SONATE 3.0

A decision aid system to mitigate the impact of sonar operations in Norwegian waters on marine life

Nina Nordlund and Frank Benders

Keywords

Sonar

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Approved by

Petter H. Kvadsheim   Project manager

Elling Tveit   Director of Research

Jon-Mikal Størdal   Director

English summary

The Royal Norwegian Navy has purchased five new frigates equipped with 1-8 kHz active sonars. Such sonars are potentially harmful to marine life. Mass strandings of whales have been claimed 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, FFI has developed a decision aid tool for the Norwegian Navy, SONATE, which will help reduce the potential environmental impact of naval exercises.

SONATE is a decision aid tool for use during planning and execution of sonar exercises, with the aim to minimize conflicts with activities such as fisheries, fish farms, tourism etc and influence of marine life. SONATE contains cartographic information on distribution maps, fishing activity and fish farms; it also contains a set of rules that defines areas where to avoid intensive and routine sonar exercises, information on critical frequency bands and sonar start-up procedures.

This report gives a description of the tool SONATE, and it is divided into three main parts. The first part is a user interface description, meant for the ground level user. The second part is meant for the data manager who takes care of data updates and is responsible for distribution of new installation files. The third part is mainly written for the programmer.

Finally a discussion about the result and about future plans is given.

Sammendrag

Det norske forsvaret har kjøpt inn 5 nye fregatter som er utstyrt med 1-8 kHz aktive sonarer. Slike sonarer kan være potensielt skadelig for marint liv. Militære sonarøvelser har blitt beskyldt for å være årsaken til massestranding av hvaler. Det har også kommet fram påstander om at også fisk blir påvirket av miltiære sonarøvelser. For å prøve og begrense dette potensielle problemet, har FFI for Sjøforsvaret utviklet et beslutningsstøtteverktøy (SONATE), som vil hjelpe til å reduserere de potensielle miljømessige påvirkningene fra marineøvelser.

SONATE er et beslutningsstøtteverktøy for bruk under planlegging og utføring av sonarøvelser, med hensikt å minimere påvirkningen på marint liv og konflikter med aktiviteter som industri fiskeri, havbruk, turisme etc. SONATE inneholder kartbasert informasjon med utbredelseskart, fiskeriaktivitet og havbruksanlegg. SONATE inneholder også et sett med regler som definerer områder der man bør unngå intensive og rutinemessige sonarøvelser, og informasjon om eventuelle oppstartsprosedyrer for sonar og kristisk frekvensbånd.

Denne rapporten gir en beskrivelse av verktøyet SONATE. Rapporten er delt inn i tre hoveddeler. Den første delen er beregnet på en vanlig bruker og fungerer som brukerdokumentasjon, med beskrivelse av bruksområde og menyer. Den andre delen er beregnet på den som skal administrere og oppdatere database og lage nye installasjonsfiler. Den tredje delen er laget for programmerere som skal gjøre endringer i software, brukergrensesnitt etc.

Til slutt er det gitt en diskusjon rundt resultatet og rundt planer for framtiden.

Contents

Preface

The story of SONATE started in 2003 with the FFI project "LFAS og Havmiljø". John Kenneth Grytten designed the first versions of SONATE in collaboration with Erik Sevaldsen (project leader) and Petter Kvadsheim (senior scientist). Nina Nordlund took over Gryttens work when he resigned from FFI in 2006. SONATE 2.0 was completed 2007, with the help of Frank Benders (FFI/TNO). In 2008 the latest version, SONATE 3.0 was completed.

1   Introduction

The Royal Norwegian Navy has purchased five new frigates equipped with 1-8 kHz active sonars. Such sonars are potentially harmful to marine life. Mass strandings of whales have been claimed 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 FFI have developed for the Norwegian navy, a decision aid tool, SONATE that will help reduce the environmental impact of naval exercises. The project is executed by FFI (The Norwegian Defence Research Establishment) and funded by the Royal Norwegian Navy.

SONATE is a decision aid tool for use during planning and execution of sonar exercises, with the aim to minimize conflicts with sea based industry (fisheries, fish farms, tourism) and influence of marine life. SONATE contains cartographic information on distribution maps, fishing activity and fish farms; it also contains a set of guidelines that recommend areas where to avoid intensive or routine sonar exercises, information on critical frequency bands and sonar start-up procedures.

This report is divided in 3 levels. The first level (Chapter 3) is a user interface description meant for the average user, either during planning or performance of a sonar operation. The second level (Chapter 4) is meant for the data manager who updates distribution maps, fish farms and fishing activity information in the databases, and prepares updated installation files with updated databases. The third level (Chapter 5) is mainly meant for the programmer. Chapter 2 gives a brief description of the input data to SONATE.

2   Input data

The input data to SONATE comes from different sources. In addition to land contours, the input data are distribution maps of fish and marine mammals, whaling, fishing activity, fishery zones, safari activities (e.g. whale watching) and fish farm locations. See overview in Table 2.1.

2.1   Geographical coverage

The land contours in SONATE are imported from a shape file (ESRI format). The land contours are not very detailed, which makes SONATE unusable for navigation. The low detail level is chosen to keep the speed of SONATE up.
See Figure 2.1 for map of coverage area.

Table 2.1   Table showing sources for input data in SONATE

Input data	Source
Distribution maps (fish and marine mammals)	Institute of Marine Research
Fish farms	Directorate of Fisheries
Fishing activity	Directorate of Fisheries
Safari activities	From tourist companies
Fishing zones and locations	Directorate of Fisheries
Whaling areas	FFI, based on data from IMR

2.2   The distribution maps

The distribution maps are obtained from Institute of Marine Research (Bergen, Norway) as shape files (ArcGIS). The delivery from IMR includes 18 fish species and 19 marine mammal species (see Table 2.2 for a complete list of species). This covers the most important species in Norwegian waters. In the North Sea, Norwegian Sea, most of the Greenland Sea and the Barents Sea, this dataset gives a complete data coverage (see Figure 2.1 for area). Some of the distribution maps cover a larger area.

In addition to the species and geographical distribution, these data hold information on time period for which the maps apply. For some species the distribution differs between age-classes, stage (feeding, moulting, spawning etc), this is reflected in the maps in SONATE.   For a more detailed description of the shape files, see Figure 2.2 and Figure 4.2, page 28.

Most distribution maps are originally delivered as valid for whole months, but for a few species, the validity period is given for another period. At these few occasions, the validity period in SONATE is extended to the beginning and end of month.

In addition to the distribution maps, SONATE also contains maps with information on safari activities (e.g. whale watching) and areas of whaling. Figure 2.2, Figure 3.3and Figure 3.4 shows examples of how distribution data are presented in SONATE.

Table 2.2   SONATE contains distribution maps for the species in the table below (Norwegian names in parentheses.

FISH:	MAMMALS:
Blue whiting (Kolmule)	Atlantic white sided dolphin (Kvitskjeving)
Capelin (Lodde)	Bearded seal (Storkobbe)
North Sea Cod (Nordsjøtorsk)	Beluga (Hvithval)
North East Arctic Cod (Nord-øst-arktisk torsk)	Bottlenose whale (Nebbhval)
Coastal Cod (Kysttorsk)	Fin whale (Finnhval)
Deepwater Redfish (Snabeluer)	Grey seal (Havert)
Greenland halibut (Blåkveite)	Harbour porpoise (Nise)
North Sea Haddock (Nordsjøhyse)	Harbour seal (Steinkobbe)
North East Arctic Haddock (Nord-øst-arktisk hyse)	Harp seal (Grønlandssel)
Norwegian Spring Spawning Herring (Norsk vårgytende sild)	Hooded seal (Klappmyss)
Fjord Herring (Fjordsild)	Humpback whale (Knølhval)
North Sea Herring (Norsdjøsild)	Killer whale (Spekkhogger)
Horse mackerel (Taggmakrell)	Minke whale (Vågehval)
Mackerel (Makrell)	Narwhale (Narhval)
North Sea Saithe (Nordsjøsei)	Pilot whale (Grindhval)
North East Arctic Saithe (nord-øst-arktisk sei)	Ringed seal (Ringsel)
Sprat (Brisling)	Sperm whale (Spermhval)
Fjord Sprat (Fjord brisling)	Walrus (Hvalross)
	White beaked dolphin (Kvitnos)

Figure 2.1   The white lines in the map show the area of data coverage. Some of the distribution maps cover areas outside these white lines, but the data coverage is not complete here. The fishing areas and fishing locations are information used by the Directorate of Fisheries to report fishing activity and catch.
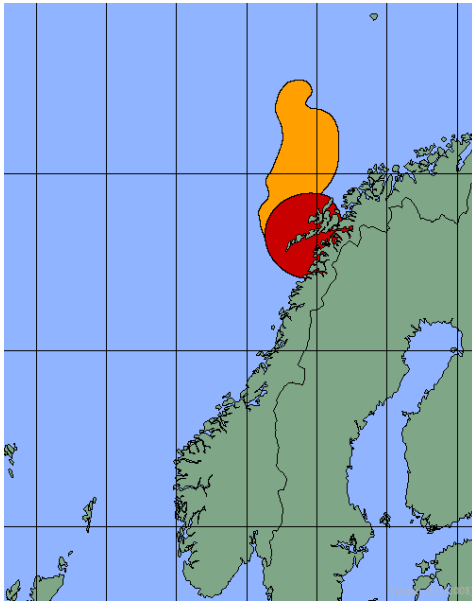
Figure 2.2   The figure shows a typical example of a distribution map as presented in SONATE. The orange areas show distribution of herring (winter area) in January, the red area is killer whale distribution in January.

2.3   Fishing activity

Fishing activity data are obtained from The Directorate of Fisheries. The Directorate of Fisheries divides the Norwegian Waters into fishing areas and fishing locations, in which catch of fish is reported. These areas and locations are also used in SONATE to display fishing activity (Figure 2.1 shows the areas and locations).

The fishing activity data holds information on catch period, area, location, fishing tool, species (or groups of species), catch (in kg) and number of vessels which have reported catch from the area. Be aware that this dataset only holds information on catches delivered in Norway. Figure 3.5 and Figure 3.6 shows examples of how fishing activity data are presented in SONATE.

Table 2.3   The table below shows an example from the fishing activity input file. The file is in Norwegian. The fields of the table are: year; nation; area; location no; year of delivery; month of delivery; yr-month; fishing tool; fish group/species; weight in kg; value in NOK; # boats

Fangst år	Fartøy nasjon	Homr	Lok	Lev_ år	Lev_ mnd	Lev_ år-md	Redskaps gruppe	Fisk_ gruppe	Rund- vekt i kg	Utbetalt verdi i kr	Ant far tøy
2007	NOR	42	14	2007	11	2007-11	Not	Sild	2299981	4835681	6
2007	NOR	42	14	2007	11	2007-11	Not	Anna pelagisk fisk	4738	2207	3
2007	UTL	43	83	2007	11	2007-11	Trål	Sild	9000	0	1
2007	UTL	43	83	2007	11	2007-11	Trål	Anna pelagisk fisk	1096489	9404331	2
2007	UTL	43	66	2007	11	2007-11	Trål	Sild	1500	0	1
2007	UTL	43	66	2007	11	2007-11	Trål	Anna pelagisk fisk	129816	1079497	1
2007	NOR	54	8	2007	11	2007-11	Line	Anna fisk	173	4410	1
2007	NOR	54	8	2007	11	2007-11	Line	Torsk og torskeartet fisk	16808	318258	1
2007	NOR	61	0	2007	11	2007-11	Trål	Anna fisk	31085	452036	1
2007	NOR	68	0	2007	11	2007-11	Trål	Anna fisk	293139	4928261	1

2.4   Fish farms

The fish farms data are obtained from the Directorate of Fisheries, on an excel file, and keeps concession holders name and address, species, production capacity, geographic coordinates etc. Be aware that the fish farm locations presented in SONATE are existing concessions. Some companies have concessions on several locations and move the fish farms between these. This means that not all fish farm locations indicated in SONATE contains a physical farm at all times. Figure 3.7 shows an example of how fish farm data are presented in SONATE.

Table 2.4   Example from fish farms input file. The input file is in Norwegian. Standard fields of the input file are: permission no; company ID; owner; address; postal code; post office; established date; temporary permission; permission municipality ID; permission municipality; object (commercial/cultivation); production (edible fish, hatchery ...); capacity; capacity unit (tonnes, number etc); location ID; location name; location type (permanent, temporary etc);location municipality ID, location municipality name; location placement (land, sea etc); environment (salt water, fresh water etc); location capacity; location capacity unit (m³, tonnes, number etc); location temporary; coordinate latitude WGS 84; coordinate longitude WGS 84

TILL_NR	FIRMA_ID NR	INNEHAVER	ADRESSE	POST NR	POSTSTED
A A 0001	969159570	UNIVERSITETET FOR MILJØ- OG BIOVIT		1432	ÅS
A AH0701		BJØRKELANGEN JFF	BOKS 131	1940	BJØRKELANGEN
A AH0701		BJØRKELANGEN JFF	BOKS 131	1940	BJØRKELANGEN

TILL_NR	ETABL_DATO	MIDL_TILL	TILL_KOMNR	TILL_KOM
A A 0001	03-10-1991		0214	ÅS
A AH0701	21-09-1995		0221	AURSKOG HØLAND
A AH0701	21-09-1995		0221	AURSKOG HØLAND

TILL_NR	FORMÅL	PRODUKSJON	ART	TILL_KAP	TILL_MH	LOK_NR
A A 0001	KOMMERSIELL	MATFISK	LAKSEFISK	6.50	TN	10362
A AH0701	KULTIVERING	YNGEL	ØRRET	130.00	STK	12826
A AH0701	KULTIVERING	SETTEFISK	ØRRET	140.00	STK	12826

TILL_NR	LOK_NAVN	LOK_TYPE	LOK_KOMNR	LOK_KOM
A A 0001	NERFJØSET	PERMANENT	0214	ÅS
A AH0701	BJØRKELANGEN	PERMANENT	0221	AURSKOG HØLAND
A AH0701	BJØRKELANGEN	PERMANENT	0221	AURSKOG HØLAND

TILL_NR	LOK_PLASS	LOK_MILJØ	LOK_KAP	LOK_MH	LOK_MIDL	N_GEOWGS84	Ø_GEOWGS84
A A 0001	LAND	FERSKVANN	100.00	M3		59.670232	10.759353
A AH0701	LAND	FERSKVANN	270.00	STK		59.871073	11.595335
A AH0701	LAND	FERSKVANN	270.00	STK		59.871073	11.595335

3 User interface description

The SONATE application can be used by users with different points of view and requirements. The application is mainly meant for planners of sonar operation and operational users (sonar operators). It can also be used by scientists or managers to get an overview of species distribution and marine activity.

