MANUAL FOR SEABIRD AND MARINE MAMMAL SURVEY ON SEISMIC VESSELS IN GREENLAND

3rd revised edition, May 2012

Scientific Report from DCE – Danish Centre for Environment and Energy No. 38 2012

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Data sheet

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Abstract: This report describes the survey protocol for collecting data on seabird and marine mammal abundance and distribution from seismic vessels operating in Greenlandic Waters.

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Preface

To increase the knowledge of seabird and marine mammal distribution and abundance in Greenland the Bureau of Minerals and Petroleum (BMP) has made it mandatory for seismic vessels operating in Greenland to collect seabird and marine mammal observation data.The marine areas in Greenland are important for many seabird and marine mammal populations, and some marine mammal and seabird species are also very important living resources utilized by Greenlanders. However, the knowledge of seabird and marine mammal distribution and abundance in Greenland is sparse and as oil activities may have an impact on marine mammals and seabirds more knowledge is needed for Environmental Impact Assessment (EIA) work and planning.

This manual describes how to do the seabird and marine mammal observations from a seismic vessel in a standardized way. The manual follows the international standard method for seabird surveys from ships (Tasker et al. 1984; Webb & Durinck 1992), but it is more specific and detailed to ensure the observations will have full value and can be combined and utilized in quantitative analyses. This manual does not deal with regulation of - or assessing the impact of - marine seismic, which is described in the reports:

Kyhn, L.A., Boertmann, D., Tougaard, J., Johansen, K. L. & Mosbech, A. 2011. *Guidelines to environmental impact assessment of seismic activities in Greenland waters*. 3rd revised edition. DCE – Danish Centre for Environment and Energy, Aarhus University, Denmark.
http://www.bmp.gl/images/stories/petroleum/environmental_reports/EIA_Guidelines_to_environmental_impact_assessment_of_seismic_activities_in_Greenland_waters.pdf

Kyhn, L.A., Boertmann, D., Tougaard, J., Johansen, K. L. & Mosbech, A. 2011. *Guidelines to environmental mitigation assessment of seismic activities in Greenland waters*. 3rd revised edition. DCE – Danish Centre for Environment and Energy, Aarhus University, Denmark.
http://www.bmp.gl/images/stories/petroleum/environmental_reports/EMA_Guidelines_to_environmental_mitigation_assessment_of_seismic_activities_in_Greenland_waters.pdf

This is the third revised edition of the seabird and marine mammal survey manual. Compared to the last editions the text has been rewritten extensively in a number of places. The data entry application has also been extended with extra features, and a couple of software bugs have been fixed. The improvements of the manual and the data entry application are to a large extent a result of comments from observers who have used the system in the field, and we wish to sincerely thank Jan Durinck (Marine Observers Company), JuliAnne (Geomotive), Anthony L. Lang (LGL), Sam Taylor, Marijke de Boer, Susan Travers and Anne Sweeney for constructive feedback.

1 Introduction

The Marine Mammal and Seabird Observers (MMSOs) on-board seismic vessels operating in Greenlandic waters have two tasks:

The two task of MMSOs

Marine mammal monitoring: The MMSOs have to watch for marine mammals before start-up and during seismic survey in order to mitigate and observe safety distances to whales and seals. The monitoring procedures, which correspond closely to the Joint Nature Conservation Committee (JNCC) standard, are described in the guidelines Kyhn et al. (2011a, 2011b) and by JNCC (http://www.jncc.gov.uk/page-1534). Data collected in this process are recorded and reported to Bureau of Minerals and Petroleum (BMP) and Danish Centre for Environment and Energy, Aarhus University (DCE) on the JNCC *Marine Mammal Recording Form* which along with instructions can be found in the MMSO Resource Package (see appendix A) or downloaded from the URL referenced above.

Seabird and marine mammal survey: The MMSOs shall also collect data on abundance and distribution of seabirds and marine mammals through systematic line transect survey following distance sampling procedures. The survey protocol and data recording practices involved are described in the document at hand.

Division of survey effort

The seabird and marine mammal survey is not secondary to the marine mammal monitoring, and considerable effort should be spent on both tasks. However, we acknowledge the fact that one MMSO cannot perform both tasks at the same time and we recommend dividing the effort in the following way:

- During 30 or 60 minutes (depending on depth) before commencement of any air-guns the MMSO should focus exclusively on marine mammal monitoring (pre-shooting search).
- During the 20 minute soft-start/ramp-up procedure the MMSO should focus exclusively on marine mammal monitoring.
- At all other times (e.g. when the airguns are on full power or when they are off during transit or line change) the effort should be split equally between marine mammal monitoring and seabird/marine mammal survey. However, the MMSO should not constantly alternate between the two tasks to achieve an exact 50-50 split of effort. Preferably, when one of the tasks is initiated, it should be continued for at least an hour to ensure a proper sample is collected. Thus the 50-50 split is to be considered as a rule of thumb and a goal on an overall survey level.
- Marine mammal monitoring and seabird and marine mammal survey should be performed simultaneously when two MMSOs are available at the same time, each concentrating only on one task.

Over time many different methods have been employed in ship based surveys, and they all have their own merits. However, if systematic analyses of abundance and distribution of seabirds and marine mammals are to be undertaken a standardisation of survey methods and data recording practices is required.

MMSO Resource Package

This document provides a detailed description of the methodology required by BMP to be used for systematic seabird and marine mammal surveys from seismic vessels operating in Greenlandic waters. Besides this manual the MMSOs need to obtain the MMSO Resource Package, which contains further documentation and the software needed to perform the MMSO duties (see appendix A). The resource package can be downloaded from BMP's webpage http://www.bmp.gl/petroleum/environment/environmental-regulation or it will be mailed on a CD if a request is forwarded to DCE (see appendix B, section 4 for contact details).

