Links to CoML National and Regional Implementation Committees (NRICs)

NRIC	Liaison or Cross-over personnel	Nature of Relationship
Australia		
Canada		
Caribbean	Patricia Milosovitch	Shared workshop in Kenya
China		
Europe		
Indian Ocean	Mohideen Wafer	Collaboration, data sharing
Japan		
South America		
Sub-Saharan Africa	Charles Griffiths	Also act as chair of this NRIC
USA		

d. Liaisons to CoML Cross-Cutting Groups

Project Name	Liaison Name & Institution	Nature of the Relationship
OBIS	Marten Grundlingh	Submission of data
FMAP		
SCOR Tech Panel		
E&O		
Barcoding		

History of Marine Animal Populations in South East Asia

Malcolm Tull
Murdoch Business School and Asia Research Centre, Murdoch University,
Western Australia 6150
Phone: (618) 9360 2481 Fax: (618) 9310 5004
Email: m.tull@murdoch.edu.au

1. WORK COMPLETED

Nil as the South East Asia component was approved only in 2006.

2. WORK PLANNED

Currently, there are three case studies underway in this area:

- Historical whaling in the Philippines (Jo Marie V. Acebes, Oxford University)
- The Evolution and Development of the Taiwanese offshore tuna fishery (Henry Chen, Murdoch University)
- Shark fishing in Indonesia (Malcolm Tull, Murdoch University)

3. RELATED RESEARCH

Doctoral Thesis

The following thesis jointly supervised by Professor James Warren and Associate Professor Malcolm Tull, is due for submission in 2006:

Ta- Yuan (Henry) Chen, 'Taiwanese Offshore (Distant Water) Fisheries in Southeast Asia, 1937-1977'.

Working Papers

M. Tull and S. Vieira, 'Potential impacts of management measures on artisanal fishers in Indonesian shark and ray fisheries: a case study of Cilacap', Asia Research Centre, Murdoch University, Working Paper 127, December 2005.

Report input from HMAP Mediterranean and Black Sea

Black Sea subproject

Coordinator:
Tønnes Bekker-Nielsen
senior lecturer, dr.phil., Dept. of history, University of Southern Denmark at Esbjerg,
tonnes@hist.sdu.dk

Report by Tønnes Bekker-Nielsen and Inge Enghoff

1. 2006 ACCOMPLISHMENTS & SCIENTIFIC HIGHLIGHTS

Mapping the faunal history of the Black Sea by means of core samples from the anoxic layers: a pilot project

As is well known, the Black Sea contains the largest anoxic body of water on the planet, stretching from c. 150 metres downwards to the maximum depth at > 2.000 metres, providing an exceptional environment for the preservation of organic material, including fish remains. The question is whether core samples taken with conventional techniques can be expected to provide identifiable fish remains, and whether these will permit detailed qualitative (species) and quantitative (relative frequency) analyses of the marine population.

A feasibility study was undertaken in the first half of 2006. In February, a workshop was held at the University of Southern Denmark, Kolding, with participation from the USD, the Danish Fisheries Research Institute, The Danish Museum of Natural History and the Middle East Technical University, to discuss the potential of core seabed sampling in the Black Sea. It was decided to proceed with a pilot study of seabed sediment cores taken in 1992 and kept at the METU Institute of Marine Sciences. Inge Enghoff of the Natural History Museum, Copenhagen visited METU and examined these cores in detail. Her report is appended below.

Background

At the Institute of Marine Sciences, Middle East Technical University, Erdemli, Turkey (METU), 6 sediment cores from the Black Sea are deposited. The cores were collected by Turkish Petroleum Company and British Petroleum in 1992 by using a 7 m long gravity core sampler with a diameter of 14.8 cm. The cores were taken in an area roughly corresponding to the central Black Sea basin (between the N and S coasts). The westernmost core was taken approximately in the middle of the Black Sea, the other five more to the east (Fig. 1).