We assume that a typical planner of sonar exercises will use SONATE to locate an area and time period suited to perform an exercise with minimum operational restrictions. A typical operational user will use SONATE to view details in the exercise area, and to find information on critical frequency bands and start up procedures.

The SONATE application has been split into several maps showing different kind and detail of information. The most complete overview of information can be found under the *SUMMARY* tab. This map shows only information about areas where restrictions are recommended. More detailed information on species can be found under the *SPECIES* tab. These maps focus on all marine species (including species and areas without restrictions). The fishery information is visualised under the *FISHERY* tab. Information on the fish farms (including positions) can be found under the *FISH FARMS* tab.
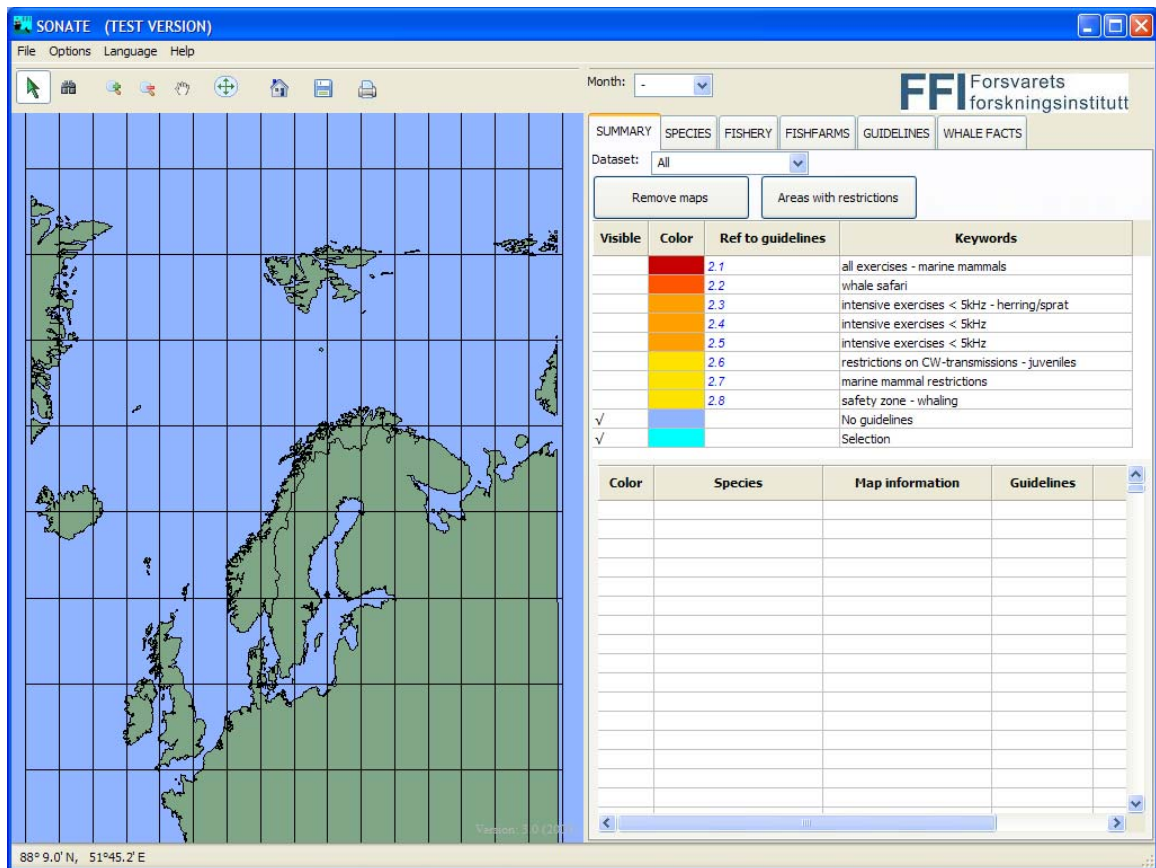
Figure 3.1   The overall structure of the SONATE window

The SONATE window is divided in two parts (see Figure 3.1): the panel at the left side contains a map and the right panel text, tables and legend. The information shown in the map depends on the selected tab. In addition to the tabs with maps (*SUMMARY*, *SPECIES*, *FISHERY* and *FISH FARMS*) there are also two other tabs containing the *GUIDELINES* and *WHALE FACTS*.

Figure 3.2   The buttons above the map: arrow, binocular; zoom in; zoom out; pan; zoom to fit; home; save; print

The buttons above the map can be used to select areas on the map and to navigate through the map by zoom in/out and changing the centre. The selection functionality (using the *arrow*) will only provide information on the area on the top of the map. The *binocular* will provide information on all layers under the SUMMARY and SPECIES tabs (the other tabs have only single layer maps).   When the *zoom-in* function is used, only the areas inside the borders of the map will be listed in the table on the right side. When the user *zooms out*, the table to the right will again be updated with the information inside the map shown on the left.

The *zoom to fit* button can be used to reset the size of the screen. Resetting the entire application to the initial settings can be done with the *home* button. Besides these buttons, also a *save* and *print* button is placed to have easy access to this functionality.

In the menu bar of the application, the user can find:
- under *File*: the functionality to print and store the map and tables
- under *Options*: turn on/off area coverage display (data coverage is assumed to be 100% inside the area), turn on/off grid display (5° latitude and longitude intervals)
- under *Language*: choose between English, Norwegian or Dutch language
- under *Help*: a help text

Above the table at the right side of the window, the user can specify the month. A "-" in the month dropdown box means that there is no month selected.

At the bottom of the window, the position of the cursor on the map is shown. The version of SONATE is always displayed at the bottom of the map.

The SONATE database contains a vast amount of data, which is to be displayed graphically. If all these data are read to the memory at the same time, SONATE will respond slowly to new requests. Selecting a specific month and restricting the geographical selection to the relevant area (by zooming in the map), will reduce the amount of data in memory and thereby the response time.

3.1   Summary maps

The summary maps are made to provide a quick overview of all areas where the guidelines recommend restrictions on use of active sonar. The summary maps show both the species distribution and fishing activity in the same map, but only areas where the guidelines recommend restrictions. Initially, no guidelines are selected. Figure 3.3 shows an example of the summary maps. The colours indicate the importance of the guideline (red is more stringent than orange). The most important information will mainly be visualised on top of the map (overlapping the other information).

At the top of the *SUMMARY* tab, the user can select the dataset (species and/or fishery) of interest by means of the dropdown menu. Below the dropdown menu, two buttons are visible. The button *Areas with restrictions* button enables the user to select all visible areas where the guidelines recommend restrictions on use of sonars, at once and show them on the map. The *Remove maps* button will remove all areas from the map.

Below the buttons, a legend of the colours and the corresponding guidelines is shown. The left column shows whether the guideline(s) are visualised, followed by the colour corresponding to the guideline. At the right side a small guideline description by means of keywords is given. By clicking in the *On/off* column, a guideline can be visualised or removed. By clicking in the *color* column, all guidelines with the same color are selected. The *guideline* column can be used to jump directly to the guideline description (under the *GUIDELINE* tab). When a guideline applies in the selected area, the text in the *Ref to guideline* column is written in blue, otherwise it will be *grey italic*.
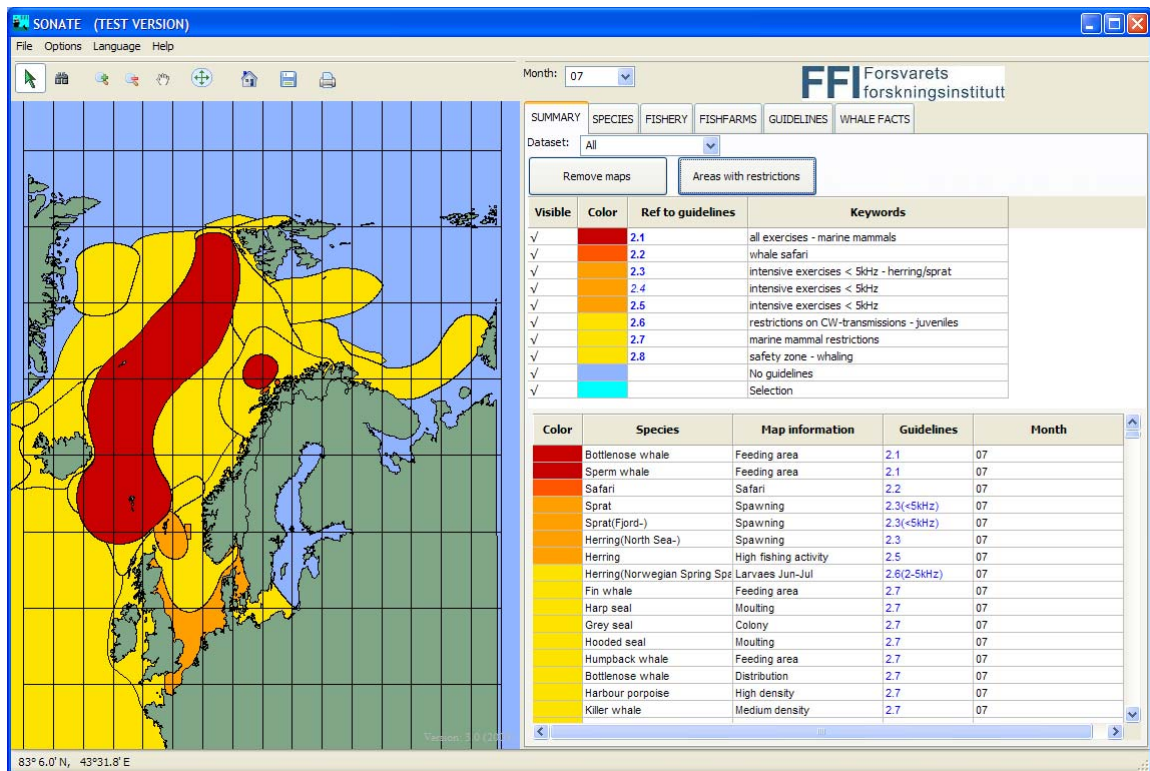
Figure 3.3   An example showing the summary map of July. Map to the left. To the right a menu to select month, dataset (species, fishing activity or both), buttons to show or hide groups of maps, legends and a table which lists all areas inside the map extent.

The table at the bottom shows a list of all areas where restrictions are recommended, either caused by the presence of vulnerable species or high fishing activity.   When the *color* column is colored, the area corresponding to this information is shown in the map. For each area in the table, the *species* name, *map* information, *guidelines* and *month* is shown in the table. In some cases more details concerning the guidelines is given in the *guidelines* column (e.g. frequency band restrictions). When all months are selected (at the top of the tab), the last column shows a list of month numbers in which the guidelines recommend restrictions on use of active sonar. To turn on or off the distribution maps one clicks in the *color* column of the table. The last distribution map turned on, will have a cyan outline.

Only restricted areas that are inside the margins of the map to the left will be shown in the table. After zooming in, only the guidelines concerning the visualised area will be displayed in the table.

3.2   Species maps

The *SPECIES* tab provides the user with distribution maps of all species in the database. Figure 3.4 shows an example of distribution maps for some marine mammals in July. The color coding is similar to the one used under the *SUMMARY* tab, but also species with no restrictions linked to them are also shown (in green).
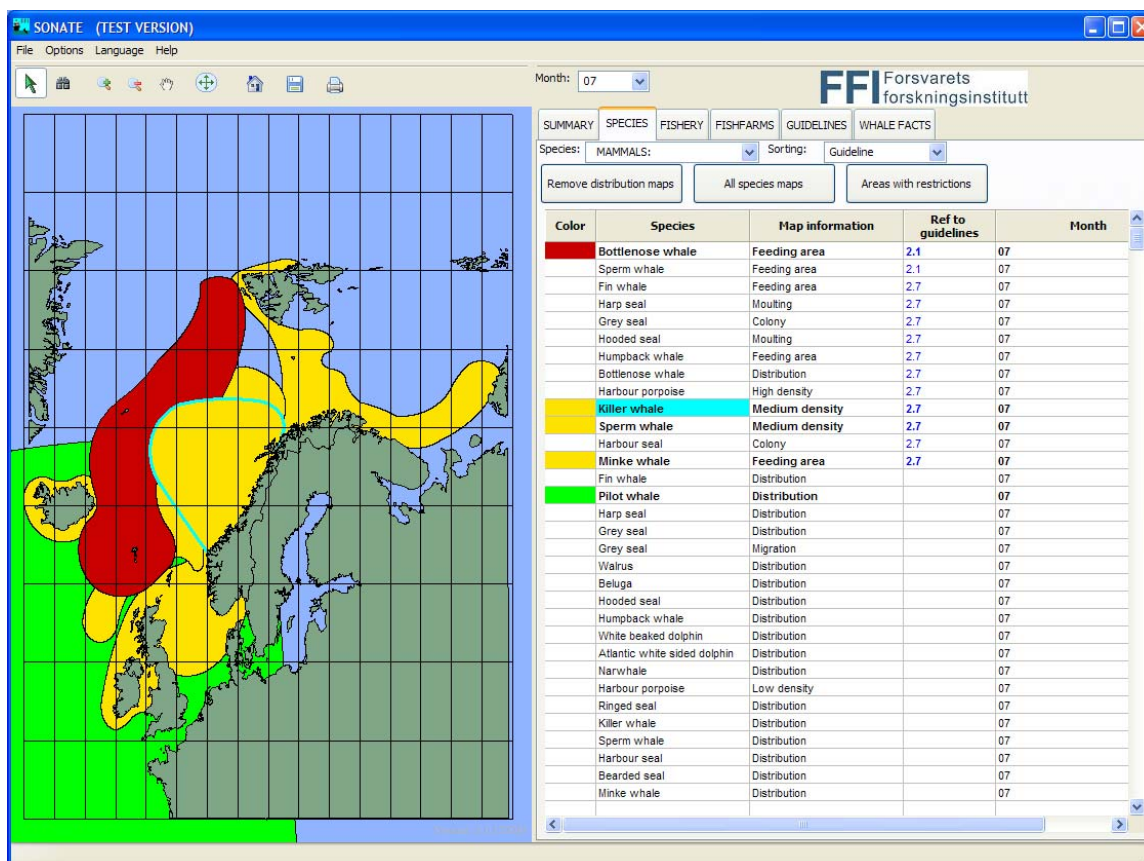
*Figure 3.4   The species tab reveals distribution maps. July month is selected, and marine
            mammal distribution maps are visualised. The killer whale distribution map is
            selected and is shown with a cyan outline.*

At the species drop down menu, the user can select species or group of species (fish or
mammals). The table below can be sorted by guideline, species name, or map information by
means of the sorting dropdown menu.

By pressing the *All species maps* button all distribution maps inside the visible part of the map
will be shown. The *Areas with guidelines* button will only show areas where restrictions are
recommended. Removing all distribution maps can be done by clicking the *Remove distribution
maps* button.

