



HMAP Dataset 4 World Whaling

Supporting Documentation





Summary

Dataset Title:	World Whaling
HMAP Case Study:	World Whaling
Large Marine Ecosystem:	n/a
Subject:	Whale catches and effort, worldwide, 1700-2000
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Extent:	66,014 records
Keywords:	whaling statistics; History of Marine Animal Populations; whaling technology; whale oil; whaling logbooks

Citation

(a) The dataset: please cite as follows: T.D. Smith ed. 'World Whaling Database: Individual Whale Catches, North Atlantic' in M.G Barnard & J.H Nicholls (comp.) *HMAP Data Pages* (www.hull.ac.uk/hmap)

(b) Supporting documentation: please cite as follows: T.D. Smith, 'HMAP Dataset 4: World Whaling, Supporting Documentation', in M.G Barnard & J.H Nicholls (comp.) *HMAP Data Pages* (www.hull.ac.uk/hmap)

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Contents

	<i>Page</i>
1. HMAP World Whaling: Objectives	1-2
2. World Whaling Database: Scope and Sources	3
3. Methodology	
(a) <i>individual whale records</i>	3
(b) <i>tabulated totals</i>	3
(c) <i>inferred totals</i>	4
4. Individual Whale Data	
(a) <i>IWC coding of BIWS catch records</i>	4
(b) <i>accuracy and reliability</i>	5
5. Outputs	5-6

1. HMAP World Whaling: Objectives

The overall goals of the World Whaling project are to:

- exploit the wealth of information in whaling logbooks for scientific and historical understanding of the distribution and abundance of marine animals, principally cetaceans;
- increase knowledge of cetacean distribution and catches;
- assess the effects of whaling on cetacean populations and oceanic ecosystems by integrating catch (removal) estimates with estimates of present-day abundance and population dynamics;
- present this new knowledge about whaling and whale populations to the public as well as to scientists and historians.

In attaining these goals, the project has made progress towards meeting four specific objectives in the following respects

1. *Map the geographic distribution and relative density of whales from the 18th to the early 20th centuries.*

Logbook data were used to prepare spatial distribution maps of mid-ocean summer feeding distribution and migrations of three species. For humpback and blue whales in the North Atlantic, we documented seasonal mid-ocean occurrence or migration patterns and for humpbacks suggested the possible existence of previously unknown mid-ocean feeding areas. For right whales in the North Atlantic, we demonstrated that a summer mid-ocean area of right whale concentration suggested on a map prepared from whaling logbooks in the 1850s was not supported by the original data sources and was likely the result of data handling errors.

2. *Estimate the numbers of sperm (and other) whales taken at spatial scales of ocean basins and finer.*

Our review of the history of right whaling in the North Atlantic from 1000 AD to the 20th century has suggested the existence of a previously unrecognized summering ground for North Atlantic right whales, and has provided an estimated a lower bound of the total catches from the western North Atlantic since 1660 of roughly 5,000 animals. Historical records revealed that 16th and 17th century European whalers congregated seasonally in the coastal Loppa Sea off North Norway (70°20' N 21°30' E). This was exactly the area where a uniquely marked right whale known from the western North Atlantic was observed to travel to during the summer a few years back. The historical observation and the present data sighting taken together suggest a possible summering location for a portion of the remnant right whale population that researchers have sought for several years.

We developed estimates of global sperm whale catches in the 18th and 19th centuries using two methods. One method is based on sperm oil marketing



records, and we developed improved estimates, albeit ones that do not include measures of statistical precision. The second method is based on sperm whale catches per voyage (from our samples of whaling logbooks) and total numbers of voyages. Preliminary estimates using the second method are broadly consistent with those using the first method, but have two advantages. One is that they include measures of statistical precision and the second is that they can be made for specific ocean areas.

3. Describe changes in relative density of whales in response to exploitation.

Published sources on the spatial distribution of sperm whaling effort were reviewed and used to define more than 60 whaling grounds. Characteristics of these grounds have been described, including the strong degree of clustering and changes in the intensity of whaling activity over time. In addition, we are now exploring differences in bottom topography that may relate to this clustering.

Further, we have identified that most 20th century whaling for sperm whales occurred outside of the 19th century grounds, primarily further poleward in both hemispheres where males predominate. We have developed a hypothesis that the biological impact of 19th century whaling on sperm whales was greater than previously thought because it focused on female and immature males that predominate in the lower latitudes, essentially allowing males a refugia.

4. Develop biological and ecological material suitable for Internet websites to complement the more historical and descriptive information generally provided on whaling museum and library websites.

Much of the statistical material we have collected has been uploaded onto the HMAP Data Pages.