Recommended reading

Since the survey method builds on the European Seabirds at Sea (ESAS) methodology (http://www.jncc.gov.uk/page-4514), we would like to refer to Tasker et al. (1984), Webb & Durinck (1992) and Camphuysen et al. (2004) for general descriptions. Further, as data collected in this manner is often analysed by means of distance sampling methods, familiarity with Buckland et al. (2001) is also recommended.

It should be emphasised that apart from strictly following the methodology described in this document, a MMSO has to be highly skilled in species identification and experienced in keeping alert during long hours of observation.

2 Summary of the survey method

Transects, observation periods and sightings

The method involves 300 m (or 500 m) wide strip transects operated only on one side the ship (fig. 1). Longitudinally, the transects are subdivided into so-called observation periods (e.g. 2, 5 or 10 minute intervals) and the sightings (flocks of birds/marine mammals) are grouped under these periods.

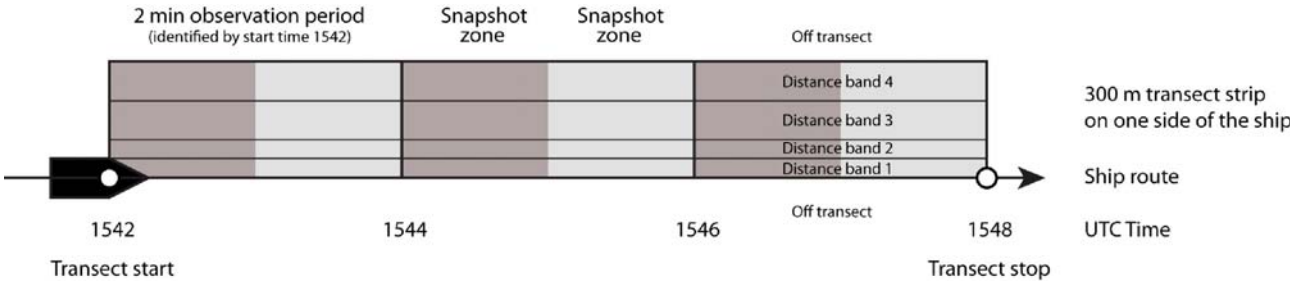


Figure 1. Schematic representation of the survey methodology. In the illustrated case observation periods are 2 minutes long and snapshot counts are made every minute (two snapshots per observation period).

Birds on the water

Due to the probability of detection decreasing with distance away from the observer, the transect strip is subdivided into narrower distance bands parallel to the track line of the ship. All birds on the water within 300 m (or 500 m) perpendicular to track line of the ship are counted and designated with a distance code according to the band in which they are observed.

Flying birds

To avoid an overestimate of flying birds, these are counted only by means of the snapshot technique. That is, at a certain moment in time (snapshot time), all birds flying over the transect strip within a certain distance ahead of the ship (snapshot distance) are counted quickly and designated with a special snapshot distance code. After making the snapshot count, the observer does not record flying birds again until the ship has travelled the snapshot distance at which point another snapshot count is made. In effect, the whole transect strip is covered with respect to flying birds, but they are counted only in instances.

Marine mammals

As sightings of marine mammals are comparatively rare, they are treated a little differently. No matter where marine mammals are sighted (inside or outside the transect strip), they are always recorded. However, during active survey focus is directed to the 180° ahead of the ship. Further, the angle relative to the course of the ship and the direct distance in meters to marine mammals are always recorded.

Unsystematic observations and total counting

This procedure constitutes the core of the methodology and results in systematic data suitable for estimating densities and spatial modelling. However, unsystematic observations of rare/interesting bird species outside the transect strip/snapshot may always be recorded if they are designated with the distance code corresponding to "off transect" (see section 5.2). In special situations the survey method is combined with so-called total counting (see section 5.1).

3 The different components of a survey

Structure of a survey

Conceptually, a seabird and marine mammal survey consists of three components: transects, observation periods, and sightings. These are internally related in a hierarchy:

- a survey consists of a number of transects
- a transect consists of a number of observation periods
- an observation period can hold a number of different sightings

Attributes recorded on the overall level of the survey

On the overall level of the survey only a few attributes that describe the cruise as a whole are recorded during digital data entry (appendix B). These comprise the name of the ship, the start date of the cruise, the end date of the cruise, the name of the operator (Oil Company), the name of the seismic contractor, the name of the MMSO contractor, and general remarks. Anything relevant that describes the survey as a whole can be written down in the remarks, but we would like MMSOs always to remember to write down the height of the platform of observation above sea surface (eye height above sea surface during observation). If several platforms of observation with different heights are used on the same cruise, eye height above sea surface should be recorded under remarks to the transects instead.

In the following sections the characteristics of transects, observation periods, and sightings are described in detail. A complete list of the attributes recorded for transects, observation periods and sightings, including lists of valid codes for the different attributes, are given in appendix C.

3.1 Transects

Characteristics

A transect corresponds to a continuous sequence of observation periods (fig. 1). That is, it is a continuous period of systematic survey performed whenever the seismic vessel is moving (on a seismic line, between lines, in transit etc.). However, we like transects to be fairly straight lines, so if the ship makes a sharp change in course, observers are encouraged to stop the current transect at the turning point, and start a new transect immediately after the ship has assumed its new course. If the observer takes a break, if the platform of observation is changed, or if the ship stops, the current transect is also stopped. A new transect is then started when the systematic survey is resumed. As can be seen from this description, transects are not equal to seismic lines.

Numbering transects

The transects of a survey are numbered consecutively starting with 1. This may be done in the field, but it may also just be done during digital data entry (appendix B).