The table at the bottom shows a list of all distribution maps in the visible area of the map. When
the *color* column is colored, the habitat of the species is shown on the map. For each species in
the table, the name, map information, guidelines, and month is depicted. In some cases more
details concerning the guidelines is given in the *guidelines* column (e.g. frequency band
restrictions). When all months are selected (at the top of the tab), the *month* column shows a list
of month numbers in which the distribution map applies.

Clicking in the *color* column of the table to the right will turn the distribution on or off in the map
to the left. Clicking on the *species* column will result in (un)highlighting of the corresponding

distribution map. An example is shown in Figure 3.4 where killer whale distribution is highlighted.

Clicking on areas on the map will hightlight them. By using the *binocular* button, information on all distribution maps below will be shown.

3.3 Fishery maps

The *FISHERY* tab gives information on fishing activity in the different fishing locations. The fishing locations are areas used by the Directorate of Fisheries for reporting catches. Fishing activity in SONATE is calculated from catch and number of catching vessels in each location. The activity is calculated month by month, and can be extracted from the database as values based on data from one year or an average of the last three years. Regulations on use of sonar are based on the average values from the last three years. Areas where restrictions are recommended are shown with orange outline in the map, and do not depend on selected dataset (it is always based on the average of the last 3 years). The dataset shown in the map can be either catch OR number of boats, which is selected by the dataset drop down menu above the table. Initially, average catch and all fish groups are selected. The fishing activity can vary a lot from year to year; this is the reason for using a three year average.
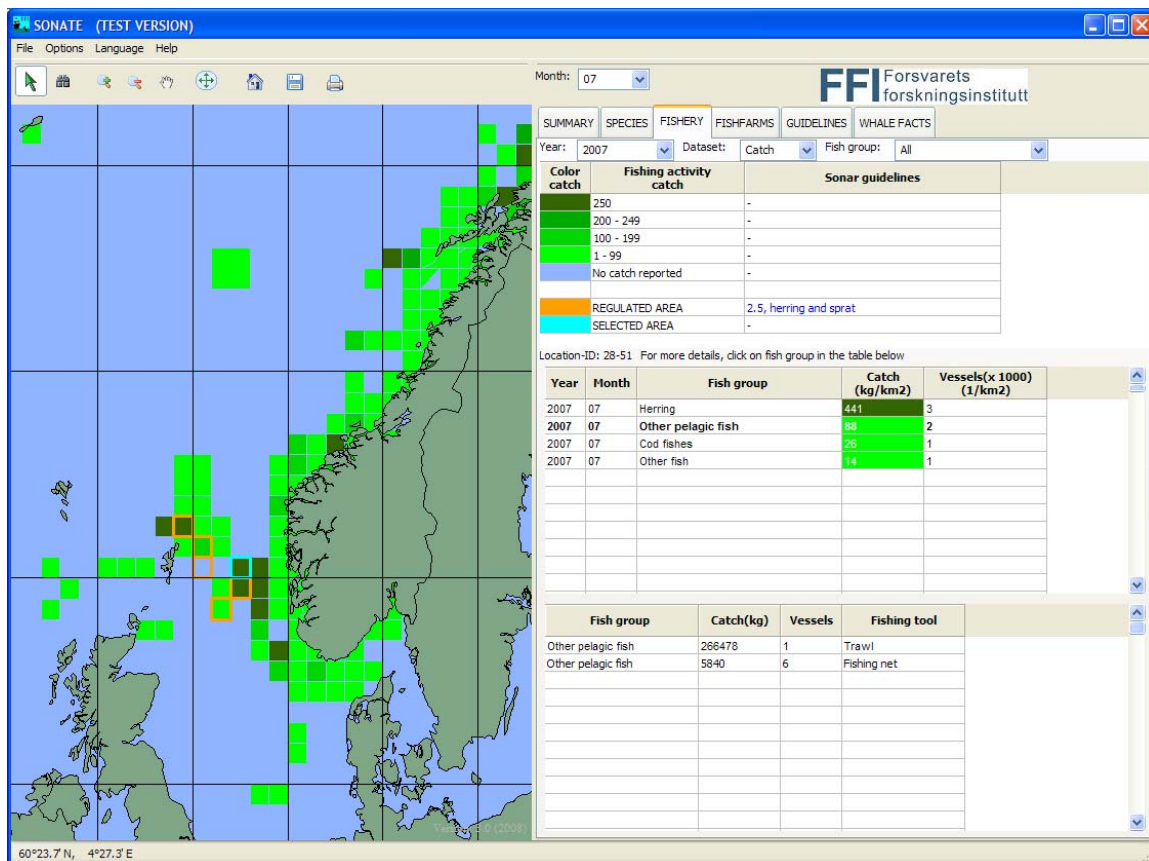
Figure 3.5 *The fishery tab reveals fishing catch activity. As an example catches per area are shown for July 2007. Details are shown for the area with location-ID: 28-51. This area appears with a cyan outline in the map. The areas with orange outline are areas where the guidelines recommend sonar restrictions based on high fishing activity on presumed sensitive species.*

Clicking on a location with the arrow will reveal give detailed information of the location in the table below the legend.

When only one year is selected, the user can select one fish group (marked bold) in the middle table (by clicking on it). For this fish group detailed information about the catch, number of vessels and fishing tools are shown in the bottom table. An example can be seen in Figure 3.6.
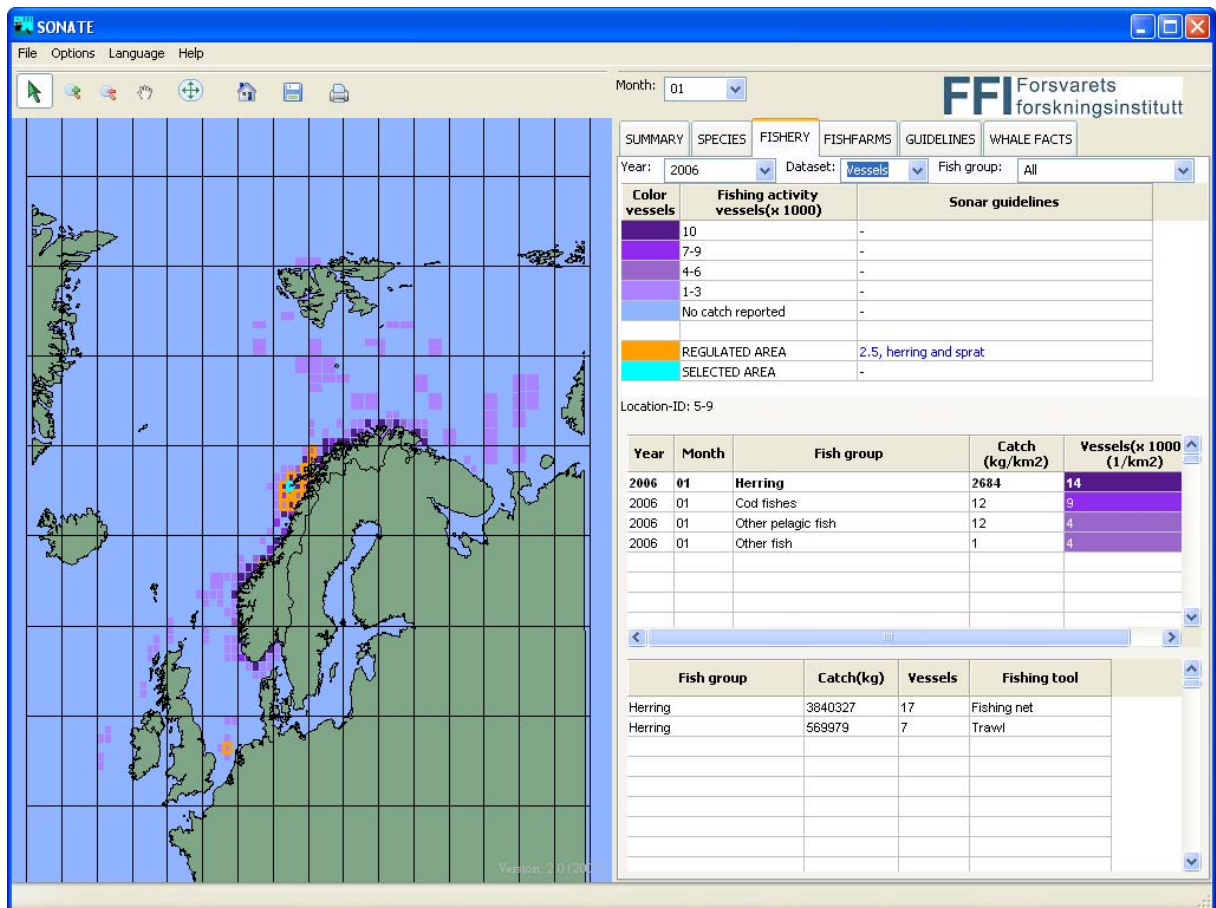
Figure 3.6   The fishery tab reveals fishing vessel density. As an example the number of vessels is shown for January 2006 in the area with location-ID: 5-9.

As mentioned above, any recommended restrictions on use of sonar caused by fishing activity is based on average values for the last three years. Also taken into consideration is the vulnerability of fish species in different time periods. Restrictions are recommended at a lower fishing activity for species vulnerable to sonar signals than for less vulnerable species.

3.4   Fishfarm maps

The *FISH FARMS* tab gives an overview of all concessions for fish farms in Norway. The first time this map is selected, all fishfarm information will be read from the fish farms database (this will take some time).

Detailed information on a each fishfarm is obtained by clicking on the markers on the map. Information of the selected fish farms will appear in the table at the right side, with the most recent selection highlighted on top. Selected fish farms in the map will change color to the selection color. All fish farms can be unselected and removed from the table by clicking on the "Remove selection" button.
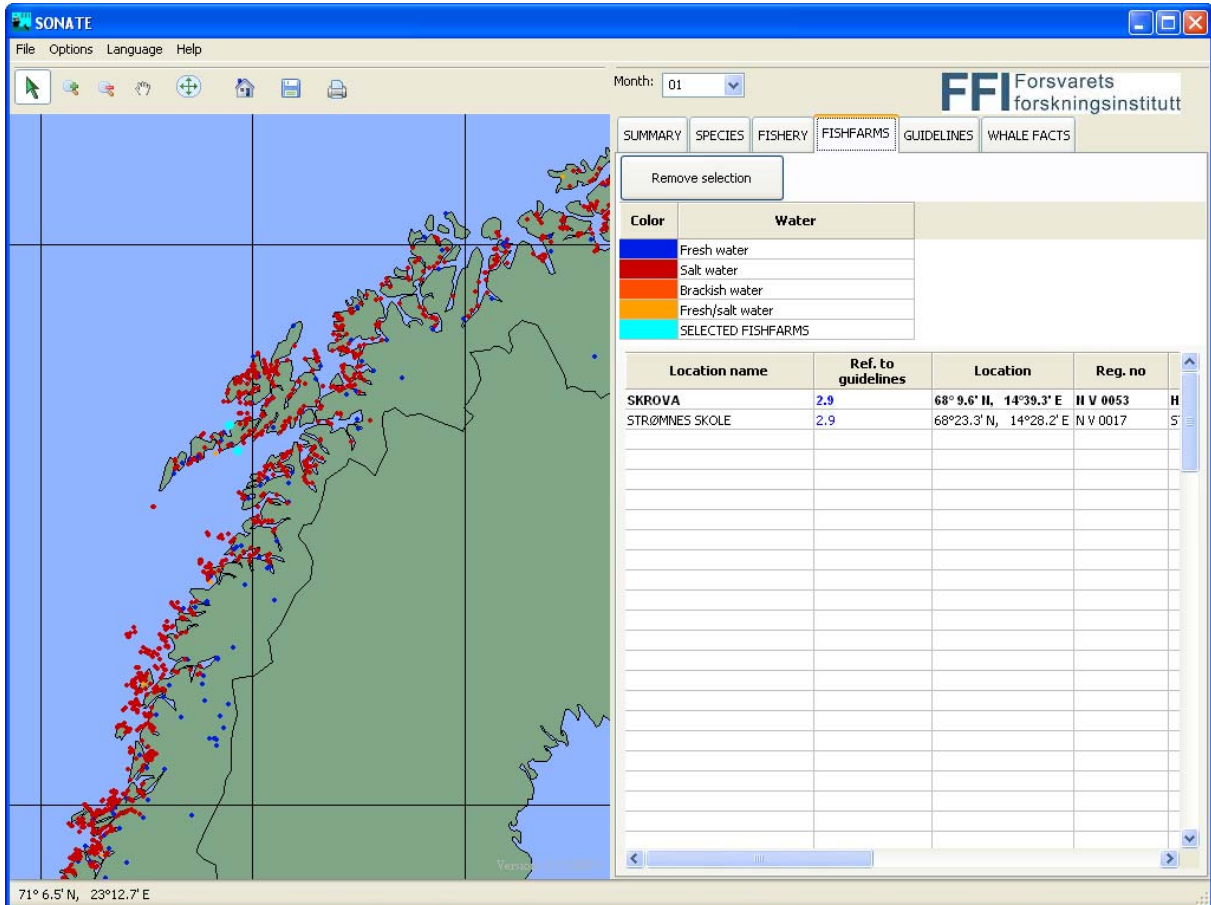
Figure 3.7   Example of the fish farms information in SONATE

The capacity of fish farms can be given in numbers (stk) (number is to be multiplied by 1000), tonnes (tn), DA (decare- 1000m^2), kg, l, m^2 or m^3.

