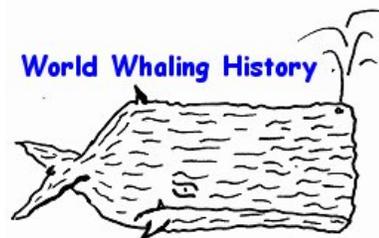


Smith, T.D. 2007. Progress towards an In-Depth Assessment of sperm whales. IWC Scientific Committee, Document SC/59/IA23, Cambridge, England.

**A contribution by the
World Whaling History project**



World Whaling History Project

People have been whaling for at least a millennium, pursuing all kinds of whales in all parts of the world. While many aspects of the history of whaling have been described in great detail, the history of the effects of whaling on the whales themselves has not received sufficient attention. The World Whaling History project is focused on describing the effects that whaling has had on populations of whales over the centuries and throughout the world's oceans.

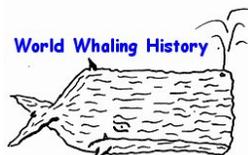
World Whaling History (www.WorldWhalingHistory.org) began in 2001 as part of the History of Marine Animal Populations (HMAP) project (www.HmapComl.org), which is itself part of the much larger Census of Marine Life (CoML) (www.CoML.org). Researchers associated with World Whaling History have produced a number of scientific and historical documents based on historical data that we have collected, drawing in most cases from their extensive previous experience with this field.

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Previous Contributions by World Whaling History

2002

Reeves, R.R. and , T.D. Smith. 2002. Historical catches of humpback whales in the North Atlantic Ocean: an overview of sources. *Journal of Cetacean Research and Management* 4(3): 219-234.

Smith, T.D. 2002. Examining cetacean ecology using historical fishery data. *Researches in Maritime History* 21:207-214.

Smith, T.D. (Ed.) 2002. 'World Whaling Database: Individual Whale Catches, North Atlantic' in M.G Barnard & J.H Nicholls (comp.) *HMAP Data Pages* (www.hull.ac.uk/hmap).

Smith, T.D. and R.R. Reeves. 2002. Estimating historical humpback whale removals from the North Atlantic. *Journal of Cetacean Research and Management* 4 (Suppl.): 242-255.

2003

Reeves, R.R., T. D. Smith, R. L. Webb, J. Robbins, and P. J. Clapham. 2003. Humpback and fin whaling in the Gulf of Maine from 1800-1918. *Marine Fisheries Review* 64(1):1-12.

Smith, T.D. and R.R. Reeves (eds.). 2003. Design of a Program of Research on Sperm Whale Catch History: Results of a Workshop. Available at www.WorldWhalingHistory.org.

Smith, T.D. and R.R. Reeves. 2003. Estimating historical humpback whale removals from the North Atlantic: an update. *Journal of Cetacean Research and Management* 5 (Suppl): 301-311.

Smith, T.D. and R.R. Reeves. 2003. Estimating American 19th century whaling catches of humpbacks in the West Indies and Cape Verde Islands. *Caribbean Journal of Science* 39:286-297.

2004

Allison, C. and T.D. Smith. 2004. Progress on the construction of a comprehensive database of twentieth century whaling catches. IWC Scientific Committee, Document SC/56/O 39, Cambridge, England. Available www.WorldWhalingHistory.org.