Side of ship to survey

The transect strip for bird counting is operated only on one side of the ship (remember marine mammals are recorded wherever they are observed). Choose the optimal side in terms of conditions of observation, for instance the side with no sun glare, and feel free to switch to the other side if conditions change. However, observers should not switch sides just because there are more animals on the other side of the ship as this will bias the sample. If land is within sight, always choose the side of the ship that faces away from land as determination of distance by means of a range stick is only possible

when the true horizon can be clearly defined (see section 5.3). We do not encourage counting strips on both sides of the ship, as one side is always suboptimal, and detection probability drops because of the larger area that needs to be covered. If both sides are counted simultaneously, it needs to be by two different observers. In this case, data should be recorded as two completely different transects, and it should be clearly indicated in the remarks to the respective transects which side that had the best conditions of observation. With two observers available we strongly recommend spending the effort on separate on-sided shifts, one observer taking over after the other, instead of simultaneous two-sided watches.

Transect types

Two different transect types are used: one with a strip width of 300 m (type A), and one with a strip width of 500 m (type B). We encourage observers to use type A as the default transect type. Type B is only to be used if the following conditions are true: the observer is experienced, visibility is excellent, and encounter rate is low. The two different transect types should never be used on the same transect. If conditions change and it is decided to alter the transect type, then stop the current transect and start a new one using the new transect type. Don't forget to note the transect type on the recording sheets as it is essential in terms of knowing the size of the covered area (the strip width).

Off transect attribute

In the data entry application transects have a true/false attribute called "Off Transect" (not present on the field recording sheets). When on a cruise, MMSOs often record sightings at times when no systematic survey is conducted, e.g. a rare bird or a marine mammal spotted on the way to lunch (see section 5.2). Such sightings are entered in the data entry application by creating a dummy-transect with TransectNo = -99 and OffTransect = True. Transect -99 is used for all sightings made outside systematic survey periods on the particular cruise.

Other attributes

In total, five attributes are recorded for transects: the transect number, the transect type, total counting procedures (see section 5.1), OffTransect and remarks to the transect (see appendix C). If several platforms of observation with different heights are used on the same cruise, remember to write down eye height above sea surface under remarks to the transects.

3.2 Observation periods

Characteristics

A transect is made up of an uninterrupted sequence of discrete observation periods, typically 2, 5 or 10 minutes long (fig. 1). The observation periods act as boxes in which the sightings made on a transect are stored. The observation periods thereby define the time-space resolution of the survey.

Length of observation periods

In terms of the length of the observation periods, no specific value can be recommended. When the ship is steaming along at full speed, we suggest using 2 minute observation periods. At slower speeds, the observation periods may be longer. However, the duration of an observation period should never exceed 10 minutes. Observers are encouraged to use observation periods of the same length throughout a whole transect.

Identification by start time

Observation periods are always given in whole minutes, and on the data recording sheets they are identified by their start time in UTC. If using 2-minute observation periods, an observation period listed as 1440 in the recording sheets therefore covers the time interval 14.40-14.42 UTC, and all

sightings made during this observation period are thus headed under 1440. If using 10-minute observation periods, the observation period listed as 1440 covers the timespan 14.40-14.50.

Attributes of observation periods

A variety of different information is recorded for the observation periods, but on an overall level it all has to do with time, space, and conditions of observation (see appendix C):

Date and time

Date and time: The date and time of the start of the observation period is used as its unique identifier. Precision is in whole minutes and the time zone is UTC. Always use the handheld GPS for keeping track of time in the field as this ensures synchronization between the time written down in the recording sheets and the coordinates recorded in the trip log of the GPS (see later). If this is for some reason not possible, be absolutely sure that the watch you are using is synchronized with the GPS.

Obs. period length, snapshot interval & distance

The length of the observation periods (in minutes) is also written down on the data recording sheets, as is the time interval between snapshots (in decimal minutes) and the distance ahead of the ship included in the snapshot zone (in meters) (see section 3.3 for a description of snapshots).

Status

Status: This is a code which identifies whether the observation period in question is the first on the current transect (1 = transect start), just one of many observation periods along the current transect (2 = on transect), or the last observation period on the transect (3 = transect stop). There is also a status code for "off transect" (status = 4). This is used exclusively for sightings recorded at times when no systematic seabird/marine mammal survey is conducted, e.g. a rare bird or a marine mammal spotted while on break (see section 5.2).

Observation period to mark transect stop

A transect is always stopped at the beginning of a new observation period, and as this observation period has no length, there can be no sightings recorded here. That is, if the last real observation period on a transect is 1523, corresponding to the time interval 1523-1525 if 2 minute observation periods are used, a dummy entry of 1525 with Status = 3 must be made in the recording sheets to hold the information (and coordinates) on transect stop, even though no survey is conducted during the time interval 1525-1527 (fig. 5).

Coordinates of observation periods

Longitude and latitude: The coordinate of an observation period is the position of the ship at the time of the start of the observation period (longitude/latitude, datum: WGS84). Thus, the coordinate written down for the observation period 1240, which corresponds to the time interval 1240-1242 if 2 minute observation periods are used, is the position of the ship at 1240. The field recording sheet is designed for recording coordinates in degrees and decimal minutes as most observers find this the easiest, and this is the convention used on ships. However, the coordinates may just as well be recorded in decimal degrees, which is what most GIS software use.

Manually recorded coordinates

In the field, observers should always manually write down the coordinates of the first and the last observation period of a transect. While on transect, coordinates should be written down hourly and if the ship changes speed or course. Coordinates should NOT be written down for every observation period as this takes focus away from the survey and errors are commonly made when writing down coordinates.