3.5   Guidelines

The *GUIDELINE* tab will show the complete official guidelines (see Figure 3.8).   The guidelines for military sonar operations in Norwegian waters are issued by the naval operational authority (FOHK) based on recommendations from FFI. The language of the guidelines can be changed by selecting another language in the menu bar.   Links to the *GUIDELINE* tab appears numerous places elsewhere in SONATE, for instance in the legend of the *SUMMARY* tab and in the *Ref to guidelines* columns under the *SUMMARY* tab and the *SPECIES* tab.
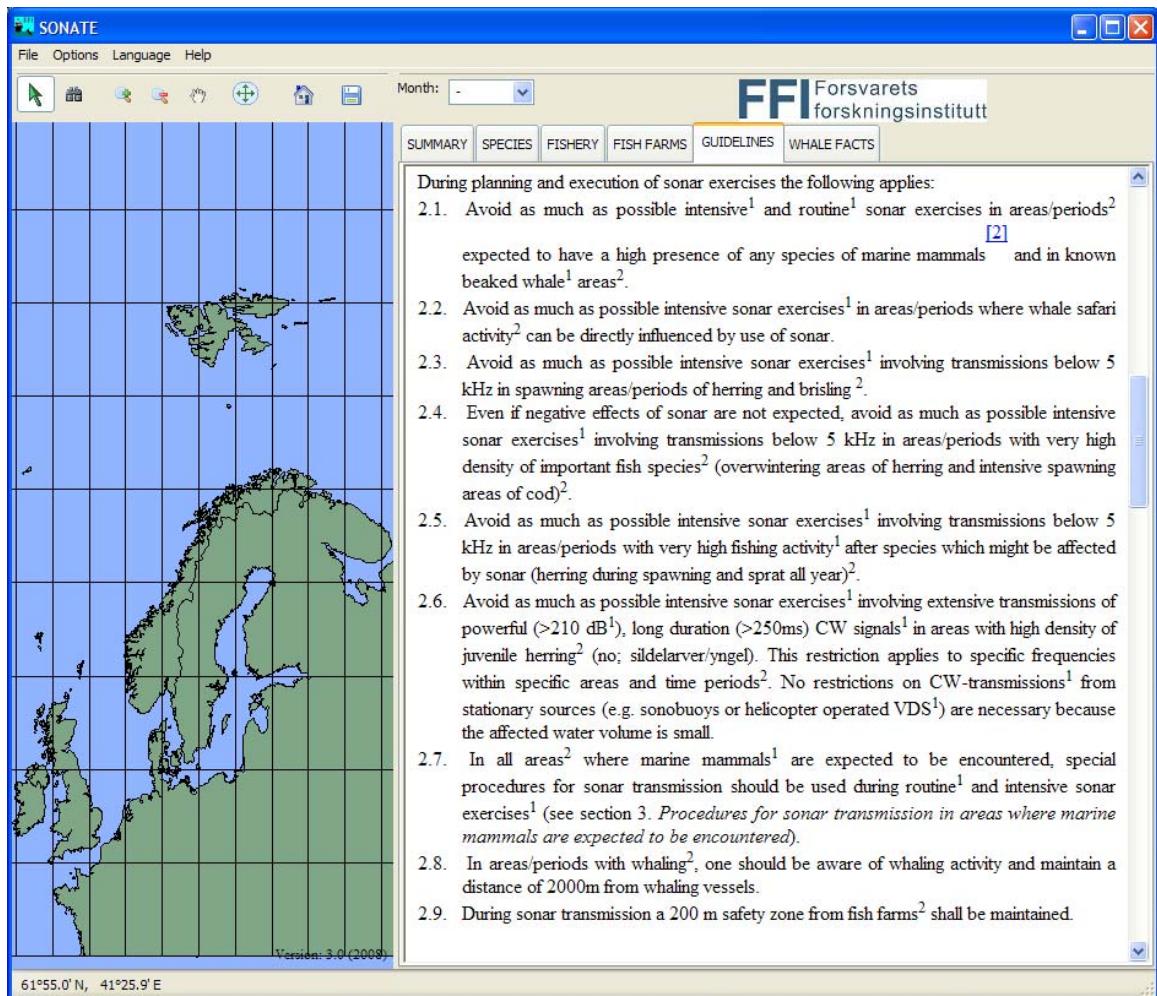
Figure 3.8   Example of the guidelines in SONATE

3.6 Whale facts

The *WHALE FACTS* tab is meant to support visual observers during exercises. The tab shows detailed visual and behavioural information about the whales. An example is shown in Figure 3.9.
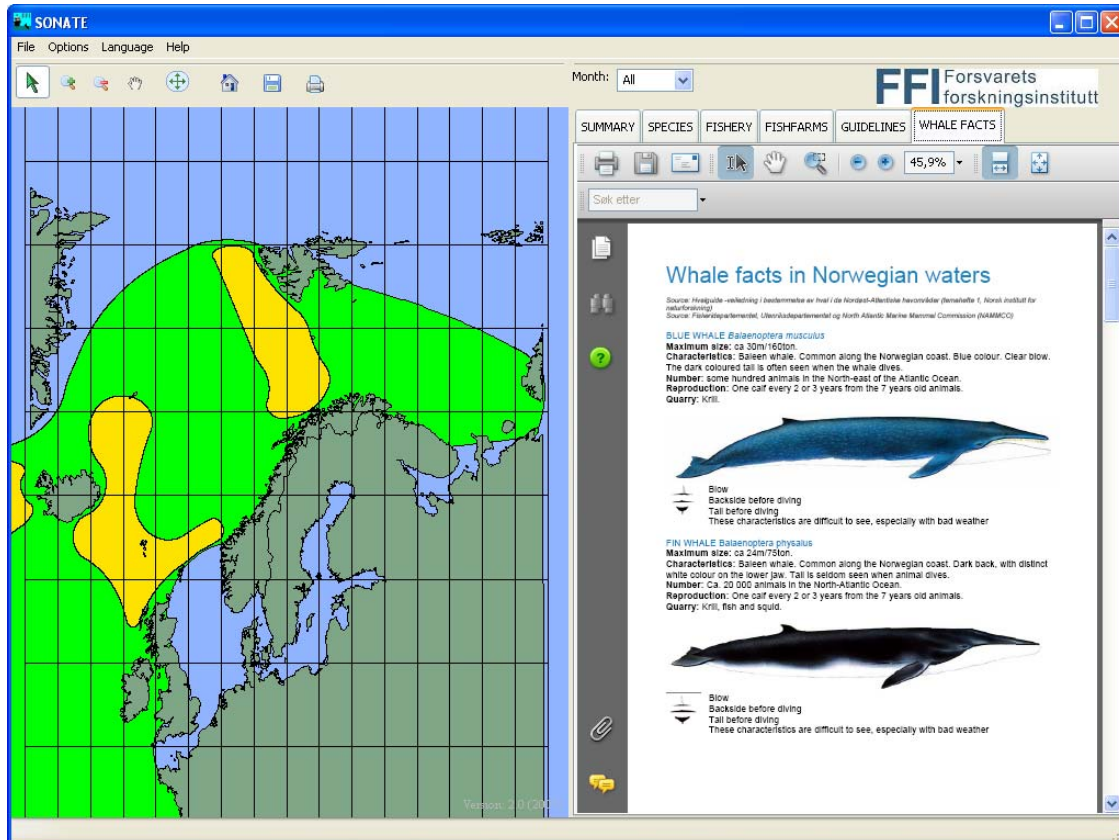

Figure 3.9   Example of the whale facts in SONATE. The map shows the distribution of the fin whale around the year

4 For the data manager: From input data files to a SONATE installation file

SONATE is programmed in python, with wxPython to take care of the graphical user interface. Geographical data are handled with POSTGRESQL (with postgis extension) database and hdf5 data format, and other database information is handled with sqlite. See Chapter 5 and Chapter 7.3 for a closer description. (More information on http://www.postgresql.org/ , http://postgis.refractions.net/ , http://www.python.org/ , http://www.sqlite.org/)

A program is made to take care of the processing of the data from input data format to make them ready for use in SONATE. This program is called *sonate_dbms.py*.

This program requires that you have POSTGRESQL with the postgis extension installed, and you will also need sqlite. See chapter 7.3 for a complete list of extensions and installations needed. The *sonate_dbms.py* has different modules to take care of the input data. The *Species* tab is used to read distribution data from shape files and export them to the SONATE databases. The *Fishery* tab is used to read data from an MS excel file containing fishing activity data and to export the data to the SONATE databases. The *Fishfarms* tab is used to read information on fish farms from an MS excel file and import the data to the SONATE databases. Finally, the *Map* and *Area* tab are used to read background maps from shape files to the SONATE databases.
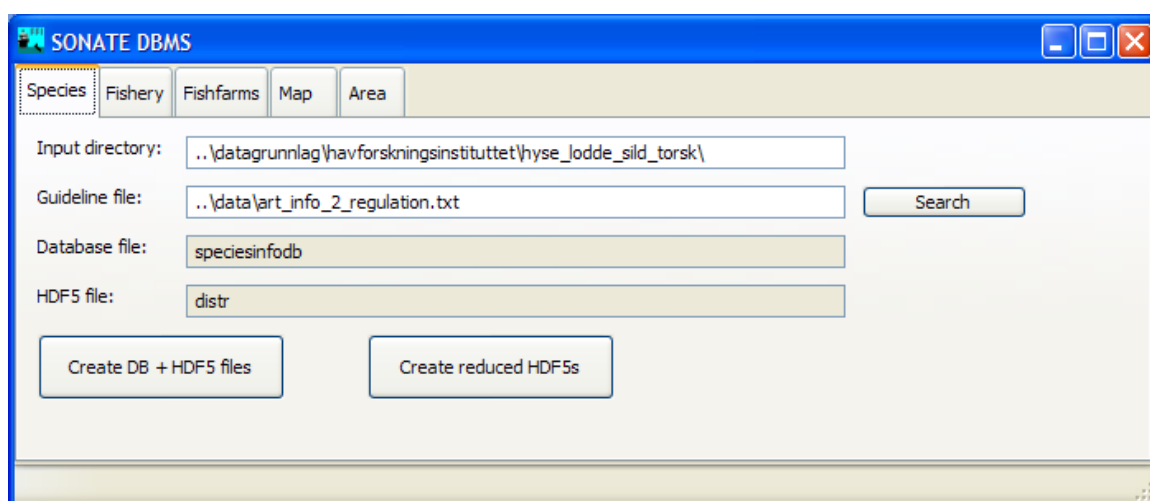

Figure 4.1   sonate_dbms.py consists of different modules

After exporting the data into the databases, SONATE can be tested by running sonate.py. To make an executable installation file, one runs setup.py.

4.1 Input to distribution maps

The distribution maps are obtained from IMR as shape files (ESRI-format). The coordinate-system used in the shape-files has been WGS84 or North Pole stereographic with WGS84 datum.

The input to SONATE must be North Polar Stereographic with WGS84 datum, so some of the shape-files have to be transformed prior to importing them to SONATE.

Normally the shape files are delivered with the fields shown in Table 4.1, but due to minor differences in the deliveries, especially the early deliveries, all shape-files have been reduced to contain only FID, Id, INFO, shape. This is because the software sets the field of the SONATE databases equal to the fields of the first shape file imported, so that all shape files must have the same fields, or the program will abort.

Prior to importing the data to SONATE, the files have to be organized in a well-defined structure, where the file path defines the species names and period, and the filename defines the mapinfo (if the file shows spawning areas, winter areas, juveniles, adults etc). See example in Figure 4.2. When the shape files are well organized, data are imported to the database by pressing the button *Create db + hdf5 files*. The drawback of this organization is that the same polygon is imported to the database several times (once for each month they are valid). The button *Create reduced HDF5s* organize the maps in the internal databases so that polygons are stored only once.

If a new type of mapinfo is introduced to the dataset, changes have to be made to the code in sonate_dbms.py. The connection between the *mapinfo* given in the *filename* and the *mapinfo* that appears in the SONATE application is hardcoded. See example in Textbox 1 below. The text marked in green is part of the filename; the text marked in yellow is the *mapinfo* that will appear in SONATE.

When a new species is added to the database, or to the set of shapefiles, this has to be added to the hardcoded list in sonate.py, where the dropdown menus for selecting species are defined. In addition to the shape files, a file is required that defines the connection between the *species*, *mapinfo* and *guideline number* (default file: art_info_2_regulation.txt). See Textbox 2.

Table 4.1 Fields in standard shape file delivery

Field	description
Id	unique ID
ATRSDATA	
DYREGRUPPE	group
ART	species
STADIUM	
STARTDATO	The distribution map is valid from this date
SLUTTDATO	to this date (MMDD)
INFO	
OPPDATERIN	date for updating of shape-file
MENGDE	amount
REFERANSE	reference
TETTHET	density
ARTSNAVN	species name
ARTSBESKRI	description
LATINSK_NA	latin name

Textbox 1 *The connection between the* mapinfo *given in the* filename *and the* mapinfo *that appears in the SONATE application is hardcoded. In Norwegian. Example: in filename: hoy_tetthet (high density) gives mapinfo 'Høy tetthet'. Translation to other languages is done elsewhere in the code.*

```
mappings = [('gyt','Gyting'),
                   ('NiseHoyTetthet',u'Høy tetthet'),
                   ('hoy_tetthet',u'Høy tetthet'),
                   ('MiddelsTetthet',u'Middels tetthet'),
                   ('beite','Beiteomr'),
                   ('egg','Egg'),
                   ('larve','Larver'),
                   ('yngle','Yngling'),
                   ('sild_larve_apr','Larver apr'),
                   (u'(4_år|4aar)',u'4 år og eldre'),
                   ('voksen','Voksen')]
```
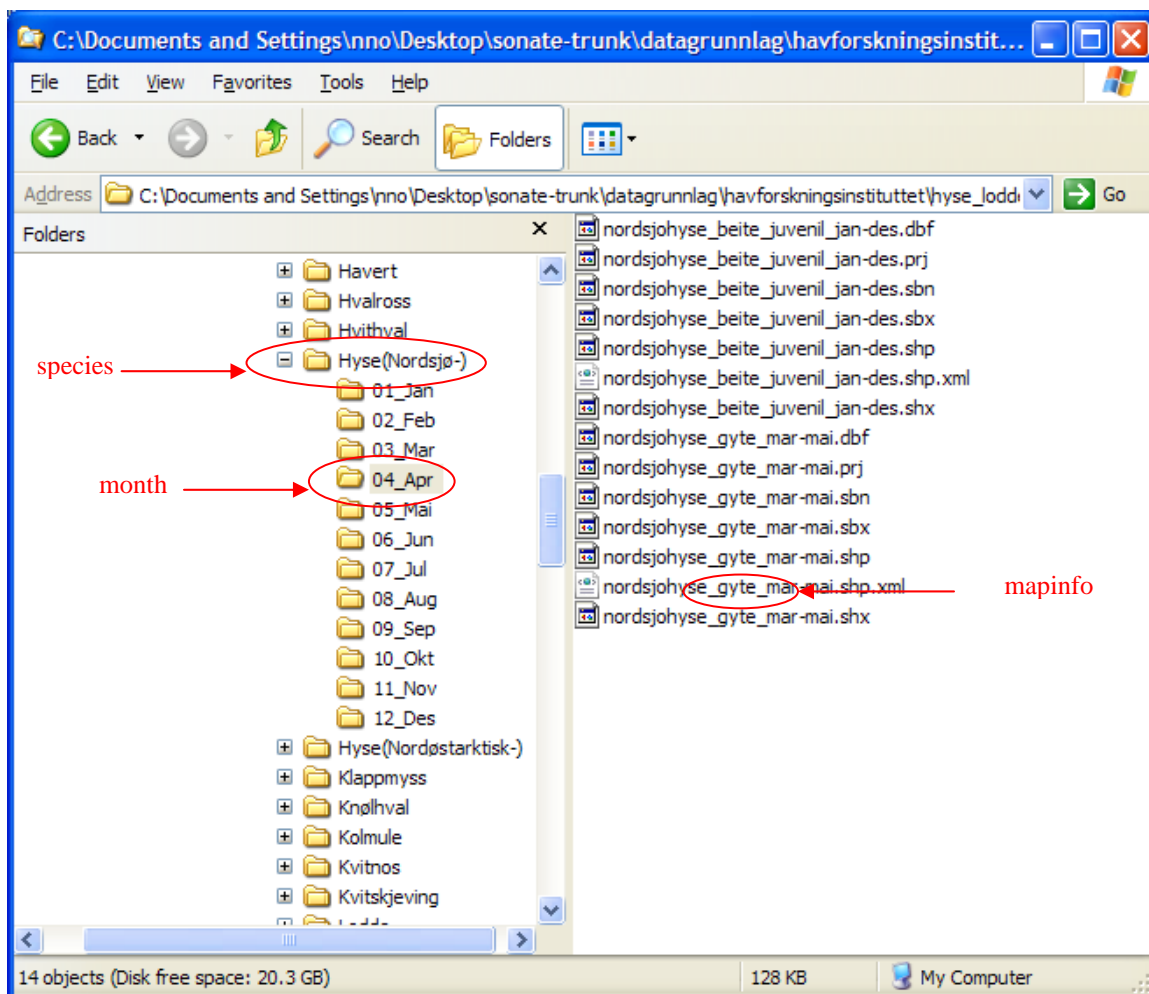
Figure 4.2   The input files for distribution maps are organized after species, month and mapinfo. "Beite" means feeding ground, "gyte" means "spawning area".