Material and methods

All sediment cores have been dried. Their diameter is 14,8 cm, and they have been divided into 1 m sections which are numbered consecutively as “section 1-2”, “section 3-4” etc.

According to V. Ediger, who has counted the layers in the columns (varve chronology), the best columns are ALF 0004 and GIR 014. The columns contain layers dominated by coccoliths (“coccolith varve layers”) as well as “sapropel varve layers”. In coccolith layers for instance, one year corresponds to a band with white coccolith deposits plus a band with

gray ferrigenic deposits. In sapropel layers, one year corresponds to a dark organic reach layer plus a band with grey-coloured ferrigenic deposits.

On this basis it has been documented that the columns cover a sequence of more than 6000 years, i.e., they reach back to before the time when the sea broke through the Bosporus strait.

Fig. 2 shows the general composition of the columns. Column ALF 004, which is the one on which V. Ediger has been working, includes a marine sequence reaching back to before the sea broke through the Bosporus strait. Column GIR 014 contains a longer sequence of the freshwater stage from before the marine breakthrough through the Bosporus.

During a three day visit to the Institute of Marine Sciences, METU, four approaches to fish bone studies of the columns were made. The chosen methods were in part dictated by the fact that all cores have been dried, the sediment being therefore very hard.

1. V. Ediger had on beforehand, selected a number of sediment blocks which were checked for fish remains.
2. Along the length of column ALF 004, a metal spatula was inserted into cracks in order to cleave the column. Hard sediments have a tendency to be cleaved in places where there are inclusions, and several fish remains were found this way.
3. A few samples from the sapropel layer were soaked overnight. The following day the samples had become leatherlike and could be “leaved through” almost like a book. This approach also revealed fish remains.
4. A number of randomly selected samples, mainly from the freshwater layers of column GIR 014, were sieved in order to look for fish remains which had so far not been found in the freshwater sediments. (Labels were inserted into the column to indicate where the samples were taken.) A piece of sediment was placed on a 0.125 mm mesh sieve and water was added to dissolve the sediment. Thereafter the sample was manually shaken under a gentle water jet until the sediment was completely dissolved, all components smaller than the mesh had been flushed out and all larger components remained on the sieve for easy inspection. However, no fish remains were found this way.

All types of samples were examined through a binocular microscope equipped with an ocular micrometer. All fish remains found are very well-preserved. Most were photographed with a digital camera (Nikon) mounted on the microscope. Pencil sketches of some of the bones were made as well.

The recovered fish remains

1. Sediment blocks selected by V. Ediger

Table 1 shows the results. The find of pipefish (*Syngnathus schmidtii)* are noteworthy, see also below. The sample contained an almost complete individual with only the tip of the tail missing, In addition heads of a further two individuals were present, one of which even as the right and left halves separately. This sample is dated to 225 years BP.
Inserting a spatula in several places along the column in question (BC 36) revealed further three groups of fish remains including several pipefish bones not mentioned elsewhere in this report.

2+3. Samples from the sapropel layers of column ALF 004

Sample 1, column section 7-8, (ALF004-1): dated to 3665 years BP
This sample was brought to Copenhagen for further analysis. It contained three assemblages of fish bones:

1. Cleithrum (shoulder bone) and vertebra of a clupeid fish.
2. A number of fishbones in a small, compact group, see Fig. 3<foto. A preliminary identification shows that two species are represented, viz.,sprat, *Sprattus sprattus* (vertebrae and prooticum (bone from neurocranium)) and anchovy, *Engraulis encrasicholus* (vertebrae, operculum (gill cover bone) and hyomandibulare). In addition there are several scales from clupeid fishes which have not been more accurately identified.
3. A larger assemblage of very small bones from juvenile clupeiform fishes (not anchovy), see Fig. 4.

Sample 2, column section 7-8, (ALF004-2): dated to 4330 yrs BP
An oblong rounded lump surrounded by a membrane including a substance of highly fragmented fishbones /too small for identification). Maybe an excrement from a large fish? See Fig 5.