The following individuals have participated in this work:

Tim Smith, USA
Randall Reeves, Okapi Wildlife Associates, Hudson, Quebec, Canada
Elizabeth Josephson, Northeast Fisheries Science Center, Woods Hole, MA, USA
Nathan Pierce, Northeast Fisheries Science Center, Woods Hole, MA, USA
Cherry Allison, International Whaling Commission, Cambridge, UK
John Bannister, Western Australian Museum, Perth, AU
Peter Best, South African Museum, Cape Town, SA
Judith Lund, New Bedford Whaling Museum, New Bedford, MA, USA

2. World Whaling Database: Scope and Sources

The World Whaling Database will ultimately include geo-referenced information on all whaling worldwide. There are several sources of data that are being used to assemble this information, and the data from the various sources varies in its completeness, form and reliability. The most complete are the individual animal data records compiled primarily during the 20th century. These were tabulated by the Bureau of International Whaling Statistics (BIWS) from reports from whaling operations. The BIWS also compiled lists of other landings albeit at varying levels of detail, frequently annual totals by different fishing operations. In addition, especially before the 20th century, various commercial statistics provide information on whale products entering into trade that in conjunction with more detailed records frequently available can be used to infer numbers or biomass of whales landed. One example is the barrels of whale oil returned by specific voyages, as in the Yankee whaling operations from the mid-18th century through the early 20th century, where the yield of oil per whale can often be inferred from analysis of voyage logbooks.

3. Methodology

The three levels of data, *individual whale records*, *tabulated totals*, and *inferred totals*, provide a wealth of information on the levels and importance of whaling operations over previous centuries. It is our intention to assemble such data as have been recorded or inferred for specific whaling operations, and to undertake additional analyses to infer totals from other whaling operations. The level of geographic detail varies among the sources, and procedures for summarizing data from all sources into common geographic and temporal frames are being developed.

(a) *Individual Whale Records*

We plan to complete the databases using three complementary approaches. First in collaboration with the International Whaling Commission we are assembling the individual whale records from the 20th century, with initial emphasis up to the IWC Moratorium on commercial whaling that was fully implemented in 1987. The IWC has been assembling the *individual animal records* originally compiled by the BIWS, including entering these data in more modern and accessible data formats and validating the accuracy of both their own work and that of the BIWS. These are being entered into the HMAP World Whaling Database by ocean region (see below).

(b) *Tabulated Totals*

In collaboration with the IWC, we are assembling *tabulated total* whale landings that were originally recorded for individual whaling operations where individual whale data are no longer extant. These are being drawn from a number of sources, including the BIWS records and various published scientific papers and reports. These data have been assembled by the IWC and other experts.

(c) *Inferred Totals*

We are undertaking analyses of other historic whaling operations in an attempt to *infer total* whale landings. The methodology for such inferences was clarified in 1979 during a workshop on historical whaling records sponsored by the International Whaling Commission, and further extended in recent studies of humpback whaling in the North Atlantic, the Atlantic Arctic bowhead whaling, and the gray whaling in the eastern Pacific. The basic approach for many fisheries is the transformation of commercial landing statistics to numbers of whales using individual whale data from voyage logbooks. In addition, methods have been developed for using information on the duration of whaling operations and average catch rates to infer landings when more direct data is lacking. An important factor that is accounted for is the animals struck but not landed.

4. Individual Whale Data

With regard to the HMAP Data Pages, the World Whaling searchable facility comprises individual whale data. This database was created from datafiles created by the International Whaling Commission, in Cambridge England, based on original coding by the Bureau of International Whaling Statistics, now defunct, but previously located in the Kommandør Chr. Christensens Hvalfangstmuseum in Sandefjord, Norway, which holds the data from the BIWS. Another major source of data for the period 1913-1950 is S.F.Harmer's records held at the Natural History Museum in London.

(a) *IWC coding of individual BIWS catch records*

In addition to the catch data provided in the records supplied to the Bureau of International Whaling Statistics (BIWS), there is also additional information which has been extracted from the infractions reports covering, in particular, lactating and lost whales. The data comprise one record for each whale caught, giving the date and position of capture, length and sex of the whale and any foetuses, the stomach contents if known, and a code for the catching expedition and nation. There are also text records, some providing general information about the catching expedition and others with extra information about particular whales. In the latter case the text will include details of any anomalies or alterations in the original catch data. Thus if there are any queries about the data, the history of any changes and the reason for the coding are an integral part of the data base.