Trip logs on hand held GPS units

Observers are required to run trip logs on TWO separate handheld GPS units while doing survey and marine mammal monitoring. The trip logs should be set up to record the position of the ship at least every minute. That is, every minute date and time (precision seconds, time zone UTC) and latitude and longitude (decimal degrees, datum: WGS84) are recorded as a new row in the trip log file. The trip log files are delivered to DCE along with the survey data and the MMSO report as Microsoft Excel spread sheets or delimited text files. At DCE we subsequently calculate the coordinates of every observation period from the survey by means of interpolation of the coordinates in the trip logs. This makes the synchronization of the time used on the field recording sheets and the time of the handheld GPS units critical and is the reason why observers should always use the GPS units for general time recording in the field. Hand held GPS devices have the habit of running out of battery, and trip log files get lost, overwritten or corrupted. This is why MMSOs should always run trip logs on two separate GPS units while surveying. Mark the GPS units so that they can be distinguished from each other and be sure keep the trip log files from the two units in separate folders on the computer.

Trip log on ship computer

On most ships the navigational computer can be set up to run a trip for the entire cruise, and the seismic contractor is obligated to do this. However, the crew on the seismic vessel may have forgotten it, so please remind the navigator. Ensure that a 1 minute logging interval is used, write down the time zone used by the navigational computer, and make sure the trip log file is saved in an appropriate file format and brought home along with the survey data when the cruise is over.

Other attributes

Other information recorded for the observation periods include the speed and course of the ship, the name of the observer, and codes for visibility, waves, swell, wind direction, wind speed, ice cover, precipitation, and temperature (appendix C). Write down this information only for the first observation period of a transect (when a transect is started). While on transect, information is only written down if conditions change, but you should make a habit out of verifying the correctness of the codes hourly. The information on changes may be written down in the remarks section of the recording sheet (see ice cover in fig. 5). The status of the seismic airgun arrays is also recorded under the observation periods, and this information should of course be updated as the changes in the seismic survey take place. On top of this systematic information, relevant comments and remarks to the observation periods may always be written down.

3.3 Sightings

Characteristics

The sightings are at the heart of the survey. The unit of observation is flocks of individuals of the same species, be it birds or marine mammals (fig. 5). That is, if a flock of 4 thick-billed murres is spotted they do not result in 4 rows of data. They result in one row of data – one flock of thick-billed murres with flock size 4. Single individuals are recorded as flocks of flock size 1. If a mixed flock is spotted, for instance a flock of 4 kittiwakes and 3 fulmars, they are recorded as two flocks: one flock of kittiwakes of flock size 4 and one flock of fulmars of flock size 3. In the latter case, however, it should be noted in the remarks section that the two sightings were really part of one big flock. In the field, this may be done simply by connecting the two rows of data with parenthesis, but during digital data entry the relationship of the flocks needs to be spelled out in the remarks to the sightings.

Surveying the transect strip

The transect strip is surveyed by a combination of binoculars and naked eye, and the perpendicular distances between the bird sightings and the track line of the ship are recorded by means of distance codes. Distance codes are recorded for birds on water within the transect strip, whereas birds outside the transect strip are generally not recorded. However, observations of rare/interesting birds outside the transect strip may of course always be recorded. It is just important that these latter sightings are designated with the special distance code corresponding to "off transect" (DistanceCode=0). This distance code differentiates them from the systematic observations made within the transect strip (see section 5.2). Assessing how far away the different distance bands are from the track line of the ship is done using a range stick (see section 5.3).

When to record birds on the water

Many species perform evasive movement (diving, flying up, or swimming away) in response to the approach of the survey vessel. For this reason birds on water should be recorded ahead of the ship, making best judgement of their distance from the ships' track line had it been at beam with their position. If on passing the birds it is evident that their perpendicular distance to the track line was misjudged, the distance code may then be corrected. How far ahead of the ship the recording needs to take place depends on the reaction of the species in question to the approach of the ship. Ideally birds and marine mammals should be recorded at the closest distance where they retain their undisturbed behaviour.

Evasive movement or attraction to the ship

Evasive movement should be described in the MMSO report: Which species display it? What is the nature of the evasive movement? Do the birds fly up, swim slowly away or escape dive? What does the evasive movement mean with respect to the counts made of the particular species? If the birds slowly swim away from the ship it might mean that a significant proportion of the birds that should have been recorded in the distance band closest to the ship are recorded in distance bands further away. If the birds fly up or escape dive, it might mean that some of the birds that should have been recorded in the distance band closest to the ship are missed. The latter case represents a major problem when using the data for abundance estimates, and measures should be taken to avoid it. Count these birds well ahead of the ship!

Attraction to the ship

If particular species are clearly attracted to the ship, which is sometimes the case with gull species when the seismic vessel trails an icebreaker, this should also be described in the MMSO report as this behaviour will artificially inflate abundance estimates of these species.

Focus on distance bands closest to the ship

During active survey, most attention should be focussed on the distance bands closest to the ship. The falloff in detection rate with perpendicular distance from the track line can be compensated for by means of distance sampling methods (fitting a detection function). However, these methods rest on the assumption that detection rate is 100 % (everything is spotted) in the distance band closest to the ship (0-50 m). This is a very important point to bear in mind. Thus, guarding the centreline is of primary concern, whereas missing some of the birds in the distance bands far away from ship is less critical. However, to accurately model the fall off in detection rate, this fall off needs to be gradual rather than abrupt. This means that although the centreline needs to be guarded, the distance bands bordering the innermost band should not be neglected either.

High encounter rate and simplified distance recording

If the encounter rate is extremely high, the observer may not have enough time to determine to which exact distance band within the transect strip the birds on water belong. In this rare case the snapshot distance code (7) may be used for birds on the water to simply indicate that they were within the transect strip (as opposed to outside the transect strip), but that the exact distance band within the transect strip was not determined. Be sure to get the behaviour code right (2 = birds on water) so that these sightings can be differentiated from flying birds recorded during real snapshot counts. Before resorting to this simplified inside/outside transect strip recording of birds on water, see if you overcome the lack of time by having a second person write down the sightings for you, or use a Dictaphone to record the sightings and transcribe later.