Sample 3, column section 7-8 (ALF004-3): dated to 2420 yrs BP
A piece of a pipefish, bones/impressions on both sides of the cleavage. See further below.

Sample 4, column section 5-6, (ALF004-4): dated to 2170 yrs BP
Bones of a juvenile clupeid fish with a piece of the vertebral column preserved, see Fig. 6.

Sample 5, column section (ALF004-5): dated to 2250 years BP
An entire pipefish, bones/impressions of the fish in its full length on both sides of the cleavage. On one half the tip of the mouth as well as the fin rays in the tail are preserved. See further below.

4. Samples from the freshwater layers of column GIR 014

Eleven samples were taken at various levels of the freshwater layers but unfortunately no fish remains were found. It cannot, of course, be excluded that this negative result is due to the random selection of samples. (In one of the samples (sample C) a small insect nymph was found, probably a mayfly (Ephemeroptera).

The finds of pipefish, *Syngnathus schmidti*

A remarkable result of this pilot study is constituted by the several individuals of pipefish. Due to the exceptionally fine state of preservation it has been possible to identify these specimens to species, viz. *Syngnaths schmidti* Popov, 1927, using the keys and illustrations in Whitehead et al. (1986).

Syngnathus schmidti is known only from the Black Sea and the Sea of Azov, i.e., it is a Black Sea and Sea of Azov endemic. It is a pelagic species living in fresh or brackish water on depths from 0 to 100 m. It mainly feeds on copepods (“water fleas”) (Fishbase, Whitehead et al. 1986).

The nearly entire specimen from coccolith layer BC36

total length of preserved fragment	ca. 4 cm

length of head from posterior margin of neurocranium to tip of mouth	12.1 mm
diameter of eye	2.1 mm
distance from anterior margin of eye to tip of mouth	6.5 mm
length of “snout” from anterior margin of neurocranium to tip of mouth	5.6 mm

The entire specimen from section 5-6, column ALF 004

See Fig. 7.

total length of preserved fragment	7.4 cm
distance from posterior margin of eye socket to tip of mouth	11.3 mm
length of head from posterior margin of neurocranium to tip of mouth	14.5 mm
diameter of eye	1.6 mm
distance from anterior margin of eye to tip of mouth	8.9 mm
height of “snout”	1.1 mm

The number of vertebrae was counted four times, each time with a slightly different result (n = 53, 54, 55, 57). An accurate count is hampered by the absence of some vertebra and the somewhat disturbed position of some others.

A recent reference skeleton of *S. schmidti* has not been available, but vertebrae etc. look quite similar to those of other *Syngnathus* species such as *S. typhle* (L., 1758).

In addition to the key characters, including the long, slender ”snout” and the characteristic large diameter of the eyes, the identification to *S. schmidti* is supported by the small size of the specimens which, nevertheless, have the appearance of mature specimens. The maximum length of *S. schmidti* is 11 cm, whereas the other Black Sea species of *Syngnathus* are much larger.

Discussion

The present pilot study was meant as a preliminary check of the fish remains contents of Black Sea sediment samples. The available columns were thus not systematically studied throughout their length, which would also have been impossible due to the dried condition of the columns and the short time available for the study. In additional, several entire sections of the coccolith layers were missing, having already been used for other purposes.

Nevertheless, the pilot study showed that a considerable number of fish bones have been preserved in the columns, as well as a few fish scales. The recovered fish remains were all found in coccolith layers or sapropel layers where conditions for preseervation of fish remains are particularly favourable. The coccolith layer has a high content of calcareous matter (coccoliths have a calcareous shell), and the sapropel layer is anoxygenic which prevent aerobic bacteria from decomposing the fish remains.