Textbox 2   Example of art_info_2_regulation.txt file. Species, mapinfo and guideline number

```
Brisling(Fjord-) Gyting 2.3(<5kHz)
Brisling Gyting 2.3(<5kHz)
Finnhval Beiteomr 2.7
Grønlandssel Hårfelling 2.7
Grønlandssel Kasting 2.1
Havert Kasting 2.1
Havert Hårfelling 2.7
Havert Koloni 2.7
Knølhval Beiteomr 2.7
Klappmyss Hårfelling 2.7
Klappmyss Kasting 2.1
Nebbhval Beiteomr 2.1
Nebbhval Utbredelse 2.7
```

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4.2 Calculation of fishing activity

The fishing activity input data is an MS excel file. The fishing activity data holds information on catch period, area, location, fishing tool, species (or groups of species), catch in kg and number of boats which have reported catch from the area.

If the content changes, or column number changes, the code of sonate_dbms.py has to be changed. See Chapter 5 For the programmer for closer description.

The guidelines recommend restrictions on use of sonar in areas with high fishing activity for vulnerable species or periods of vulnerability. High fishing activity areas are defined as locations where the catch per km^2 per month OR the number of boats per km^2 per month is above a threshold value.

The catch and number of boats per area is calculated in sonate_dbms.py, under the *Fishing* tab. In addition to the fishing activity data (as shown in Figure 4.4) a file containing the areas of the different locations is needed (AREA.XLS), and a file (default: fish_info_2_regulation2.txt) which sets the threshold values for recommending restrictions on use of sonar.

To perform the calculations of the fishing activity, first press the *Create DB + HDF5 files* button, this will import the data from the input files. Then press the *Create AVG DB* button, to calculate the average values for the last three years. This process updates the input files to SONATE and the file missing_areas.txt. The missing_areas.txt lists all locations from the input file that are missing in the map (default: fiskerilokasjonerf_33N.shp). A missing location can be caused by the facts that some catches are reported to be delivered from a location that not exists, or that the location number is not reported. The fishing activity data from non-existing locations are not used in the calculations.
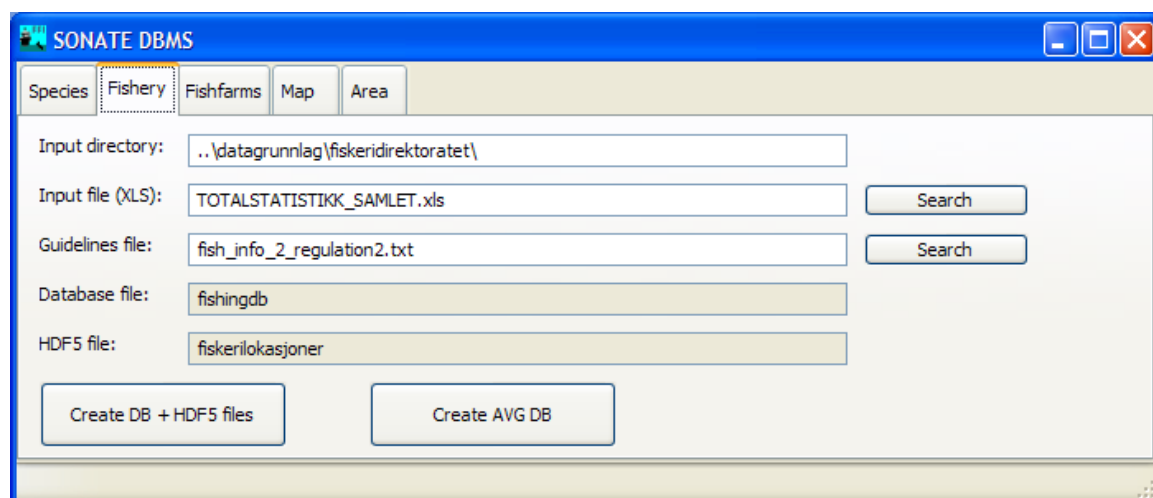

Figure 4.3 SONATE DBMS, the fishery tab.

Figure 4.4   Input to the fishing activity calculations (TOTALSTATISTIKK.XLS)

Textbox 3   The file fish_info_2_regulation.txt, which is input to sonate_dbms (the numbers in the catch/km^2 and the vessels/km^2 columns are the threshold values):

```
#This file is used by sonate_dbms.py to set guidelines to the
fishing activity data
#fish; month; catch/km2 ; vessels/km2; areas; guideline
Sild; 1,2,3    ; 250; 0.01; 7,6,0,5,37,4,39,12; 2.5
Sild; 7,8,9,10 ; 250; 0.01; 42,28,8          ; 2.5
Sild; 2,3,4    ; 250; 0.01; 28,9             ; 2.5
Brisling; All  ; 250; 0.01; All              ; 2.5
```

4.3   Importing the fish farm locations

The fish farm locations are imported from an excel file, which in turn are downloaded from http://www.fdir.no/fiskeridir/kystsone_og_havbruk/registre.
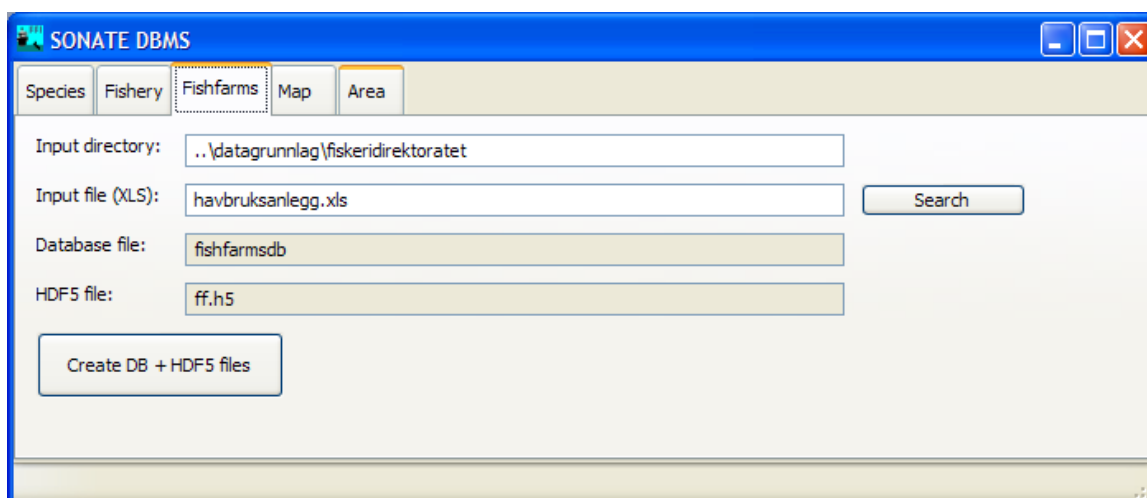

Figure 4.5   The Fishfarms tab in SONATE DBMS

SONATE DBMS reads data from the MS excel file and writes them to two database files that are used in SONATE. The positions are read from the two last columns of the excel file. See example in Figure 4.6.

Figure 4.6   Example of fish farms input to SONATE DBMS. Only some of the columns in the input file are shown

In SONATE the guideline number which applies in the vicinity of fish farms are read from the fishfarms.txt. See Textbox 4.

Textbox 4   The content of the file that defines guideline number that applies in the vicinity of the fish farms:

```
2.9
```

4.4   Creating a new installation file, and the different modes of SONATE

A new executable installation file is made by means of the setup.exe.
(usage: `python setup.py py2exe`). Depending on the mode defined in sonate.ini, the installations file will be in either of the modes described in Table 4.2. The sonate.ini also gives the possibility to change some of the colors in the SONATE window and change the screen dimension. The grid step is the intervals in degrees shown on the map display. The sonate.ini file is shown in Textbox 5. The USER_MODE controls which tabs to be visible in SONATE. Table 4.2 gives an overview.

Textbox 5 The sonate.ini file

```
BACKGROUND_COLOR = (144, 180, 255)
LAND_COLOR = (127, 166, 135)
GRID_COLOR = (0, 0, 0)
GRID_STEP = 5
SELECTION_COLOR = (0, 255, 255)
SCREEN_DIMENSIONS = (1024, 768)
USER_MODE = -1    #-1: normal; -11: all; 0: operational (not all details about species) ; 1:
planning (not "facts about whales" and fishfarms); 2 : track mode
```

Table 4.2   Overview of the different USER_MODEs

SUMMARY SPECIES FISHERY FISHFARMS GUIDELINES WHALE FACTS TRACK	USER_MODE = -11 All
SUMMARY SPECIES FISHERY FISHFARMS GUIDELINES WHALE FACTS	USER_MODE = -1 Normal
SUMMARY FISHFARMS GUIDELINES WHALE FACTS	USER_MODE = 0 Operational mode
SUMMARY SPECIES FISHERY GUIDELINES	USER_MODE = 1 Planning
TRACK WHALE FACTS	USER_MODE = 1 Track

The track mode also gives the possibility to load a detailed map of an area, or another map adjusted to the track data. The map file must be on hdf5 format. To load a new map, select from the menu: File – Load map.

5   For the programmer

The SONATE software is developed using the object oriented software engineering. Therefore the software description will be shown by means of Unified Modeling Language (UML) diagrams. The application is developed by FFI (Norwegian Defence Research Establishment) for the Norwegian Defence. The data on fish, marine mammals, fishing activities, and fish farms is received from other institutions.

The software can be split in a number of software packages (see Figure 5.1). The main application the users will use is the SONATE application. This application uses the SONATE Database. The databases are created by means of the SONATE Database package. This package uses the environmental information delivered by the other institutions, together with the guidelines, to create new versions of the SONATE databases.
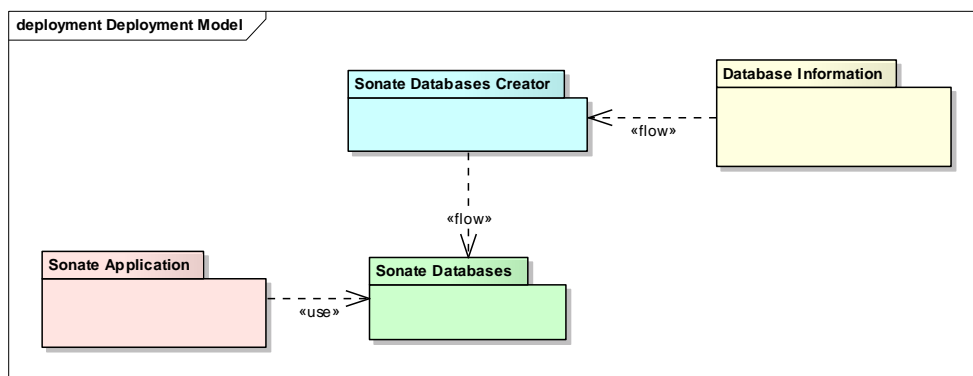

Figure 5.1   The deployment model of the SONATE application

The main idea is to develop the SONATE application such that no commercial tools are needed to run this application. This leads to the fact that the databases are stored in open source databases and file formats. Furthermore, the applications are developed in Python which is an open source development environment.

The database and information that are used to create these databases can be in other formats (e.g. MS Excel, ArcGIS shape files).

5.1   SONATE application

SONATE is a windows based application that focuses on presenting data on a geographical display. Any detailed information is always shown in tables. Figure 5.2 shows the schematic structure of the application. The main SONATE window has a menu bar at the top and a status bar at the bottom. The window is split into two parts: 1) the SONATE frame showing the map information, and 2) the SONATE notebook showing the detailed (textual) information.

The SONATE frame also contains a toolbar to interact with the visualised map.