- Bannister, J. 2004. A Study of Published Information on Pre-20th Century Whaling Grounds for Sperm Whales. Contract Report, Northeast Fisheries Science Center, Woods Hole, MA.
- Best, P.B. 2004. Estimating the landed catch of sperm whales in the nineteenth century. IWC Scientific Committee, Document SC/56/IA 5, Cambridge, England.
- Reeves, R.R., T.D. Smith and E. Josephson. 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, G. Woolmer, P. Clapham and E. Josephson. 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.
- Smith, T.D. and R.R. Reeves. 2004. Estimating whaling catch history. IWC Scientific Committee, Document SC56/O 22, Cambridge, England.
- 2005**
- Smith, T.D. and J. Link. 2005. Autopsy your dead... and living fisheries: a proposal for fisheries science, fisheries management and fisheries. *Fish and Fisheries* 6:73-87.
- Smith, T.D., R.R. Reeves, and J. Bannister (Eds.). 2005. Report of the International Cachalot Assessment Research Planning Workshop, Woods Hole, Massachusetts, 1-3 March 2005. NOAA Technical Memorandum NMFS-F/SPO-72. Available at www.WorldWhalingHistory.org.
- 2006**
- 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 (ed.), *Whaling and History II – New Perspectives*. The Whaling Museum, Sandefjord, Norway.
- Smith, T.D., K. Barthelmess and R.R. Reeves. 2006. Using historical records to relocate a long forgotten summer feeding ground of North Atlantic right whales. *Marine Mammal Science* 22(3):723-734.
- Reeves, R.R. and T.D. Smith. 2006. A taxonomy of world whaling: operations and eras. Pp. 82-101 In J.A. Estes, D.P. DeMaster, D.F. Doak, T.M. Williams, and R.L. Brownell, Jr. (Eds.), *Whales, Whaling, and Ocean Ecosystems*. University of California Press, Berkeley.
- 2007**
- Punt, A.E., N. Friday and T.D. Smith. 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.
- Reeves, R.R., T.D. Smith and E.A. Josephson. 2007. Near-annihilation of a species: right whaling in the North Atlantic. Pp. 39-74 In S.D. Kraus and R.M. Rolland (Eds.), *The Urban Whale: North Atlantic Right Whales at the Crossroads*. Harvard University Press, Cambridge, MA.
- Smith, T.D. 2007. Progress towards an In-Depth Assessment of sperm whales. IWC Scientific Committee, Document SC/59/IA23, Cambridge, England. Available at www.WorldWhalingHistory.org.
- 2008**
- Bannister, J.L., E.A. Josephson, R.R. Reeves and T.D. Smith. 2008. There she blew! Yankee sperm whaling grounds, 1760-1920. pp. 109-132 In D.J. Starkey, P. Holm and M. Barnard (Eds.), *Oceans Past: Management Insights from the History of Marine Animal Populations*. Earthscan, London.
- Josephson, E.A., T.D. Smith and R.R. Reeves. 2008. Depletion within a decade: the American 19th-century North Pacific right whale fishery. pp. 133-147 In D.J. Starkey, P. Holm and M. Barnard (Eds.), *Oceans Past: Management Insights from the History of Marine Animal Populations*. Earthscan, London.
- Smith, T.D., R.R. Reeves, E.A. Josephson, J.N. Lund and H. Whitehead. 2008. Sperm whale catches and encounter rates in the 19th and 20th centuries: an apparent paradox. pp. 149-173 In D.J. Starkey, P. Holm and M. Barnard (Eds.), *Oceans Past: Management Insights from the History of Marine Animal Populations*. Earthscan, London.
- In Press**
- Josephson, E.A., T.D. Smith and R.R. Reeves. In press. Historical distribution of right whales in the North Pacific. *Fish and Fisheries*.
- Smith, T.D. In review. Encountering Whales: How Encounter Rates Became the Basis for Managing Whaling. Invited chapter, volume to be published by the North Atlantic Marine Mammal Commission, Tromsø, Norway. Available at www.WorldWhalingHistory.org.
- Smith, T.D. and D. Pike. In review. The Enigmatic Whale: the North Atlantic Humpback. Invited chapter, volume to be published by the North Atlantic Marine Mammal Commission, Tromsø, Norway. Available at www.WorldWhalingHistory.org.

Progress toward an In-Depth Assessment of Sperm Whales

Tim D Smith

ABSTRACT

Progress towards developing information essential for the conduct of an In-Depth Assessment of sperm whales is reviewed. Progress has been made on population structure, historical catches, and survey methods. In addition, substantial information is being developed on abundance and distribution in several studies and on the potential effects of acoustic activity. Progress has been slower than might be hoped, and the timing for conducting such an assessment should be discussed further.

INTRODUCTION

There is a need to better understand the status of sperm whale populations both world wide and regionally. The IUCN is interested in completing an assessment of status on a worldwide basis (B. Taylor personal communication) and the US has revised a draft recovery plan for sperm whales (originally written by Randy Reeves) and will be circulating it soon for public comment (J. Barlow, personal communication). Although the IUCN and the US classification as endangered were based on global considerations, the need for considering the status on regional levels consistent with population structure has been discussed within both for a (B. Taylor, personal communication).

The Scientific Committee agreed in 2003 (IWC 2003, p49, IWC 2004, section 10.6.1) to pursue the possibility of conducting an In-Depth Assessment of sperm whales. In support of this interest, a workshop to review assessment-related research on sperm whales was held in Woods Hole, Massachusetts, USA, 1-3 March 2005. The results of that workshop were reviewed in 2005 (IWC 2006), based on a summary of the report of the workshop (SC/57/IA8). The report of the workshop was finalized as Smith, Reeves and Bannister (2005). Workshop participants identified many topics where additional research is needed (Table 1), with the following five having highest priority (SC/57/IA8):

- Developing provisional hypotheses about population structure;
- Obtaining information on female survival rates;
- Improving historical catch data in several ways, including spatial resolution to match hypothesized population structure; further exploring the effects of differential exploitation by sex;
- Improving methods to correct abundance survey data to account for bias;
- Refining population modelling approaches.