The finds of several individuals of pipefish which because of the exceptionally favourable conditions of preservation could be identified as the endemic Black Sea and Sea of Azov species *Synghathus schmidti*, constitute a unique outcome of the study. *S. schmidti* was found

in both coccolith and sapropel layers, which could be dated to 225 years BP, 2250 years BP and 2420 yrs BP respectively. This species is thus demonstrated in the Black Sea at different times covering a longer period.

In addition, bones of sprat, anchovy and unspecified juvenile clupeid fishes were found in the sapropel layers.

The anchovy is an euryhaline spicies which can tolerate 5-41 ‰ salinity. It is a coastal pelagic species; however it can descend to 150 m during winter in the Mediterranean. In the Black Sea area the anchovy is locally called “hamsi”.

The sprat is also a coastal pelagic species which can sometimes tolerates salinities as low as 4 ‰.

Summarising, the fish species so far found in the Black Sea sediment samples are pelagic and able to tolerate a wide range of salinities ranging from very salty to fresh water (euryhaline species).

Conclusion

The number of fish bones, and their scattered occurrence throughout the columns, prevents quantitative analyses such as population estimates. Nor can the fish remains by themselves form the basis of a detailed description of the development of the Black Sea over time.

Nevertheless, it is quite impressive that so many fish bones have actually been found in just one column such as ALF 004 (the best studied column), just by taking spot samples. The fish bones are exceptionally well preserved and thus lend themselves to a detailed identification. It was an especially nice surprise that entire and almost entire fish individuals have been preserved. This further facilitates identification because dimensions of the body are available for identification in addition to characters of individual bones.

The species which could be identified to species provide useful information. They provide concrete evidence of which species of fish lived in the Black Sea at the various times from where the bones derive. Through our knowledge of their particular environmental demands they further provide information about the Black Sea marine environment at the time they were deposited.

The finds of anchovy and sprat bones in layers dated to 3665 years BP in addition provide the information that these species, which nowadays are among the commercially most important fish species, were also available for the human populations around the Black Sea during this period of the past.

Systematic analyses of fresh columns, specifically collected for the purpose of fish bone analysis, without doubt will provide a much richer material of fish bones, allowing more detailed conclusions about temporal changes in fish fauna and environment, than has been possible in the present pilot study.

References

Fishbase, www.fishbase.org, accessed on 25 June 2006.

Whitehead, P.J.P., Bauchot, M.-L., Hureau, J.-L., Nielsen, J & Tortonerse, E. (eds.) 1986. Fishes of the North-eastern Atlantic and the Mediterranean, Vol. II. Unesco

Table 1. Samples selected by V. Ediger and their contents of fish remains

Sample no.	Fish remains	dating
GIR 014 sapropel 79	no	4720 yrs BP
GIR 014 sapropel 80	no	4900 yrs BP
GIR 014 sapropel 82	no	5000 yrs BP
GIR 014 sapropel 83	no	5300 yrs BP
GIR 014 sapropel 84	no	5420 yrs BP
GIR 014 sapropel 84	no	5560 yrs BP
GIR 014 aragonit 8AD	no	5660 yrs BP
ALF 004 38A	no	1630 yrs BP
ALF 004 sapropel 49	no	2170 yrs BP
ALF 004 sapropel 57	unidentified fish bones	2460 yrs BP
ALF 004 sapropel 63	no	2850 yrs BP
ALF 004 sapropel 67	no	4850 yrs BP
ALF 004 sappropel 69	no	5010 yrs BP
ALF 004 sappropel 70	no	5190 yrs BP
BC 36 Black Sea B	no	32 yrs BP
BC 36 Black Sea D	no	437 yrs BP
BC 36 Black Sea E	no	635 yrs BP
BC 36 Black Sea F	no	819 yrs BP
BC 36 coccolith layer	several specimens of pipefish*	225 yrs BP

Fig. 1. Location of the core samples.