The main SONATE can create a help dialog to show the supporting help of the application. The application support multi languages, to support users from other countries to be able to use the application.
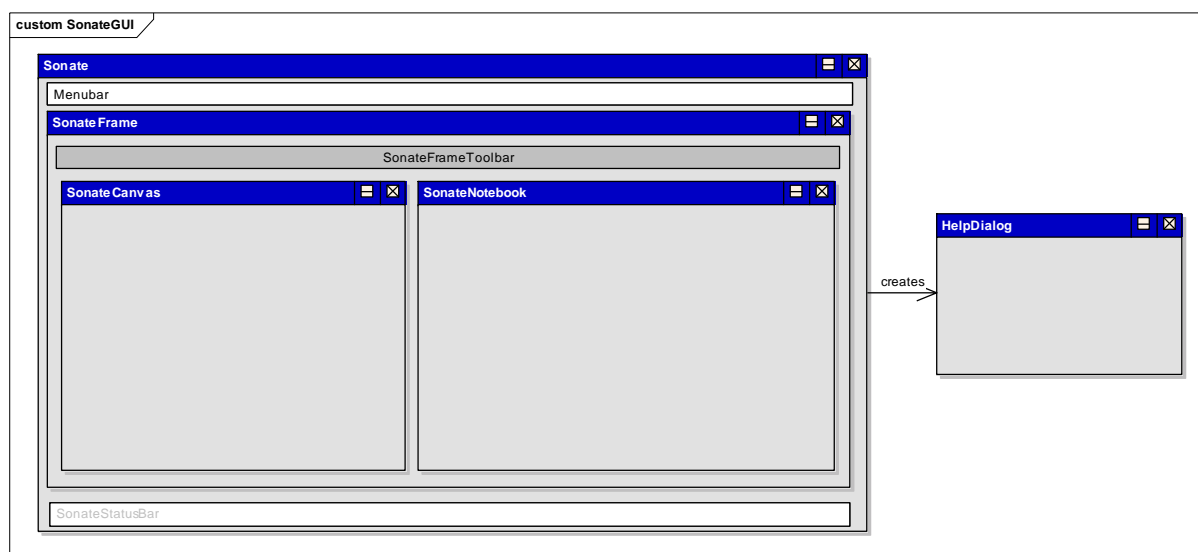
Figure 5.2   Graphical user interface structure

5.2   Software architecture

The SONATE application uses external databases to retrieve data from, so the application is a client of the databases (see Figure 5.3). The application will interact with these databases all the time, so only the required information is retrieved from the database and stored in the memory. The application also supports several user modes for the different users: 1) sonar planner, 2) sonar

operator, and 3) scientific user. Depending on this mode, functionality will be enabled in the user interface. For instance the visual whale facts will only be displayed for the sonar operators and scientific users and not to the planner.
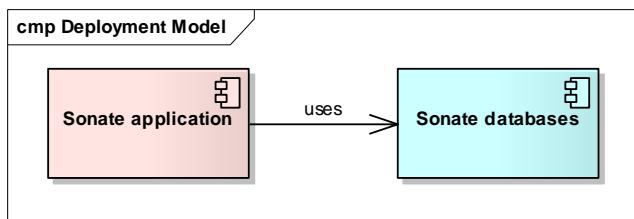

Figure 5.3   Architecture of the SONATE application

5.3   Software design of SONATE

The design of the SONATE application has been made after the code was written. Figure 5.4 and Figure 5.5 shows the object diagram (in UML) of the SONATE application. The *SonateApp* is the main application object to start.

This application creates the *SonateFrame*. This object creates the *SonateCanvas* and *SonateGridPanel* and gives them to the *SonateSplitter* to enable a split window view. The *SonateFrame* can also create *SonateTransientPopup* and *SonateHelpDialog* dialogs to show more information to the user. The *SonateFrame* sets up the connection to the databases and retrieve the most important information.

The *SonateGridPanel* contains a *SonateNotebook* containing tabs of information; summary map, species map, fishery map, fish farms map, guidelines, and whale facts. Depending on the user mode, these information tabs are created. Each of the tabs can also contain a number of tables (grids). These are created during the initialisation of the notebook.
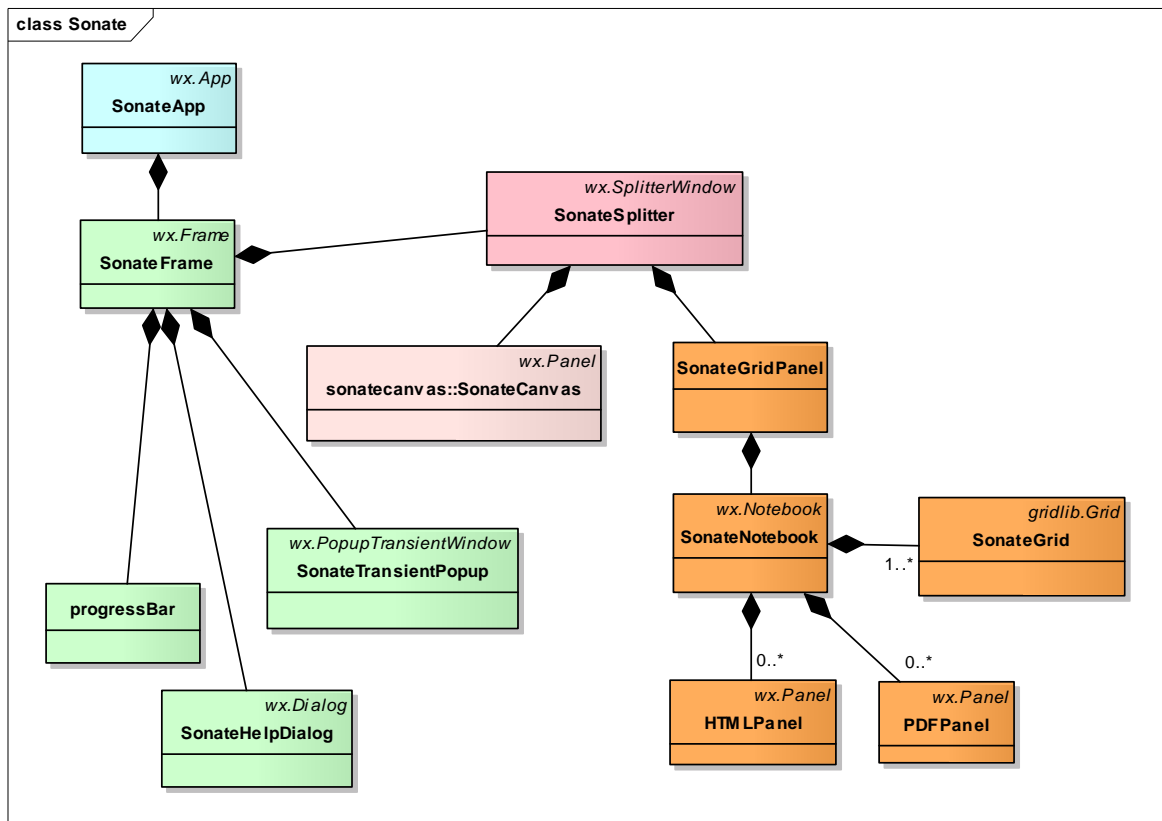
Figure 5.4   Object model of the SONATE application

There are different grids that can be visualised on the notebook. The following diagram shows all grids that are available.
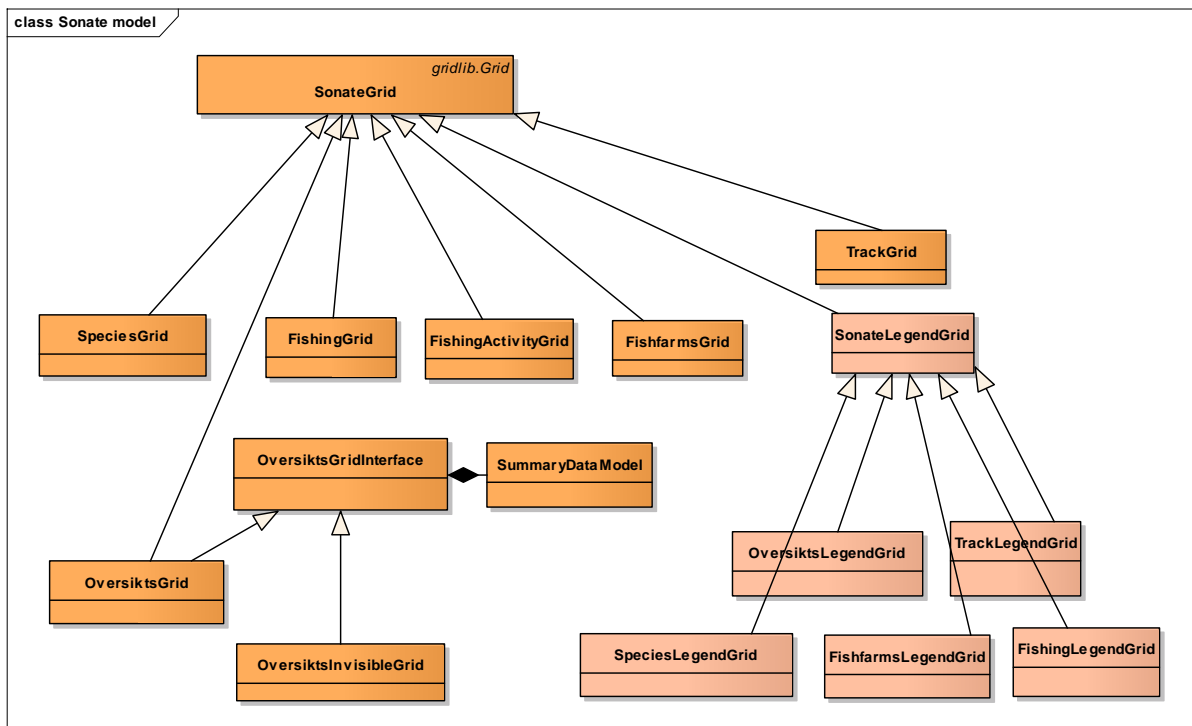

Figure 5.5   Object model of the different grids which can be attached to the notebook

In the SONATE application a large set of databases are used. Figure 5.6 shows all databases and other files that are used by the SONATE application. The HDF5 files (*.h5) contain the location and shape/contour information. The databases (colored green) contain more information about species, fishing activities, and fish farms. These databases refer to the HDF5 files to indicate the locations.

The text files are used in the display of the application to define the colors and corresponding description. The regulations text file describes the regulations, the color coding, and guideline importance. This file is used in the *SUMMARY* and *SPECIES* Tab. The fishery.txt file describes the legend of the fishing activity and the color coding and link to the regulations. This file is only used in the Fishery tab. When the guidelines change, these files need also to be updated.
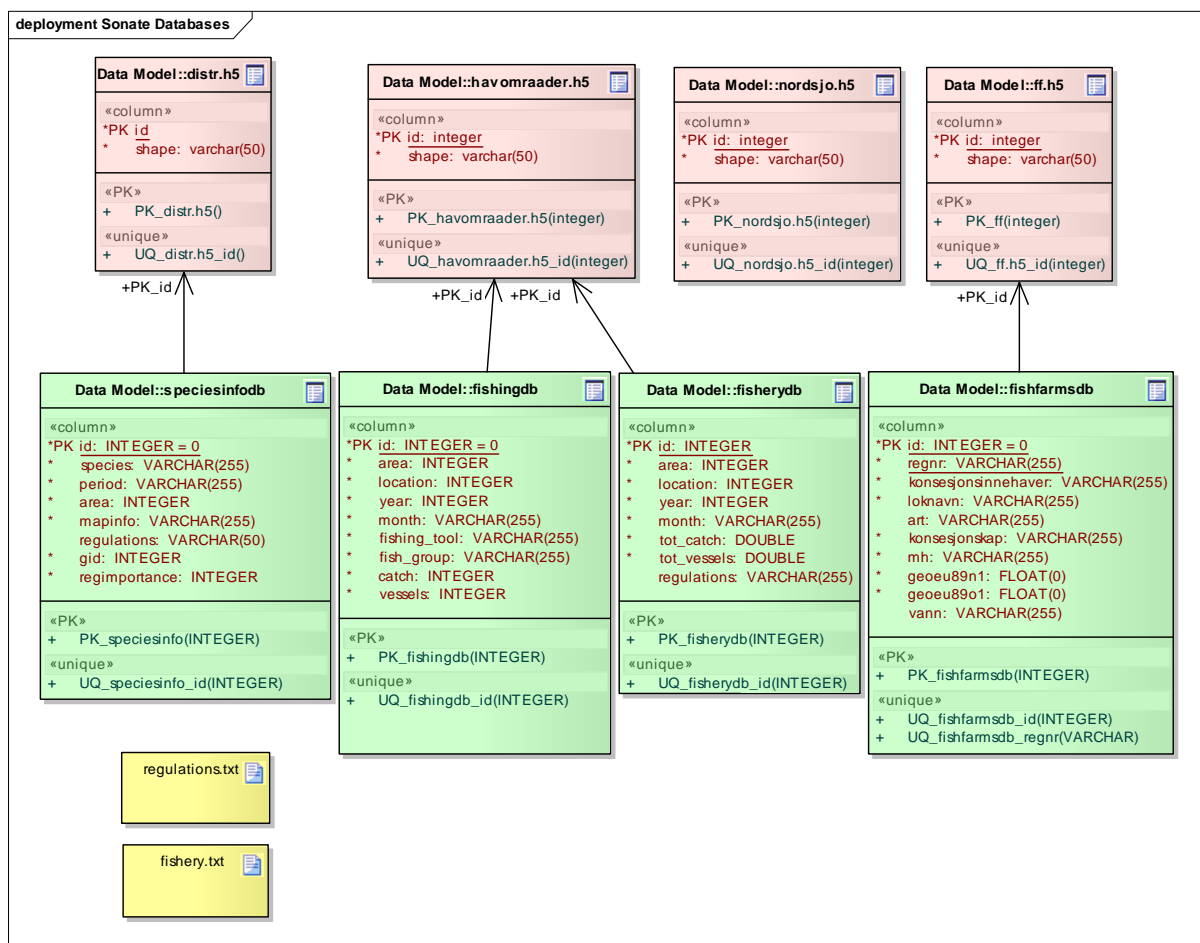
Figure 5.6   Database model of the SONATE application

5.4   Implementation

The SONATE application is written in Python (version 2.4) and uses *wx.Python* do create the graphical user-interface. In the implementation the standard python coding styles is used (http://www.python.org/doc/peps/pep-0008). The application uses SQLite database (http://www.sqlite.org/index.html) to retrieve the information from. The geographical information

is stored in HDF5 format (a general purpose library and file format for storing scientific data (http://www.hdfgroup.org/).

The default setting and user mode are selected in the *sonate.ini* file. This file is loaded during the start of the application and overrules the initial settings in the code. The file format is written in the python language format.

The setup/installation executable is created by means of the *InnoSetup* compiler and the py2exe script. The script creates the SONATE executable and the compiler collects all relevant input files and executable and composes the installation file.

5.5   Testing

Before a release of the software is distributed, a large number of tests are performed. The testing of the application is done on four levels:
1. programmers test,
2. data test,
3. internal software test,
4. external user test.

The programmers develop the python software and test the implementation by looking at the functionality and the specified requirements. These tests are mainly done by debugging the code.

The data tests are very important, since they focus on the correctness of the databases and the interaction between the application and the databases. It also focuses on the correctness of the translation of the external input data into the internal databases.

The internal software tests are performed by the people within FFI (not the programmers, but some times the users), to check the functionality and user interaction. They focus in whether the application is user friendly and intuitive. They also check whether the application will give the expected results.

After the application is tested within the FFI organisation, the first version is sent to a selected group of users to check the databases and whether the tool reflects their idea of how the application should function. This user group will do the beta testing of the application. When they accept the version, a new release can be created.

5.6   Updating guidelines

When the guidelines are changed, the developer also needs to update the following file:
regulations.txt
fishery.txt
regulations#.pdf

The text files are used in the user-interface to color-code different guidelines. In these files, every guideline should be described.

Note that the SONATE application assumes that the guideline numbers are defined as "#.#" where each # is one digit/letter. When longer numbers are used, the program will not distinguish between the last digits/letters.