Subsequent to that workshop there has been progress on developing needed information. That progress is described below, first relative to these five priority topics and second relative to other topics.

PROGRESS

Developing provisional hypotheses about population structure

Mesnick, Taylor and Morin have continued the analysis of tissue samples to determine population structure in the North Pacific (S. Mesnick, personal communication). Morin et al. (2006) report on a new method of sex determination using genetic markers and Morin et al. (2007) report on the characterization of 18 new single nucleotide polymorphism (SNP) markers for sperm whales; these provide a necessary addition to the genetic tools employed for understanding population structure on a global scale. Rendell et al. (in preparation) will provide a direct comparison of genetic and acoustic markers for determining stock structure in the Pacific.

A global compilation of all known mitochondrial DNA haplotypes (n=28) as described by the Cachalote Consortium (see Smith et al 2005) has been posted on GenBank (S. Mesnick, personal communication).

Plans for a study of population genetics using old tooth samples, which had been recommended by the workshop, were developed and funding continues to be sought.

Obtaining information on female survival rates

Marcoux et al (2006) identified a distinctive vocalization (coda) that was produced only by females in breeding areas.

Improving historical catch data

No progress has been made on resolving uncertainties about 20th century sperm whale catch data in the North Pacific. No additional data are known for the Soviet pelagic fishery, so no further advance is expected (R. Brownell, personal communication).

Aguilar and Borrell (2007) reported on a study of logbooks of 19th century whaling voyages on the Straits of Gibraltar Ground, including observations on the effects of the prevailing winds on the seasonal distribution of whaling in this area. They estimated minimum removals from 1862-1889 at 237.

Using 19th and 20th century estimates of removals and encounter rates, Smith et al. (in review) identified several possible causes of the apparent inconsistency between catch data and the encounter rate data that has been noted in previous assessments. They were able to determine that the inconsistency was primarily restricted to the North Pacific, to rule out some explanations and to shed some light on others. They suggest that further resolution may be possible based on additional logbook studies and also suggest that the inconsistency may be due to one or more breeding populations primarily distributed north of 40° N having been subject to whaling primarily in the 20th century.

Improving methods to correct abundance survey data to account for bias

J. Barlow (personal communication) reported further progress in estimating g_0 for sperm whales; results will be forthcoming. Because of sexual segregation by latitude and differences in schooling and diving behaviour by sex, there is a need for regional estimates of this parameter (B. Taylor, personal communication, T. Kasuya, personal communication).

Refining population modelling approaches

No progress

Abundance and Distribution

Several new estimates of regional abundance and density have appeared (Barlow 2006, Gero et al. 2006, and Lewis et al. 2007). The areas include the eastern Caribbean, the Ionian Sea and Straits of Sicily, and the Hawaiian Island region. Barlow (2006) estimated the density of sperm whales in a large area around the Hawaiian Islands at roughly 3 times that of estimates for the eastern tropical Pacific and California offshore regions made with comparable methods.

Additional field studies related to abundance and distribution are planned or continuing in 2007, including the eastern Mediterranean (IFAW, personal communication), the Norway and Barents Seas (N. Øien, personal communication), the North Atlantic (D. Pike, personal communication), the Sargasso Sea (H. Whitehead, personal communication), the western North Pacific (JARPN and JARPN II), the Antarctic Areas III-VI (IDCR and SOWER).

The 2007 Trans North Atlantic Sightings Survey (TNASS), coordinated by the Scientific Committee of NAMMCO, will cover the shelf waters of Eastern Canada, Davis Strait, West Greenland and inshore and offshore waters off Iceland and the Faroes. Both visual and acoustic methodologies will be used. Together with the bordering CODA and Norwegian surveys, a large portion of the North Atlantic will systematically surveyed in 2007 (D. Pike, personal communication).

Plans for proposal for a follow-up survey to the whaling operations off Albany, Western Australia, are being developed (J. Bannister, personal communication).

Preliminary analyses of Japanese sighting data based on Japanese Progress Reports has provided some insight into rates of increase, which may provide insight into movement or immigration (T. Kasuya, personal communication).