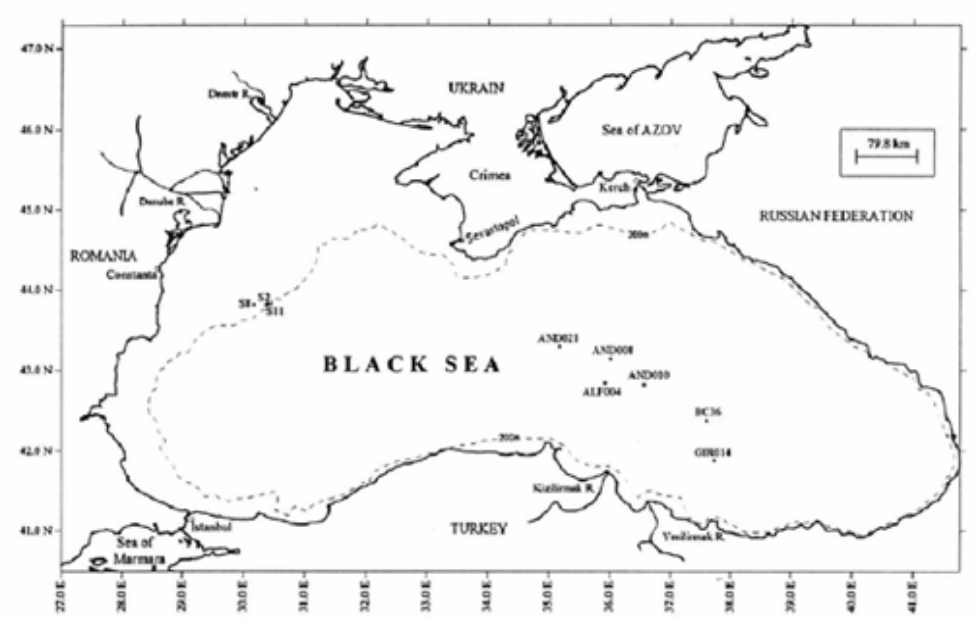


Figure 1. Locations of the cores.

Figure 2. General structure of the studied Black Sea sediment cores.

Unit 1	Coccolith varve layers 0-1610 years BP	Brackishwater conditions
TZ	Transition zone 1619-1710 years BP	
Unit 2	Sapropel varve layers 1710-5660 years BP	
	5660 years BP	
Unit 3	Turbidite layers Older than 5660 years BP	Freshwater conditions

2. SOCIETAL BENEFITS, IMPACT & APPLICATIONS

Since the transition from a freshwater to a saline environment is recent (< 8.000 yrs BP) and its stages well documented, and since the seabed deposits are varved, making it possible to count the years, the Black Sea offers a unique chance of tracing the faunal history of a major sea literally year by year, identifying the effects of climatic change, rising salinity and invasive species. Given the limited number of species in the Black Sea even today and that until c. 150 years BP new species could only enter the Black Sea by way of the Thracian Bosporus, the preconditions for reconstructing the ecosystem dynamics of the Black Sea are also unusually favourable.

3. WORK PLANNED FOR 2007

Sediment cores from the southern Black Sea

The work of Inge Enghoff on the six cores at METU has shown that a) fish remains are well preserved in sediment cores, b) for a more detailed study, dried cores will not suffice. A full-scale project will need to base itself on virgin cores taken for the purpose of fish bone analysis. This would also make it possibly to apply more sophisticated analytical techniques such as DNA analysis.

The proposed methodology will be further refined and discussed at the HMAP workshop in Chioggia, Italy, 27-29 September 2006. Coring will be organized by the Turkish partners, but

the archaeoicthyological analysis requires access to a comprehensive reference collection. There is no such collection in Turkey but suitable reference collections are found in Copenhagen and Madrid. The analysis could be done by either Inge Enghoff or Arturo Morales, both leading specialists in the field.

The total cost estimate for coring, analysis and database compilation is 40,000 USD. Assuming that funding is available and that research vessels and labs are not committed to other projects, coring could commence in early 2007 and results be available online by late 2007 or early 2008.