Snapshots of flying birds

Flying birds are recorded only by means of the snapshot technique. That is, at a certain moment in time (snapshot time), all birds flying over the transect strip within a certain distance ahead of the ship (snapshot distance) are counted and designated with a special snapshot distance code. After making the snapshot count, the observer does not record flying birds again until the ship has travelled the snapshot distance at which point another snapshot count is made. In effect, the whole transect strip is covered with respect to flying birds, but they are counted only momentarily.

Birds counted during snapshot are given the snapshot distance code (DistanCode=7). This means that their perpendicular distance to the track line of the ship is not recorded – it is simply recorded that they were within the transect strip and snapshot distance at snapshot time. It must be stressed that like the recording of birds on water, the snapshot counts are only performed on one side of the ship, and to make counting easier the same side of the ship should be used for observing flying birds and birds on water. Flying birds that occur within the snapshot zone between the times of snapshot are generally not recorded. However, observations of rare/interesting birds outside the snapshot/transect strip may of course be recorded. It is just important that these latter sightings are designated with the distance code corresponding to "off transect" (DistanceCode=0). This distance code differentiates them from the systematic snapshot sightings (see section 5.2).

Timing of snapshots

Achieving the correct coverage of flying birds through snapshot counting is a matter adjusting the timing of the snapshots in relation to the speed of the ship and the distance ahead of the ship included in the snapshot. The speed of the ship is easily determined by means of the handheld GPS units. How far a distance ahead of the ship to include in the snapshot depends entirely on how far away flying birds can be reliably identified and counted quickly. In many situations it is possible to identify flying birds up to 1000 meters ahead of the ship. In some cases, for example when it is foggy or when species not easily detected are present, it may be more appropriate to use a considerably shorter snapshot distance. Having established the speed of the ship and decided on the snapshot distance, the appropriate time interval between the snapshots can be determined from the table in figure 2.

Time interval between snapshots in minutes and seconds											
Ship speed		Snapshot distance in meters									
Knots	Meters per minute	100	200	300	400	500	600	700	800	900	1000
1	31	03:14	06:29	09:43	12:58	16:12	19:26	22:41	25:55	29:09	32:24
2	62	01:37	03:14	04:52	06:29	08:06	09:43	11:20	12:58	14:35	16:12
3	93	01:05	02:10	03:14	04:19	05:24	06:29	07:34	08:38	09:43	10:48
4	123	00:49	01:37	02:26	03:14	04:03	04:52	05:40	06:29	07:17	08:06
5	154	00:39	01:18	01:57	02:36	03:14	03:53	04:32	05:11	05:50	06:29
6	185	00:32	01:05	01:37	02:10	02:42	03:14	03:47	04:19	04:52	05:24
7	216	00:28	00:56	01:23	01:51	02:19	02:47	03:14	03:42	04:10	04:38
8	247	00:24	00:49	01:13	01:37	02:01	02:26	02:50	03:14	03:39	04:03
9	278	00:22	00:43	01:05	01:26	01:48	02:10	02:31	02:53	03:14	03:36
10	309	00:19	00:39	00:58	01:18	01:37	01:57	02:16	02:36	02:55	03:14
11	340	00:18	00:35	00:53	01:11	01:28	01:46	02:04	02:21	02:39	02:57
12	370	00:16	00:32	00:49	01:05	01:21	01:37	01:53	02:10	02:26	02:42
13	401	00:15	00:30	00:45	01:00	01:15	01:30	01:45	02:00	02:15	02:30
14	432	00:14	00:28	00:42	00:56	01:09	01:23	01:37	01:51	02:05	02:19
15	463	00:13	00:26	00:39	00:52	01:05	01:18	01:31	01:44	01:57	02:10
16	494	00:12	00:24	00:36	00:49	01:01	01:13	01:25	01:37	01:49	02:01
17	525	00:11	00:23	00:34	00:46	00:57	01:09	01:20	01:31	01:43	01:54
18	556	00:11	00:22	00:32	00:43	00:54	01:05	01:16	01:26	01:37	01:48
19	586	00:10	00:20	00:31	00:41	00:51	01:01	01:12	01:22	01:32	01:42
20	617	00:10	00:19	00:29	00:39	00:49	00:58	01:08	01:18	01:27	01:37

Figure 2. Time between snapshots based on ships' speed and snapshot distance.

Example

As an example of using the snapshot table in figure 2: If the ship travels at a speed of 8 knots and 500 meters is used as the snapshot distance, the table says that the observer needs to make a snapshot count every 2 minutes and 1 second. This is all the observer needs to worry about in the field, but we can check it: At 8 knots the table says that the ship will travel 247 meters per minute. With 500 meters as the snapshot distance, a snapshot is thus needed every 500/247 = 2.025 decimal minutes, which corresponds to 2 minutes and 1 second.

Snapshots in the field

I order to remember to make the snapshot counts while surveying the observers need to have a clock with an alarm that goes off at regular intervals corresponding to snapshot times. Instead of an alarm some observers like to use an iPod/MP3-player that repeatedly loops a small recording with snapshot times. The birds counted during a snapshot are recorded under the current observation period on the field recording sheet, even though the snapshot distance might extend into the next observation period. The time interval between snapshots and the distance ahead of the ship included in the snapshot zone are only written down for the first observation period of a transect, but this information should of course be updated if the snapshot procedure is altered underway. In the data entry application, SnapshotInterval is entered in decimal minutes, e.g. 2 min 15 sec = 2 + (15/60) = 2.25 decimal minutes.