5.7 SONATE database creation application

This application focuses on the creation of the databases and supporting files that are used by the SONATE application. It uses external input data to create the internal data, and mainly transfers data in commercial formats to open-source databases and formats.
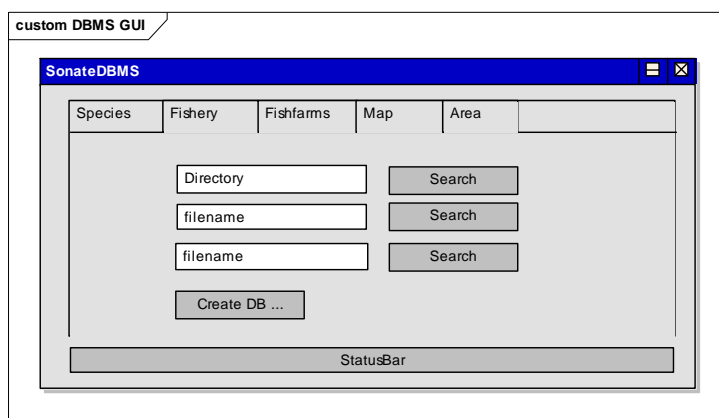
Figure 5.7 Example user interface of the SONATE DBMS application

The user-interface consists of five tabs: *Species*, *Fishery*, *Fish farms*, *Map* and *Area*. Each tab contains some text fields in which files can be specified. The search buttons can be used to select a file with a file selector. Below the text fields, the buttons are placed to create the output files.

At the bottom of the windows a status bar is placed to indicate the progress of the creation process.

5.8 Software design of SONATE DBMS

The design consists of an application that has a main frame containing a notebook and progress bar (see Figure 5.8).
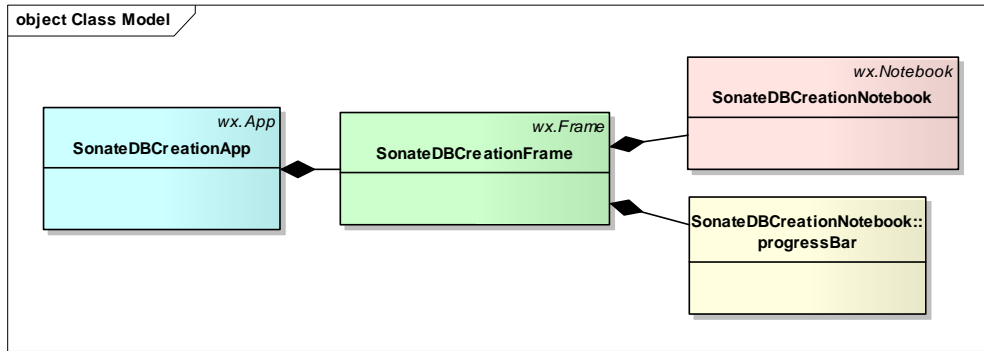
Figure 5.8   Object model of the SONATE DBMS application

The following diagrams show the dataflow within the SONATE DBMS. Figure 5.9 shows the creation of the *speciesinfodb* (SQLite) database and the corresponding *distr.h5* (HDF5) file. The creation process uses the Postgress Database (*distrinfo.pql*), a large number of shape files (*species_###.shp*), and a file describing the guidelines in combination with the related species (*art_2_regulations.txt*). In the diagram also the tables in the database are shown.
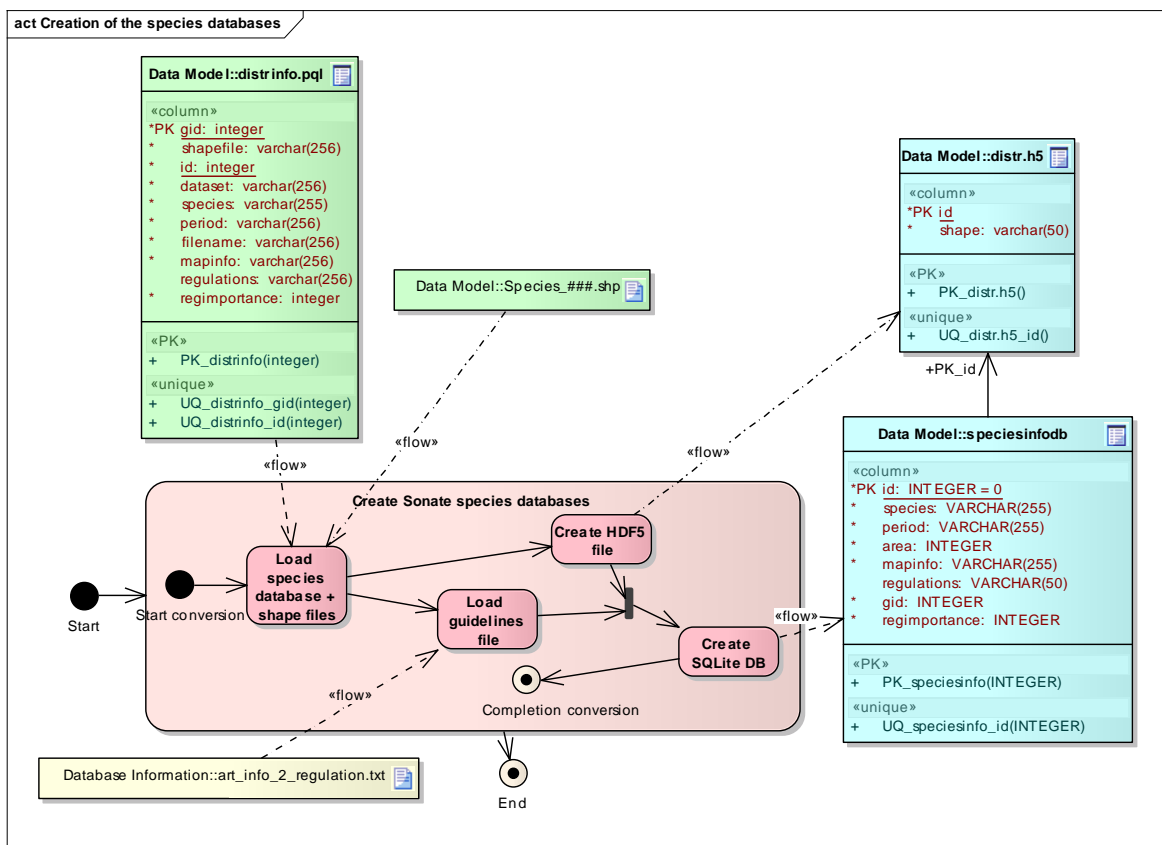
Figure 5.9   Activity diagram of the creation process of the species databases

The fishery databases (fishingdb and fisherydb) and shape file (havomraader.h5) are created by means of a similar process. Figure 5.10 shows the activity diagrams of this creation process. Within the Create Summary fishery database the total catch of each fish group is summed and divided by the fishing area size (km²). In the Link guidelines activity, the average catch of the last

three years is determined and the appropriate guidelines are specified in the database. The data is stored with year=9999 in the database.
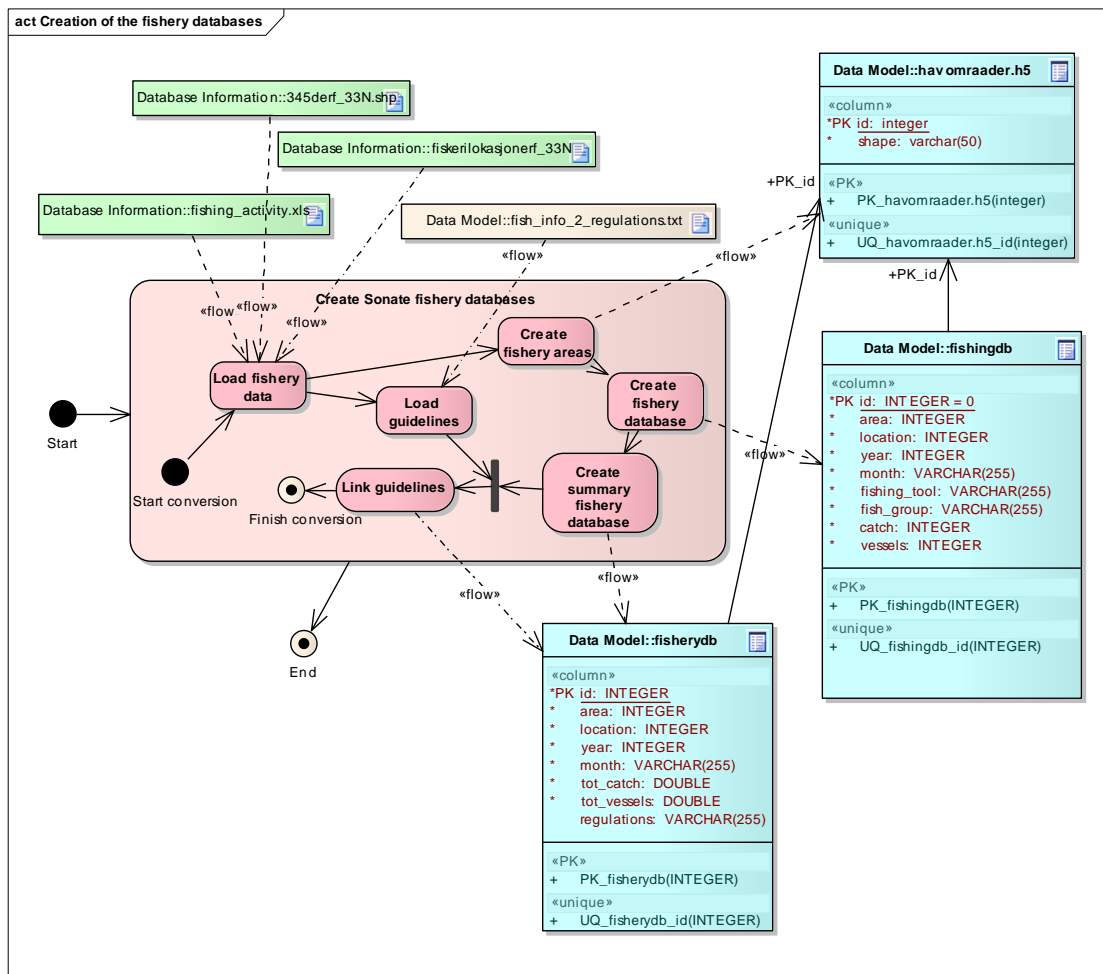
Figure 5.10   Activity diagram of the creation of the fishery databases

The creation of the fish farms database (*fishfarmsdb*) and position file (*ff.h5*) is very simple and similar. Figure 5.11 shows the activity diagram. All information of the fish farms is read from the *fishfarms.xls* file. In the fish farms database no guideline numbers are stored since there is only one regulation that holds for all fish farms.

Figure 5.11   Activity diagram of the creation process of the fish farms database and position file

6   Status and future developments

SONATE has now been in use by the Norwegian Navy for about one year.

During this period we have had discussions with the users and received feedbacks on how SONATE is working. Many of the reported problems have been po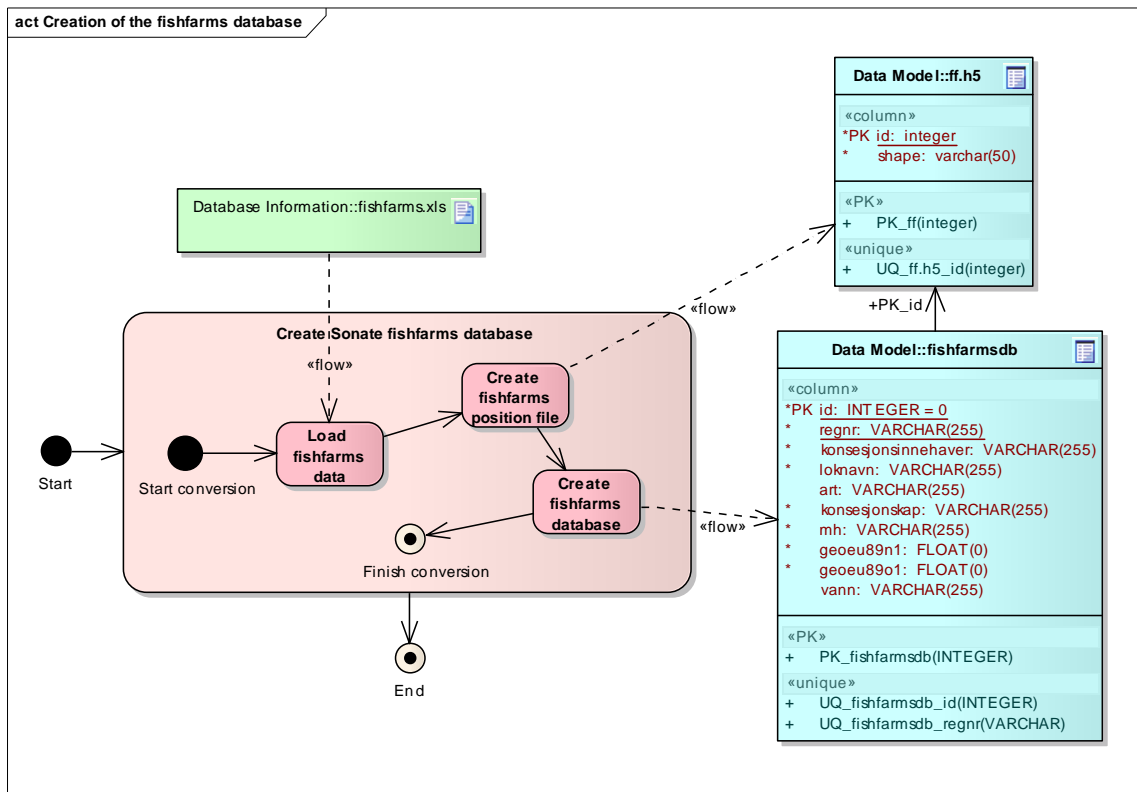ssible to correct, but a few has not been possible to solve due to the chosen technical solution. The major negative feedback we have received is that SONATE is working to slow. This is a problem we have been trying to solve, but as the amount of data in the programs database has increased, so has the response time. The working speed of SONATE is therefore an important topic for the future development of the tool.

Other important demands for future development are the possibility to show all the different maps in the same view (species distributions, fishing activity, fish farms etc), more flexibility in how to show the maps, a legend in the map, more colors to distinguish the different map details, and at last we want a more streamlined update procedure than we have today, where FFI manually collects the data from the data suppliers and format it to fit into the SONATE database.

The Norwegian Defence uses other geographical information tools today (e.g. MARIA), and we will look into the possibility to integrate SONATE with these. This will give the users a well known user interface, and distribution of the product will be simplified. We are currently considering if the future requirements are possible to implement within the current software platform, or if alternative solutions are mandatory.