Documentary sources for the northern Black Sea

This consists of two subprojects.

A. Ruthy Gertwagen (University of Haifa) will survey Genoese archives for documentary evidence for fishing and fish exports from the Genoese trading settlements in the Crimea, as a pilot project for a possible data mining exercise.

B. A study of documentary sources for freshwater fishing in the northern tributaries of the Black Sea: '*Sturgeon in the Don River 17th-18th c., Kuban and shoaling waters 18th-19th c.*'.

The project will provide the following deliverables:

(1)Research report, together with the created databases. (December 2007);

(2)Database of research results formatted according to the HMAP Hull database template (December 2007)

4. PARTNERSHIPS & COLLABORATION

a. Partnerships

Organization Name	Point-of-Contact (Name)	Nature of Relationship
Danish Black Sea Centre	Pia Guldager Bilde	

b. Links to CoML Ocean Realm Projects

None to report.

c. Links to CoML National and Regional Implementation Committees (NRICs)

None to report.

d. Liaisons to CoML Cross-Cutting Groups

None to report.

History of Marine Animal Populations – Catalan Sea

Survey and retrieval of fishing effort and landings data from the Catalan Sea (1900-2004)

Alfons Garrido
Joan Lluís Alegret
GESPM – Universitat de Girona

Isabel Palomera
Francesc Maynou
Marta Coll
CMIMA – ICM Barcelona, CSIC

Presentation

The experience acquired by GESPM working on the history of fishing in the north-eastern coast of the Mediterranean - coast of Catalonia - has revealed two very important questions related to the study of the marine ecosystem in the past and the history of our fishing industry. In one hand, it showed that to have reliable and relevant data in quantitative and qualitative terms, it is necessary to develop hypothesis and to draw conclusions about long-term evolution of marine environment, presence and abundance of certain species or evolution of fishing in Catalonia. In second terms, the ignorance generalized on the existence, location, characteristics and usability of primary sources susceptible to be useful to the investigator, and the difficulties that are involved when working with them, must be taken into account in relation with their relevance and reliability.

In the HMAP workshop held in Barcelona on September 2004 GESPM presented a brief report about the existence and main characteristics of primary and secondary sources that contains historical data relating fish landing and fishing effort from the antiquity to the present time that would be present in regional and local archives and libraries. In that report, GESPM gave a list of possible interdisciplinary guidelines to researchers who don't know well the potentialities of the archives sources or didn't had used them yet. GESPM also offered itself to apply its knowledge and skills to locate data sources, to define characteristics and to identify potential problems of interpretation of those sources.

Since the HMAP workshop the historians of GESPM have been worked in close interdisciplinary cooperation with ICM-CMIMA biologists in recuperation of quantitative data. We had considering different possibilities during the first stage of the project, but finally we have believed necessary and useful to concentrate the efforts to recover and work with historical data relating to Catalonian Sea that are contained in official fishing statistical yearbooks since 1831 to present times. Potentialities and reliability of these sources were not well known yet but they were thought to be very important.

Summary of project activities

HMAP Mediterranean – Catalan Sea Project established a working scheme that was divided in different stage.

The first stage has carried out by GESPM and it has been centred in the location, study, characterization and digitalization of all the official fishing yearbooks published in Spanish

during XIX and XX centuries. During the same one, it was necessary to look for in numerous holdings and documentary collections of diverse university libraries of Catalonia (UAB, UB, UPF, UPC). The possibility of working in this phase with rough copy or not published official statistics, conserved in the Marine Archive (Ciudad Real) and General Government Archive (Madrid), was rule out given the economic and temporary limitations of the project.

In a second stage, once located and digitized all the yearbooks, a database in MSAccess, adapted to the characteristics of the statistics, its structure and nature of the data, was designed in terms of catches, fishing effort, economic value and demography of the sector. This database required to be able to contain data gathered in different places and presented/displayed with diverse degrees of aggregation, considering geographic scale, fishing effort or catch species.