Snapshots at variable vessel speed

When the ship is travelling at a constant speed, it is generally no problem to achieve the correct coverage of flying birds by using the snapshot table. If the ship changes speed, the snapshot procedure of course has to be altered. This is no problem if the changes in speed are few and well defined. However, if the ship constantly changes speed and course, for instance when travelling in ice covered waters, the snapshot procedure should in principle constantly be altered too, and this is clearly not feasible in the field. In such a situation it is better to maintain a constant snapshot rate and distance, and simply note under the remarks to the transect and/or the observation periods in question that the snapshot coverage is wrong.

Marine mammals

Contrary to birds, which are generally only recorded within the transect strip, marine mammals are recorded wherever they are seen. However, during active survey focus is directed to the 180° ahead of the ship. Distance codes are not used for marine mammals and during digital data entry they are simply entered with DistanceCode=0 (distance code is a mandatory field). Instead of distance codes the direct distance in meters (radial) and angle to marine mammals are always written down. The angle (0-360°) is recorded relative to the course of the ship using an angle board (see the file DCE_AngleBoard.jpg in the folder SeabirdAndMarineMammalSurvey in the MMSO Resource Package). The distance in meters is assessed with the aid of a range stick (see section 5.3). It is important to bear in mind the contrast in distance recording between birds and marine mammals. The distance codes of bird sightings reflect the perpendicular distance between the birds and the track line of the ship, whereas the distances recorded for marine mammal sightings are the direct distance between the marine mammals and the observer (the radial distance).

Most important attributes to record

A number of different attributes are recorded for the sightings. They are not equally important, and normally there is not enough time to record all of them. Species, flock size, distance code and the basic behaviour code (1-3) are the most important and should always be recorded. For marine mammals the same applies for angle and radial distance. The other attributes are of secondary importance and should only be recorded if the observer has enough time. The complete list of attributes comprises:

Species codes

Species: A five letter species code made up of the first two letters of the scientific genus name and the first three letters of the scientific species name, for example: Northern Fulmar, ***Fu****lmar* ***gla****cialis* = fugla. There are exceptions, since strictly following this logic some species will end up with the same code. For example, arctic tern (*Sterna paradisaea*) and arctic skua (*Stercorarius parasiticus*) would both end up with the code stpar and they are therefore coded as atern and askua instead. The observers are to familiarize themselves with the species codes listed in appendix C, section 3.1. It should be noted that fishing vessels, large icebergs and marine fronts are also recorded as sightings as these have impact on the distribution of marine mammals and birds.

Flock size

Flock size: A whole number representing the flock size of the sighting.

Distance code

Distance code: A code detailing in which distance band of the transect strip the sightings of birds on water are made. There are also codes for sightings made outside the transect strip (DistanceCode = 0) and for snapshot counts of flying birds (DistanceCode = 7). As mentioned earlier, if the encounter rate is extremely high and the observer does not have enough time to deter-

mine to which exact distance band within the transect strip the sightings belong, the snapshot distance code (DistanceCode = 7) may be used for birds on the water to simply indicate that they were within the transect strip, but that the exact distance band was not determined. Since angle and direct distance in meters are always recorded for marine mammals, distance codes are not relevant for these. However, during digital data entry, the distance code is a mandatory attribute, and marine mammals are therefore entered with DistanceCode = 0.

Behaviour

Behaviour: A code which is used to discriminate between birds observed flying (1), birds observed on water (2), and flying birds following the ship (3). Birds on water that escape dive or fly up in response to the approach of the ship should be recorded as if they were observed on water (their undisturbed behaviour). It may be noted in the remarks that the birds fly up in response to the approach of the ship, but their behaviour code should be "on water" (2). Amongst the flying birds recorded during snapshot, it is important to discriminate between flying birds simply passing by (2) and flying birds continually following the ship (3). If this is not recorded, the latter will artificially inflate the estimated densities. Ship followers will generally be excluded in the analyses, and if a flock of fulmars are following the ship, there is no need to constantly record them during the snapshots. Generally, the observers should count the number of ship followers when a transect is started and stopped, and at regular time intervals while on transect, for instance every hour. Remember to give them behaviour code 3. Marine mammals are recorded with the behaviour code corresponding to "on water" (2).

Age

Age: A code specifying the age group of the sighted birds. If not homogenous across the sighted flock, age should be recorded as mixed (Mx) and detailed in the remarks to the sighting.

Plumage

Plumage: A code which describes the plumage of sighted birds. If not homogenous across the sighted flock, plumage should be recorded as mixed (Mx) and detailed in the remarks to the sighting.

Moulting

Moulting: A code which describes whether or not the sighted birds are moulting. If not homogenous across the sighted flock, moulting should be recorded as mixed (Mx) and detailed in the remarks to the sighting.

Color phase

Color phase: A code which describes the color phase of northern fulmars and skuas. If not homogenous across the sighted flock, color phase should be recorded as mixed (Mx) and detailed in the remarks to the sighting.

Foraging behaviour

Foraging behaviour: An optional detailed behaviour code of sighted seabirds following the system of Camphuysen & Garthe (2004). A pdf-version of the codes from this publication can be found in the folder SeabirdAndMarineMammalSurvey in the MMSO Resource Package.

Direction

Direction: The direction of movement of sighted flocks/individuals relative to True North (0-360 degrees increasing in clockwise direction). This attribute is mainly relevant for flying birds and marine mammals. Use the handheld GPS unit as compass. If you use a conventional mirror compass remember to adjust for the declination angle which varies considerably across Greenland (Cape Farewell: 23.8 W, Nuuk: 29.92 W, Upernavik: 40.88 W, Thule Air Base: 51.40 W, Scoresby Sound: 19.25 W, Daneborg: 19.88 W).

