SONATE -
SONAr effecTs on marinE life
Aiding naval officers in planning safe operation of active sonar

Jonas F. Henriksen* and Nina Nordlund**

* Institute of Marine Research (IMR)- Norwegian Marine Data Centre - P.O.Box 1870 Nordnes, N-5817 Bergen - Norway, http//www.imr.no

** Norwegian Defence Research Establishment (FFI) - Maritime Systems Division - Horten - Norway

Introduction

The Royal Norwegian Navy has purchased 5 new frigates equipped with low-to-medium frequency active sonars. Such sonars are potentially harmful to marine life. Mass stranding of whales have been thought to be caused by naval sonar exercises. Furthermore, the navy has been met with allegations that fish are also affected.

As a way to mitigate this potential problem, the Norwegian Navy is developing a decision aid tool, SONATE, that will help reduce the environmental impact during naval exercises.

The project is funded by the Norwegian Defence Research Establishment and The Royal Norwegian Navy, Institute of Marine Research and STATOIL and HYDRO represented by MRDB (Marine Resource Database).

Software and Development

The SONATE system is being developed by the Norwegian Defence Research Establishment (FFI) in collaboration with Institute of Marine Research (IMR) in Norway.

It consists of a graphical user interface used by the naval officers, a GIS-enabled database with marine environmental data, and scripts for importing and exporting.

The user interface was developed by FFI, while the database backend was developed by IMR.

Data

The goal of the project is to include all species in norwegian waters that are either commercially important, important factors in the ecosystem, or possibly vulnerable to sonar signals. So far we have included:

Fish
– Norwegian Spring Spawning Herring
– North Sea Herring
– Local Herring in Norwegian fjords
– North East Arctic Cod
– Norwegian Coastal Cod
– North Sea Cod
– European Sprat
Marine Mammals
– Bottlenose
– Grey seal
– Harbour seal

Species to be added during
 end 2006 / beginning 2007:
Fish
– Greenland Halibut
– North East Arctic Haddoc
– North East Arctic Saithe
– Capelin
– Blue Whiting
– Mackerel
– Atlantic horse mackerel
– North Sea Saithe
– North Sea Haddoc
–**Marine Mammals**
– Ringed Seal
– Bearded Seal
– Walrus
– Minke Whales
– Humpback Whale
– Fin Whale
– Harbour Porpoise
– Springer
– Killer Whale
– Sperm Whale

Fig 1: A surfacing Fin Whale (Photo: Petter Kvadsheim).

The Graphical User Interface

The user is presented with a blank map and a choice to select an area and time period. Vulnerable species, fisheries activity etc. that match the selection are presented in a list. The user can view which guidelines apply for the species, and for each species she can view the extent of the area that the species occupy at the selected time period. The user interface is written in Python and keeps data embedded in a SQLite database and in HDF files.
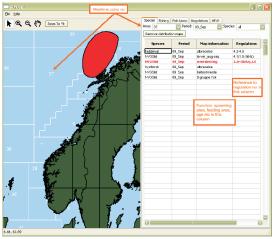
Fig. 2: Screenshot of the Graphical User Interface of SONATE,with herring egg-distribution.

The Spatial Database Back-end

A spatial database was developed to organize data in a flexible manner. Species area coverage is expressed as points or polygons, along with seasonal information, species stage (e.g. youth, adult), and species density (low, medium and high). The database includes regulations/restrictions for different species/stages where such regulations exists, as well as references to the specific paper or scientist that has approved the information in the database. The database is implemented in PostgreSQL with PostGIS extention.
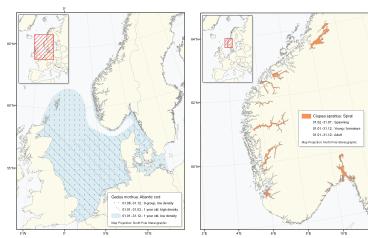
Fig 3: Examples of species distribution data for Atlantic Cod (left) and Sprat (right).

Discussion

The first operative version of SONATE was delivered to The Royal Norwegian Navy in July 2006. The intention is that SONATE shall be installed on all ships equipped with sonars, but it will probably take some time until all ships and other personnel starts using the software. Feedback from the users are crucial for further development of the software. The responses so far have been positive, but we are looking forward to a more extensive use, for instance during a military exercise, to get feedback after use in a realistic situation.

One current problem is execution speed. As more and more data have been loaded into the database, execution speed has decreased, and will continue to decrease as even more data is loaded.

We are considering the possibility of integrating SONATE with other map tools used in the Norwegian Defence. We have already made a test of loading SONATE data into an existing tool, METOC, which is a WMS based map tool. This is mainly used for distributing weather data, but can also be used for other purposes. This tool is well suited for distributing overview maps of the SONATE data, but is probably not suited for the specialized handling and presentation of data that is required for naval officers.

MARIA is another GIS tool used by the Norwegian Defence. MARIA is used for many purposes and is probably suitable platform for SONATE data in the future.

For further information:

Jonas F. Henriksen: Nina Nordlund
jonasfh@imr.no   nina.nordlund@ffi.no

INSTITUTE OF MARINE RESEARCH
H A V F O R S K N I N G S I N S T I T U T T E T

FFI Forsvarets forskningsinstitutt
Norwegian Defence Research Establishment