Photographic identification studies are continuing in connection with whale watching operations from Andenes, North Norway, to the Bleik Canyon area (N. Øien, personal communication). Studies are continuing (now for four years) in the western Mediterranean around the Balearic Islands. Studies include habitat use and vocal dialects, as well as developing a photo-identification catalogue. There are 47 known individuals but too few resights to allow calculating confidence limits for population size estimates (L. Rendell, personal communication).

Further, the Pelagos Cetacean Research Institute continued its 10 year research programs on sperm whales in the Hellenic Trench, Eastern Mediterranean. They have photo identified 150 animals (both stable and apparently resident social units and mature males). Mark-Recapture analysis suggests a total abundance around 200 animals in that region. Photographic identification studies are planned in parallel with the 2007 acoustic survey by IFAW, with a goal of producing a mark-recapture estimate of abundance for the entire Eastern Mediterranean.

Kaschner et al. (2006) developed a method of determining habitat suitability for marine mammals that may prove useful in extrapolating information on distribution and abundance, along the lines used by Whitehead (2002).

Life History

Watwood et al. (2006) reported on foraging behaviour from acoustic studies in the Gulf of Mexico, off the northeast USA, and in the Ligurian Sea. They found differences in average depth of dive, but more similarities than differences in foraging among the three regions. MacLeod et al. (2006) compared prey selection and

specialization among toothed whales more generally. P. Madsen (personal communication) is preparing information on male sperm whale foraging off northern Norway.

Mendes et al (2007) used stable isotope ratios from sperm whale teeth to describe ontogenetic movements and trophic ecology. From the prey side, Ruiz-Cooley et al. (2006) used stable isotopes to estimate the trophic position of jumbo squid, a known prey of sperm whales.

JARPAN II will continue to collect and analyze stomach contents of sperm whales from the western North Pacific, with the goal to elucidate the role of the sperm whale in the marine ecosystem and construct an ecosystem model (S. Ohsumi, personal communication).

Human Interactions

The US Minerals Management Service's Sperm Whale Seismic Study (SWSS) in the Gulf of Mexico completed its final field season in the summer 2005. A final report is expected this year. Results from this study and other related studies were reviewed by the Scientific Committee in a previous discussion on the potential effects of acoustic activity on sperm whales (IWC 2007, section 12.1). Recently published papers related to this issue include DeRuiter et al. (2006), Laplanche et al. (2006), Madsen et al. (2006), Nosal and Frazer (2006), Thode et al. (2006), and Tiemann et al. (2006a, 2006b). New acoustic methods have been developed that may have implications for other field research, especially related to foraging and abundance surveys.

J. Straley (personal communication) continued collection of distribution and abundance data off Sitka, in collaboration with A. Thode, and have determined that sperm whales in this area are using fishing vessel engine cycling as a cue in their predation on fish caught on long line gear. Mesnick and Warner have continued compilation of accounts of depredation globally and have found that sperm whale depredation of demersal longlines has been recorded in waters of the North Pacific, North Atlantic and Southern Oceans, and that reduction of catch from this varies widely but includes losses of catches for entire deployments of gear (S. Mesnick, personal communication). A symposium hosted by the Vancouver Aquarium, "Fisheries Depredation by Killer and Sperm Whales: Behavioural Insights, Behavioural Solutions" was held Oct. 2-5, 2006, in British Columbia, Canada (<http://www.killerwhale.org/depredation/index.htm>).

DISCUSSION

While substantial progress has been made towards filling the many gaps in information identified by the 2005 workshop (Table 1), progress on certain high priority issues has not been as rapid as might be hoped. Further work is urgently needed on population structure, female survival rates, and population modelling approaches.

The workshop recommended organizing an email consultation group to keep people abreast of developments, which provided input for this report. It also recommended organizing a follow up workshop. The best timing of and involvement in that needs to be discussed further.

The previous discussion within the Scientific Committee indicated that because of its schedule, an assessment could not in any event be undertaken prior to 2008. Because the process of scheduling an assessment can stimulate research, it may be useful for the Scientific Committee to discuss how an assessment may fit into its ongoing schedule.