Angle	Angle: The angle to marine mammal sightings relative to the course of the ship (0-360 degrees increasing in clockwise direction). Print and laminate the angle board found in the folder SeabirdAndMarineMammalSurvey in the MMSO Resource Package.
Radial distance	Radial: The absolute distance to marine mammal sightings in meters.
Remarks	Remarks: Miscellaneous relevant comments to the sightings.

4 Practical issues

4.1 Equipment needed for observation

- Observation box and chair.
- Warm clothes and boots.
- Binoculars.
- Cloth to clean binoculars.
- Plenty of paper recording sheets (print the file DCE_Ship Survey _RecordingSheet.pdf in the folder SeabirdAndMarineMammalSurvey in the MMSO Resource Package).
- A printed version of the manual (main text and appendix C), and perhaps the list of behaviour codes from Camphuysen & Garthe (2004), which is included as a pdf-file in the folder SeabirdAndMarineMammal Survey in the MMSO Resource Package.
- Clipboard, pen and pencil.
- Spare pen and pencil.
- Bulldog clip and rubber bands to keep recording sheets still.
- Plastic bag to protect the paper recording sheet on the clipboard in case of rain. A so-called Weather Writer is a good alternative to the clipboard/plastic bag setup.
- Two handheld GPS units which display coordinates (longitude/latitude, datum: WGS84), time in UTC, speed and course, and which can be set up to make a running log of UTC time and coordinates (a trip log). The trip logs should be set up to store a position at least every minute (longitude/latitude, datum: WGS84). The handheld GPS units are also used for keeping track of time in the field and to determine the course of the ship and the directions of movement of sightings.
- A water-resistant alarm clock which can be set up to go off at regular time intervals corresponding to snapshot times. Use the alarm clock only for signalling snapshots, not for keeping track of time. Using the GPS as watch ensures synchronization between the recorded sightings and the trip log, and it means that the observer will notice when the batteries of the GPS units need to be changed. The alarm clock can be replaced by an iPod/MP3 player, which loops a recorded sequence with snapshot times. An earphone in one ear and the iPod/MP3 player in the breast pocket to keep the batteries warm works well.
- Two sets of rechargeable batteries for each GPS unit as well as for the alarm clock, especially in cold weather. To avoid running out of batteries, we recommend bringing a recharger and using rechargeable batteries.
- A range stick for assessing how far away the different distance bands are from the track line of the ship and for determining the distances to marine mammal sightings (see section 5.3).
- Angle board to determine angles to marine mammal sightings. Print and laminate the angle board in the file DCE_AngleBoard.jpg in the folder SeabirdAndMarineMammalSurvey in the MMSO Resource Package.
- A mirror compass to determine directions of movement if the GPS units do not have suitable compasses.
- A field guide to species determination of birds and marine mammals.
- Digital Dictaphone or tape-recorder (or second observer to help writing) if encounter rate is expected to be high, or if rain prevents the recording on the paper sheets.

The items above should all be brought to the observation box prior to initiating seabird and marine mammal survey. For the cruise in general, the MMSOs should bring a laptop computer with the data entry application installed and tested (see appendix B), software/cables for downloading the GPS trip logs, a memory stick for backup of digital data, suitable power adapters for the laptop, and a battery recharger. The MMSOs should also bring equipment for measuring eye height above sea surface. This may simply comprise of a small weight, 30 meters of string, and a measuring stick (see section 5.3).

4.2 Platform of observation

Location on ship

Find the best place for carrying out observations on the ship. This will be a high position with a clear view forward, to the side and overhead, but do not go as high as to the "crow's nest". Survey should always be conducted outside and never from the bridge through windows. Assure that radar antennae are placed above you and not behind you. The radiation can be harmful.

Observation box

Observation shall be conducted from an observation box that shelters the MMSOs from the weather (see fig. 3). Usually an observation box simply consists of four pieces of plywood for the sides, a suspended board or a chair to sit on, a table/shelf to write on, and a shelf under the table to store items that need to be kept out of the weather.

Figure 3. Example of a setup with an observation box.

It is the responsibility of the seismic contractor that an observation box is installed on the seismic vessel somewhere suitable for observation without compromising safety. However, to be sure that a satisfactory solution is worked out, the MMSOs are strongly advised to contact the crew of the seismic vessel well in advance of the survey and inquire about the observation box.

4.3 Paper recording sheets

Structure of recording sheet

The file DCE_ShipSurvey_FieldRecordingSheet.pdf in the folder SeabirdAndMarineMammalSurvey in the MMSO Resource Package contains a recording sheet that should be printed in large numbers and used in the field. The recording sheet directly reflects the described methodology and the codes in appendix C. However, for the recording sheet to remain practical in the field, it was not possible to directly group the attributes under the headings of transects, observation periods and sightings as has been done in this text. Fig. 4 gives an overview of where the attributes of the paper recording sheet belong.