7 Appendices

7.1 Appendix – files in src folder and data folder

Table 7.1   source folder

`build`	
`dist`	folder
`floatcanvas`	folder - The FloatCanvas is a high level window for drawing maps and anything else in an arbitrary coordinate system.
`sonatecanvas`	folder
`missing_areas.txt`	Missing areas in the AREA.xls – locations that occur in AREA.xls but not exist as an location in the file havomraader.shp. Output from sonate_dbms.py
`postgis.py`	makes connection to the postgis database
`readtracks.py`	used when sonate is in track mode. Reads track from track file.
`setup.py`	run to make installation file
`sonate.py`	the main program
`sonatedbcreation.py`	used in SONATE DBMS
`sonate_dbms.ini`	setting default paths for files in SONATE DBMS
`sonate_dbms.py`	tool for creating databases to SONATE
`sonate_image.png`	icon

Table 7.2   data folder

`art_info_2_regulation.txt`	defines the connection between the species, mapinfo and guideline number
`distr.h5`	the geometry table – distribution maps
`distr_boundingbox.h5`	bounding box for distr
`distr_small.h5`	reduced version of distr, only one version of each polygon
`ff.h5`	fish farms table
`FFI-logo.bmp`	icon used in SONATE
`find.bmp`	icon used in SONATE
`fishery.txt`	defines the legend and intervals of fishing activity
`fisherydb`	the fishing actvity database table, output from SONATE DBMS, input to SONATE (SQLITE)
`fishfarms.txt`	defines the guidelines number that applies in vicinity of fish farms, see Textbox 4
`fishfarmsdb`	the fish farms database, used in SONATE DBMS to create input table to SONATE (SQLITE)

`fishingdb`	the fishing actvity database table, output from SONATE DBMS, input to SONATE (SQLITE)
`fish_info_2_regulation2.txt`	defines the threshold values for recommending restrictions
`fiskerilokasjoner.h5`	table of fishing locations
`hand.bmp`	icon used in SONATE
`havomraader.h5`	table of fishing zones
`help0.pdf`	help file in Nowegian, found under the HELP menu in SONATE
`help1.pdf`	help file in English, found under the HELP menu in SONATE
`help2.pdf`	help file in English, found under the HELP menu in SONATE, used in Dutch mode
`home.bmp`	icon used in SONATE
`id_mapping.h5`	only for internal use, used in "Reduce species database", used in combinaton with distr_small.h5
`mfc71.dll`	dll file needed for SONATE to run properly
`msvcp71.dll`	dll file needed for SONATE to run properly
`msvcr71.dll`	dll file needed for SONATE to run properly
`nordsjo.h5`	background map
`pointer.bmp`	icon used in SONATE
`printer.bmp`	icon used in SONATE
`regulations.txt`	defines the legend of the overview map, colors, guidelne number and key words, and the drawing order
`regulations0.html`	the regulations in Norwegian, found under the regulations tab in SONATE
`regulations1.html`	the regulations in English, found under the regulations tab in SONATE
`regulations2.html`	the regulations in English, found under the regulations tab in SONATE, used in dutch mode
`save.bmp`	icon used in SONATE
`sonate.ico`	icon
`sonate.ini`	defines map colors, user mode
`sonate_dbms.ini`	defines initial settings of the SONATE DBMS
`sonate_image.png`	icon used in SONATE
`speciesinfodb`	species information table
`vestfjordendetalj.h5`	detailed map of Vestfjorden. Can be imported when in track mode.
`whaleinfo0.pdf`	whale facts in Norwegian, found under the Whale Facts tab in SONATE
`whaleinfo1.pdf`	whale facts in English, found under the Whale Facts

	tab in SONATE
`whaleinfo2.pdf`	whale facts in Dutch, found under the Whale Facts tab in SONATE
`zoomfit.bmp`	icon used in SONATE
`zoomin.bmp`	icon used in SONATE
`zoomout.bmp`	icon used in SONATE

7.2 Appendix – file descriptions

7.2.1 fishery.txt

fishery.txt defines the colors used in the fishing activity maps, the intervals and text describing the guideline:

```
=        ;  FF9F00; =      ; FF9F00; 2.5, sild og brisling; 2.5, herring and sprat;
2.5, haring en sprot;
0        ;  90B4FF; 0      ; 90B4FF; -; -; -;
   1 - 99;  00FF00; 1-3    ; AB82FF; -; -; -;
 100 -199;  00D600; 4-6    ; 9966CC; -; -; -;
 200 -249;  00AA00; 7-9    ; 912CEE; -; -; -;
```

7.2.2 fish_info_2_regulation2.txt

```
#This file is used by sonate_dbms.py to set guidelines to the fishing activity data
#fish; month; catch/km2 ; vessels/km2; areas; guideline
Sild; 1,2,3   ; 250; 0.01; 7,6,0,5,37,4,39,12; 2.5
Sild; 7,8,9,10 ; 250; 0.01; 42,28,8        ; 2.5
Sild; 2,3,4   ; 250; 0.01; 28,9           ; 2.5
Brisling; All  ; 250; 0.01; All           ; 2.5
```

7.2.3 regulations.txt

guideline number; color; Norwegian keywords; English keywords; Dutch keywords:

```
2.1; 8; C90000;alle øvelser - sjøpattedyr;all exercises - marine mammals;vermijd alle oefeningen - zeezoogdieren;
2.2; 7; FF5400; intensive øvelser - hvalsafari; whale safari; safari
2.3; 6; FF9F00;intensive øvelser < 5kHz - sild/brisling; intensive exercises < 5kHz - herring/sprat; intensive
oefeningen < 5kHz - haring/sprot
2.4; 5; FF9F00;intensive øvelser < 5kHz - viktige fiskearter; intensive exercises < 5kHz;intensive oefeningen < 5kHz
2.5; 4; FF9F00; intensive øvelser < 5kHz - høy fiskeriaktivitet; intensive exercises < 5kHz;intensive oefeningen <
5kHz
2.6; 3; FFE300; restriksjoner på lange CW-signaler - fiskeyngel; restrictions on CW-transmissions - juveniles;
restricties op CW-uitzendingen - volwassen vis;
```

2.7; 2; FFE300; sjøpattedyr - restriksjoner; marine mammal restrictions;zeezoogdierrestricties;

2.8; 1; FFE300; sikkerhetsavstand til hvalfangstfartøy; safety zone - whaling; veiligheidszone - walvisvangst

7.2.4   art_info_2_regulation.txt

Species name in Norwegian; mapinfo; guideline number and critical frequency band

```
Brisling(Fjord-) Gyting 2.3(<5kHz)
Brisling Gyting 2.3(<5kHz)
Finnhval Beiteomr 2.7
Grønlandssel Hårfelling 2.7
Grønlandssel Kasting 2.1
Havert Kasting 2.1
Havert Hårfelling 2.7
Havert Koloni 2.7
Knølhval Beiteomr 2.7
Klappmyss Hårfelling 2.7
Klappmyss Kasting 2.1
Nebbhval Beiteomr 2.1
Nebbhval Utbredelse 2.7
Nise Høy tetthet 2.7
Sild(Fjord-) Gyting 2.3(<5kHz)
Sild(Nordsjø-) Gyting 2.3
Sild(NorskVårGytende-) Gyting 2.3(<5kHz)
Sild(NorskVårGytende-) Larver mai 2.6(3-6kHz) 5
Sild(NorskVårGytende-) Larver apr 2.6(3-6kHz) 4
Sild(NorskVårGytende-) Larver jun-jul 2.6(2-5kHz) 6,7
Sild(NorskVårGytende-) Larver aug-sep 2.6(1.5-3kHz) 8,9
Sild(NorskVårGytende-) Overvintringsomr 2.4
Safari Safari 2.2
Spermhval Beiteomr 2.1
Spermhval Middels tetthet 2.7
Spekkhogger Høy tetthet 2.1
Spekkhogger Middels tetthet 2.7
Steinkobbe Koloni 2.7
Steinkobbe Hårfelling 2.7
Steinkobbe Kasting 2.1
Torsk(Nordøstarktisk-) Gyting 2.4
Hvalfangst Sporadisk aktivitet 2.8
Hvalfangst Lav aktivitet 2.8
Hvalfangst Sporadisk aktivitet 2.8
Hvalfangst Moderat aktivitet 2.8
Vågehval Beiteomr 2.7
```

7.3   Installations needed

The following batch file gives an overview of the installations needed, and web-adresses for downloading:

```
# Cygwin: http://www.cygwin.com
# You need cygwin with wget and unzip installed in order to run this script
# To run type: sh get_dependencies.sh in cygwin

mkdir dependencies
cd dependencies
# Subversion: http://subversion.tigris.org
#wget http://subversion.tigris.org/files/documents/15/25364/svn-1.2.3-setup.exe
# Python 2.4: http://www.python.org
wget http://www.python.org/ftp/python/2.5.1/python-2.5.1.msi
# matplotlib: http://matplotlib.sourceforge.net
# wget http://kent.dl.sourceforge.net/sourceforge/matplotlib/matplotlib-0.90.1.win32-py2.5.exe
```

```
wget http://kent.dl.sourceforge.net/sourceforge/matplotlib/basemap-0.9.5.win32-py2.5.exe
# Numarray: http://www.stsci.edu/resources/software_hardware/numarray
wget http://kent.dl.sourceforge.net/sourceforge/numpy/numarray-1.5.2.win32-py2.5.exe
# Numeric: http://sourceforge.net/projects/numpy
wget http://kent.dl.sourceforge.net/sourceforge/numpy/numpy-1.0rc2.win32-py2.5.exe
wget http://kent.dl.sourceforge.net/sourceforge/numpy/numpy-1.0.3.win32-py2.5.exe
# HDF5: http://hdf.ncsa.uiuc.edu/HDF5
wget ftp://ftp.ncsa.uiuc.edu/HDF/HDF5/prev-releases/hdf5-1.6.4/bin/windows/5-164-win-net.ZIP
#wget ftp://ftp.ncsa.uiuc.edu/HDF/HDF5/current/bin/windows/5-165-win-net.zip
wget ftp://ftp.ncsa.uiuc.edu/HDF/lib-external/szip/2.0/bin/windows/xp-net/szip20-win-xpnet-enc.tar.gz
#wget ftp://ftp.ncsa.uiuc.edu/HDF/lib-external/szip/2.0/bin/windows/xp-net/szip20-win-xpnet-noenc.tar.gz
# PyTables: http://pytables.sourceforge.net
wget http://kent.dl.sourceforge.net/sourceforge/pytables/tables-2.0.win32-py2.5.exe
# pysqlite (2.x) and psycopg (2.x): http://initd.org
# see also http://stickpeople.com/projects/python/win-psycopg/
wget http://stickpeople.com/projects/python/win-psycopg/psycopg2-2.0.6.win32-py2.5-pg8.2.4-release.exe
wget http://initd.org/pub/software/pysqlite/releases/2.3/2.3.5/pysqlite-2.3.5.win32-py2.5.exe
# SQLite: http://www.sqlite.org
wget http://www.sqlite.org/sqlitedll-3_4_2.zip
# wxPython 2.6: http://www.wxpython.org (see vendorsrc/ for required patch)
wget http://kent.dl.sourceforge.net/sourceforge/wxpython/wxPython2.8-win32-unicode-2.8.4.2-py25.exe
wget http://kent.dl.sourceforge.net/sourceforge/wxpython/wxPython2.8-win32-docs-demos-2.8.4.2.exe
# py2exe: http://www.py2exe.org
wget http://kent.dl.sourceforge.net/sourceforge/py2exe/py2exe-0.6.6.win32-py2.5.exe
# Inno Setup: http://www.jrsoftware.org/isinfo.php
# current version: 5.1.6 \ 5.1.14
wget http://www.jrsoftware.org/download.php/is.exe?site=3
# PostgreSQL: http://www.postgresql.org
# PostGIS: http://www.postgis.com
wget
http://wwwmaster.postgresql.org/redir?ftp%3A%2F%2Fftp.no.postgresql.org%2Fpub%2Fdatabases%2Fpostgresql%2Fbinary%
2Fv8.1.2%2Fwin32%2Fpostgresql-8.1.2-1.zip
wget http://wwwmaster.postgresql.org/download/mirrors-ftp?file=%2Fbinary%2Fv8.2.4%2Fwin32%2Fpostgresql-8.2.4-1.zip
# Python Imaging Library (PIL): http://www.pythonware.com/products/pil/
wget http://effbot.org/downloads/PIL-1.1.6.win32-py2.5.exe
# Python "xlrd" package for extracting data from Excel files:
# http://www.lexicon.net/sjmachin/xlrd.htm
wget http://www.lexicon.net/sjmachin/xlrd-0.6.1.win32.exe
wget ftp://ftp.ncsa.uiuc.edu/HDF/lib-external/zlib/1.2/bin/zlib122-windows.tar.gz
pywin32-210.win32-py2.5.exe
#http://sourceforge.net/projects/pywin32/
```

7.4   Appendix – track files support within SONATE

*.GPX
This is a standardised format used by many GPS systems. The format is described in
http://www.topografix.com/GPX/1/0/gpx.xsd.

*.CSV
The file format contains the following elements separated by commas. The other data will not be used. This
file format is used by ARGOS to store the information of satellite tags.

Latitude	Longitude	Altitude	TimeDate(yyyy/mm/dd hh:mm:ss:S)
59.436182	10.467248	40	2007/9/27 09:45:31:104

*.XLS
This MS Excel file format contains the following elements. Only the first nine columns are used in Sonate
tracker module. This file format is used by ARGOS to store the information of satellite tags.

Year	Month	Day	Hour	Min	Sec	Lat	Lon	Alt	.....
2007	9	27	11	17	41	59,43538	10,46633	43	....

*.LOG

This log file format contains the time and positions of the track. All elements are separated by commas.

Year	Month	Day	Hour	Min	Sec	Lat (deg)	Lat (min)	Lon (deg)	Lon (min)
2007	9	27	11	17	41	59	43.538	10	46.633

*.TXT

This file format is used by MARIA to store tracks.

SRF/ARTSTAG/HO/
592608.5N-0102802.8E 271117ZSep2007
592610.0N-0102803.5E 271117ZSep2007

*.NMEA

This standardised NMEA file format. It uses the line starting with $GPRMC.
$GPRMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11><CR><LF>

1) UTC time of position fix, hhmmss.sss format.
2) Status, A = data valid, V = data not valid.
3) Latitude, ddmm.mmmm format.
4) Latitude hemisphere, N or S.
5) Longitude, dddmmm.mmmm format.
6) Longitude hemisphere, E or W.
7) Speed over ground, 0.0 to 1851.8 knots.
8) Course over ground, 000.0 to 359.9 degrees, true.
9) Date, ddmmyy format.
10) Magnetic variation, 000.0 to 180.O.
11) Degrees
12) Checksum.