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REFERENCES

- Aguilar, A. and A. Borrell. 2007. Open-boat whaling on the straits of Gibraltar Ground and adjacent waters. *Marine Mammal Science* 23(2):322-342.
- Barlow, J. 2006. Cetacean abundance in Hawaiian waters estimated from a summer/fall survey in 2002. *Marine Mammal Science* 22(2):446-464.
- DeRuiter SL, Tyack PL, Lin Y, Newhall AE, Lynch JF, Miller PJO. 2006. Modeling acoustic propagation of airgun array pulses recorded on tagged sperm whales (*Physeter macrocephalus*). *The Journal of the Acoustical Society of America* 120(6):4100-14.
- Garde E, Heide-Joergensen MP, Hansen SH, Nachman G, Forchhammer MC. 2007. Age-specific growth and remarkable longevity in narwhals (*Monodon monoceros*) from west Greenland as estimated by aspartic acid racemization. *J Mammal* 88(1):49-58.
- Gero, S., J., Gordon, J., Carlson, C., Evans, P. and Whitehead, H. 2006. Population estimate and inter-island movement of sperm whales, *Physeter macrocephalus*, in the Eastern Caribbean. SC/58/O4, 13 pp.
- IWC. 2003. Reports of the Scientific Committee. *Journal of Cetacean Research and Management* (suppl.) 5.
- IWC. 2004. Reports of the Scientific Committee. *Journal of Cetacean Research and Management* (suppl.) 6.
- IWC. 2006. Reports of the Scientific Committee. *Journal of Cetacean Research and Management* (suppl.) 7.

- Kaschner K, Watson R, Trites AW, Pauly D. 2006. Mapping world-wide distributions of marine mammal species using a relative environmental suitability (RES) model. *Mar Ecol Prog Ser* 316:285-310.
- Laplanche C, Adam O, Lopatka M, Motsch J-. 2006. Depth/range localization of diving sperm whales using passive acoustics on a single hydrophone disregarding seafloor reflections. *J Acoust Soc Am* 119(5):3403-4.
- Lewis, T., Gillespie, D., Lacey, C., Matthews, J., Danbolt, M., Leaper, R., McLanaghan, R. and A. Moscrop. 2007. Sperm whale abundance estimates from acoustic surveys of the Ionian Sea and Straits of Sicily in 2003. *J. Mar. Biol. Ass. U.K.* 87:353-357
- MacLeod CD, Santos MB, Lopez A, Pierce GJ. 2006. Relative prey size consumption in toothed whales: Implications for prey selection and level of specialisation. *Mar Ecol Prog Ser* 326:295-307.
- Madsen, P.T., Johnson, M., P.J.O. Miller, Aguilar Soto, N., Lynch, J. and Tyack, Pl. 2006. Quantitative measures of air-gun pulses recorded on sperm whales (*Physeter macrocephalus*) using acoustic tags during controlled exposure experiments. *Journal of the Acoustical Society of America* 120(4):2366-2379.
- Marcoux M, Whitehead H, Rendell L. 2006. Coda vocalizations recorded in breeding areas are almost entirely produced by mature female sperm whales (*Physeter macrocephalus*). *Can J Zool /Rev can Zool* 84(4):609-14.
- Mendes S6, Newton J, Reid RJ, Zuur AF, Pierce GJ. 2007. Stable carbon and nitrogen isotope ratio profiling of sperm whale teeth reveals ontogenetic movements and trophic ecology. *Oecologia* 151(4):605-15.
- Morin, P.A., Aitken, N.C., Rubio-Cisneros, N., Dizon, A.E., and Mesnick, S. 2006. Characterization of 18 SNP markers for sperm whale (*Physeter macrocephalus*). *Molecular Ecology Notes (OnlineEarly Articles)*. doi:10.1111/j.1471-8286.2006.01654.
- Morin, P.A., Nestler, A., Rubio-Cisneros, N.T., Robertson, K.M. and Mesnick, S.L. 2005. Interfamilial Characterization of a Region of the ZFX and ZFY Genes Facilitates Gender Determination in Cetaceans and other Mammals. *Molecular Ecology* 14: 3275-3286.
- Nosal E and Frazer LN. 2006. Bottom-mounted hydrophones used to investigate sperm whale click and swim characteristics. *J Acoust Soc Am* 120(5):3013.
- Ruiz-Cooley RI, Markaida U, Gendron D, Aguiniga S. 2006. Stable isotopes in jumbo squid (*Dosidicus gigas*) beaks to estimate its trophic position: Comparison between stomach contents and stable isotopes. *J Mar Biol Assoc U K* 86(2):437-45.
- Smith, T.D., Bannister, J. and Reeves, R.R. 2005. Report of the International Cachalot Assessment Research Planning Workshop, Woods Hole, Massachusetts, 1-3 March 2005. NOAA Technical Memorandum NMFS-F/SPO-72. (Available at <http://www.nefsc.noaa.gov/nefsc/publications/tm/tmspo72.pdf>)
- Smith, T.D., Reeves, R.R., Josephson, J. and Lund, J. In review. Sperm Whale Catches and Encounter Rates in the Nineteenth and Twentieth Centuries: an Apparent Paradox. David Starkey (Ed.) *Oceans Past*.
- Thode A, Norris T, Azzara A, Jochens A, Biggs D. 2006. 3-D tracking of sperm whale dive profiles from a towed hydrophone array in ray-refractive environments. *J Acoust Soc Am* 120(5):3013.
- Tiemann CO, Thode AM, Straley J, Folkert K, O'Connell V. 2006a. Three-dimensional passive acoustic tracking of sperm whale behavior with widely separated vertical arrays in the Gulf of Alaska. *J Acoust Soc Am* 120(5):3014.
- Tiemann CO, Thode AM, Straley J, O'Connell V, Folkert K. 2006b. Three-dimensional localization of sperm whales using a single hydrophone. *J Acoust Soc Am* 120(4):2355-65.
- Watwood SL, Miller PJO, Johnson M, Madsen PT, Tyack PL. 2006. Deep-diving foraging behaviour of sperm whales (*Physeter macrocephalus*). *J Anim Ecol* 75(3):814-25.
- Whitehead, H. 2002. Estimates of the current global population size and historical trajectory for sperm whales. *Marine Ecology Progress Series* 242:295-304.