During the third stage, all registries in the yearbooks were introduced in the database. Altogether 38.014 registries are entered, ,corresponding to years 1831, 1868, 1892, 1907-1918, 1920, 1929, 1932-1932-1934, 1940-1941 and 1943-1984. For the rest of years between both extreme values published data did not exist and the introduction was not viable given the character of data because aggregation.

Finally the database has been adapted to the criteria determined for its publication by the equipment of the HMAP with seat in the University of Hull, and according to the guidelines established for its later publication in the databases OBIS and Darwin Core, including in the Census of Marine Life.

In the present, and in co-operation with ICM-CMIMA biologists, data is being gathered to plan future applications in reconstruction of marine ecosystems using ecological models and developing temporal simulations and model comparisons. This has the aim to reconstruct pass situations of the exploited ecosystem and to evaluate ecosystem changes through the last century by comparing past situations with the present one.

Preliminary conclusions regarding data collection

Like any source of historical character, results cannot be used of acritical form, but previously the sources must be put under the textual and documental criticism to establish with clarity their utility and reliability. The familiarisation with the official statistics and their study in depth has allowed us to make some characteristic judgments and to establish some surroundings to diverse parameters that are of vital importance for their use in the later phase of modelization.

In the first place, the bibliography that has referred to the yearbooks evidences the inaccuracy of the data contained in the them at least for aims of XIX and the principles of XX century. Data collection over time, underreporting and inefficient institutional organization didn’t allow to obtain data with enough quality to fulfil a minimum level in terms of reliability and exactitude. People in charge of their edition indicated that the data contained in the yearbooks were "*not only defective and erroneous, but that as a rule useless by its lack of uniformity and not to come accompanied from scientific observations, does not need to demonstrate it*" (Central Commission of Fishing, 1885). It is also said that in relation to the period 1904-1920, "*the data of those statistics were false*" (Odón de Buen, 1929).

As the institutional organization became more complex, the reliability of the data contained in the yearbooks improved sensibly, in spite of a progressive reduction, mainly as of the

decade of the 1960, of the species recorded (being only identified those of greater commercial importance). For this reason it is possible to conclude that the reliability of the information passed from a null or low level to a high or very high level. However, the level of complexity and disaggregation has passed trough different stages over time, although in the last years the level is low.

Secondly, a detailed study of the yearbooks revealed that in many occasions data had been adulterated so that they are directly copied in successive years, falsifying the annual stages and generating alterations in the final results. This can be observed during the first yearbooks of XX century.

In another hand, numerous changes in the collecting methods, edition and publishing of statistical table impeded to use the information included and to build large and complete series of disaggregate data by harbours, delegations, regions o species before 1940. Methods used to publish the data of fishing effort and catches and the different levels of disaggregation didn't allow to directly calculating CPUE.

Finally, given the own nature of the sector and its agents, it is evident that altogether the data of effort and catches are underestimated in a percentage unknown for us. The configuration of the fishing sector previous to the industrialization of the fleet and its concentration in certain ports around 1910-1920 made enormously difficult the systematic and exhaustive collection of catch results. Yearbooks only gathered data of landings of those ports in which civil employees of the state were in charge of their harvesting. For this reason data from infinity of small coves and moved away beaches of the administrative centres were neglected, of which scarcely no information would have taken shelter. We also need to take into account the concealment of a part of the catches on the part of the fishermen or the falsification of its testimonies. All this makes us to think to what extent absolute values gathered in the statistics are trustworthy and similar to the Catalan Sea fishing reality of the first half of the XX Century .

Data from more recent time regarding catches and effort, although are more real, are also underestimated due to a proportion of the catches do not happen through the official channels of commercialization - direct sale, ration for the fisherman - and to the breach of the prohibition of limitation of the power of the boats, mainly in the sub sector of trawl. These dysfunctions cannot be entered either in percentages.