The Bureau of International Whaling Statistics, based in Sandefjord, Norway, until 1984, has for some 50 years acted as a repository for data collected by commercial whaling operations. Summaries of these data have been published annually in authoritative reports, compiled with great care, which have formed the definitive record of modern whaling. Since 1984 the IWC has taken over the functions of the Bureau. It is worth emphasising how comprehensive the original records are. For almost all whales caught and reported to the Bureau a written record shows for each individual whale the expedition, date and position of capture, species, sex, length, the

number of foetuses and their sex and length, and (less frequently) stomach contents.

These data are recorded for approximately two million animals.

The infractions reports are forms sent to the IWC by member nations, listing any infractions including undersized (i.e. those taken below the minimum size limit), oversized or lactating whales caught. Lost whales are also listed (although they are not actually infractions). These reports have been useful in confirming the lengths of undersized whales - often if a whale was reported with a short length this had been thought to be a typographical error. Unfortunately, not all members have submitted infractions reports for every year.

(b) *accuracy and reliability*

All possible measures have been undertaken to ensure that the coding is as accurate as possible. The coding is carried out using an on-line fast data-entry program which performs extensive and rigorous checks on the feasibility of the input. The user is able to correct errors as they are detected. The data are entered twice, in two independent streams (i.e. by two people). Discrepancies between the two streams detected in a computerised comparison and then any corrections made after recourse to the original catch records. Several subsequent checks of internal consistency are also carried out. For example, the catch positions are plotted to ensure none are on land, and the data are summarised so that they may be compared with the BIWS published statistics. However, this obviously cannot correct errors in the original records.

5. Outputs

The data have been used to inform a number of analyses, including:

Reeves, R.R., E. Josephson and T.D. Smith. 2004. Putative historical occurrence of North Atlantic right whales in mid-latitude offshore waters: 'Maury's Smear' is likely apocryphal. *Marine Ecology Progress Series* 282:295-305.

Reeves, R.R., T.D. Smith, E. Josephson, P. Clapham and G. Woolmer. 2004. Historical observations of humpback and blue whales in the North Atlantic Ocean: clues to migratory routes and possibly additional feeding grounds. *Marine Mammal Science* 20(4): 774-786.

Reeves, R.R. and T.D. Smith. 2006. A Taxonomy of World Whaling: operations and eras. Pp. 82-101 *In* Estes *et al.* (Eds). *Whales, Whaling and Ocean Ecosystems*. Univ. of California Press, Berkeley.

We provide an overview of the history of whaling in the context of a multidisciplinary discussion of the effects of whaling on ocean ecosystems. This overview was in the form of a taxonomy that organizes information about 113 distinct whaling operations into 11 *whaling eras*. We have used this taxonomy to organize and guide our historical studies.

Smith, T.D., and R.R. Reeves. 2006. Pre-20th century whaling: implications for management in the 21st century. pp. 119-134 *In* J.E. Ringstad. *Whaling and History II*. Publication 331, Kommandør Chr. Christensens Hvalfangstmuseum, Sandefjord, Norway.

We provide examples of the use of pre-20th century whaling data for five genera of whales in several different ocean areas to describe current population status. The genera include right,



bowhead, sperm, humpback and gray whales, and we drew from our own published work as well as the work of several others. We set these examples in the wider context of the utility of such studies.

Reeves, R.R., T.D. Smith and E.A. Josephson. 2007. Near-annihilation of a species: right whaling in the North Atlantic. Pp. 75-104 *In* S.D. Kraus and R.M. Rolland (eds.) *The Urban Whale*. Harvard U. Press, Cambridge, MA.

We provided the historical setting for this collection of invited papers documenting the historical and present status of right whales in the North Atlantic. We assembled right whale catches for the several fisheries and estimated the total removals from the western North Atlantic from the relentless assault on this species since the first millennium.

Smith, T.D, K. Bartlemess and R.R. Reeves. 2006. Using historical records to relocate a long forgotten summer feeding ground of the North Atlantic right whales. *Marine Mammal Science* 22:732-734.

Based on a seemingly anomalous sighting in northern Norway of a right whale previously known only in the western North Atlantic, we brought to light overlooked information on historical right whaling in northern Norway. We suggested that the movement of that animal across the North Atlantic may provide insights on the historical distribution of this species.

Punt, A., Friday, N. and Smith, T.D. 2007. Reconciling data on the trends and abundance of North Atlantic humpback whales within a population modeling framework. *Journal of Cetacean Research and Management* 8:145-160.

Here we reconsidered the failure of an attempted assessment of North Atlantic humpbacks by the International Whaling Commission's Scientific Committee. We evaluated alternate models and data sets and identified an apparent inconsistency between the estimate of abundance for one feeding ground and estimates of population mixing on feeding grounds. We were unable to resolve this inconsistency using different combinations of data sets and different population models, but were able to identify topics of needed research implied by the modeling framework.