Table 1. Description of research tasks by general category recommended to be addressed in preparation for in-depth assessment of sperm whale populations, with an indication of recent progress towards each task (“?” indicates progress not known). Modified from Table 2 in Smith et al (2005).

Category	Prog	Description
Pop. Structure	Yes	Provisionally identify units to test for discreteness.
Pop. Structure	Yes	Continue and expand genetic analyses, integrated with data on vocal clans as possible.
Pop. Structure	No	Conduct comprehensive analysis and synthesis of Discovery mark program, including USSR data.
Pop. Structure	Yes	Conduct global inventory of photo-identification data, linking catalogs to the maximal extent possible. (Also applies to Abundance)
Pop. Structure	?	Conduct global inventory of tissue collections.
Pop. Structure	Yes	Conduct global inventory of coda repertoires.
Pop. Structure	No	Establish unified, comprehensive database on sperm whale morphometrics.
Pop. Structure	No	Refine provisional population units.
Abundance	No	Conduct global inventory of dive profiles.
Abundance	Yes	Refine estimates of $g(0)$.
Abundance	No	Improve automation of photograph matching; evaluate use of dorsal fins and other features besides the flukes in photo-identification of individuals.
Abundance	No	Improve methods for estimating group size acoustically, especially for large groups (up to 30 individuals).
Abundance	No	Develop consensus on relative merits of acoustic and visual surveys.
Abundance	Yes	Evaluate methods of extrapolating densities to unsurveyed areas.
Abundance	Yes	Conduct additional surveys in selected areas.
Human Interactions	Yes	Improve estimates of whaling removals in 18 th and 19 th centuries, by region and sex, including estimates of statistical precision.
Human Interactions	Yes	Resolve problems surrounding misreported and under-reported catches in North Pacific during 20 th century: USSR, Japan.
Human Interactions	?	Improve reporting and estimation of incidental mortality of sperm whales in fisheries, especially drift gillnets.
Human Interactions	?	Obtain additional measures of chemical contaminants in sperm whale tissues and improve understanding of effects, including dose-response relationships whenever possible.
Human Interactions	Yes	Get more and better data (both qualitative and quantitative) on sperm whale interactions with longline fisheries.
Human Interactions	Yes	Determine effects of human-induced noise on behavior and ecology of sperm whales, especially in relation to oil and gas industry.
Life History	No	Compare observed calf proportions in different study areas and refine understanding of calving rate and maximal potential rate of increase.
Life History	Yes	Determine function of codas.
Life History	No	Determine population effects of differential depletion by sex.
Life History	No	Obtain more precise estimates of adult female survival.
Modeling	No	Establish population modeling working group to ensure interaction among researchers.
Modeling	No	Refine modelling approaches – e.g., alternative values of r_{max} , sensitivity to input parameters.
Coordination	Yes	Organize e-mail consultation.
Coordination	No	Conduct follow-up workshop in two years to review progress.
Coordination	No	Determine when sufficient information is available to allow in-depth assessment of sperm whales.