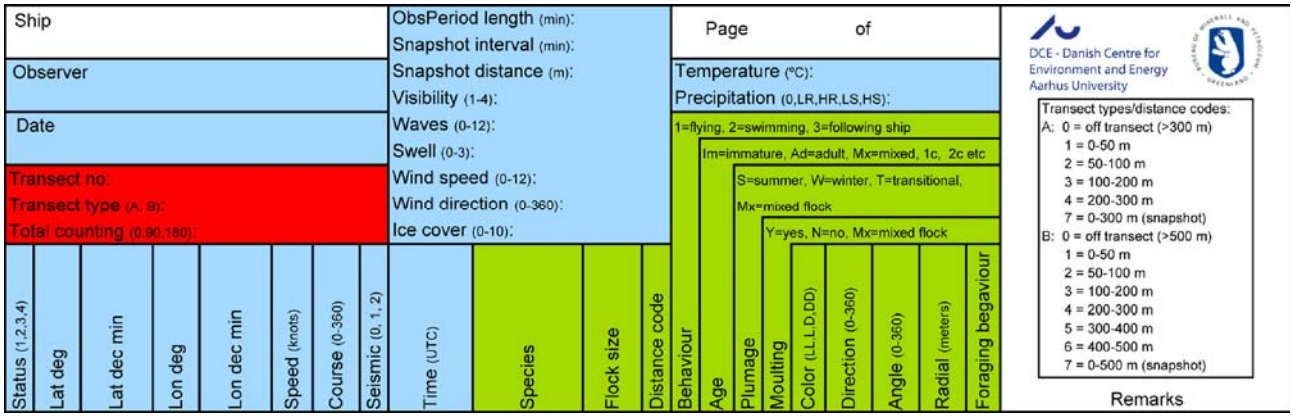


Figure 4. The headings of the paper recording sheet colour coded according to where the information belongs. Attributes belonging to transects are red (dark grey when printed in black and white), attributes belonging to observation periods are blue (light grey), and attributes belonging to sightings are green (medium grey).

Handling changes in page header attributes

The fact that the observation period attributes observer, date, observation period length, snapshot interval, snapshot distance, visibility, waves, swell, wind speed, wind direction, ice cover, precipitation and temperature are recorded on the page header means that if conditions change, these changes must be noted under remarks until a new page is turned (e.g. the ice cover note in the remarks at time 19:46 in fig. 5). It also makes it important to use a new recording sheet every time a new transect is started.

4.4 The survey procedure in practice

Start-up procedure

1. Bring all the equipment on the list to the observation box and get everything organized.
2. Turn on both the GPS units and start a 1 minute trip log (longitude/latitude in decimal degrees, datum: WGS84). Use the GPS for keeping track of time.
3. Choose which side of the ship to survey and on the basis of visibility, level of experience and expected encounter rate decide on which transect type to use (A=300 m is default).

4. On the basis of the speed of the ship decide on the length of the observation periods.
5. On basis of the visibility choose an appropriate snapshot distance and read the speed of the ship off the GPS. Knowing the snapshot distance and the vessel speed, you can find the correct time interval between snapshots via the table in figure 2. Set up the alarm clock/iPod to continuously signal snapshot times, but do not activate it before you start surveying.
6. On the recording sheet, fill in all the basic information, the information about the transect to be started (transect type, transect no., total counting), and the information about the first observation period of the transect (visibility, waves, swell, coordinates etc.).
7. You are now ready to begin.

Survey procedure in practice

When you have completed the start-up procedure and reached the point in time where you have decided to start the survey (start time of first observation period), activate the snapshot alarm and do the first snapshot count. The survey has now begun. Birds on water and marine mammals are recorded continuously at closest undisturbed distance, whereas flying birds are only recorded at the sound of the snapshot signal. Whenever a sighting is written down, remember to determine the correct observation period heading for the sighting (the start time of the observation period, e.g. 1940) by looking at time on the GPS. While surveying, there is no reason to write down observation periods with no sightings as it consumes a lot of recording sheets and it takes focus away from the survey. During digital data entry, it is important also to enter empty observation periods, but this is done semi-automatically in the data entry application. There is also no reason to keep writing 2 in the status column when sightings are recorded as this is also done semi-automatically in the data entry application (appendix B). The activity of the seismic air gun array is recorded as changes in the seismic survey takes place, again using the correct observation period headings. If conditions of observation change, write down the new codes for visibility, waves etc. in the remarks. Every hour, verify the codes for visibility, waves etc. and write down the position of the ship. If the speed or the course of the ship change markedly, stop the current transect and start a new one. This procedure should also be followed if the observer takes a break, or if it is decided to switch to a different transect type. It is recommended to use a new paper recording sheet every time a new transect is started. Figure 5 illustrates how a recording sheet may look after a (very short) transect has been completed.

Ship: **Adolf Jensen**
Observer: **David Boertmann**
Date: **26-07-2008**
Transect no: **2**
Transect type (A, B): **A**
Total counting (0,90,180): **0**

ObsPeriod length (min): **2**
Snapshot interval (min): **2:01**
Snapshot distance (m): **500**
Visibility (1-4): **1**
Waves (0-12): **1**
Swell (0-3): **2**
Wind speed (0-12): **1**
Wind direction (0-360): **180**
Ice cover (0-10): **0**

Page **1** of **1**
Temperature (°C): **8**
Precipitation (0,LR,HR,LS,HS): **0**

DCE - Danish Centre for Environment and Energy
Aarhus University

Transect types/distance codes:
A: 0 = off transect (>300 m)
1 = 0-50 m
2 = 50-100 m
3 = 100-200 m
4 = 200-300 m
7 = 0-300 m (snapshot)
B: 0 = off transect (>500 m)
1 = 0-50 m
2 = 50-100 m
3 = 100-200 m
4 = 200-300 m
5 = 300-400 m
6 = 400-500 m
7 = 0-500 m (snapshot)

Status (1,2,3,4)	Lat deg	Lat dec min	Lon deg	Lon dec min	Speed (knots)	Course (0-360)	Seismic (0, 1, 2)	Time (UTC)	Species	Flock size	Distance code	Behaviour (1=flying, 2=swimming, 3=following ship)	Age (Im=immature, Ad=adult, Mx=mixed, 1c, 2c etc)	Plumage (S=summer, W=winter, T=transitional, Mx=mixed flock)	Moulting (Y=yes, N=no, Mx=mixed flock)	Color (LL.L.D.DD)	Direction (0-360)	Angle (0-360)	Radial (meters)	Foraging begaviour	Remarks
1	73	46.803	58	38.326	8	96	2	19:40	urlom	1	7	1									
							0	19:42													
								19:44	urlom	1	3	2									
									fugla	1	7	3				LL					
									urlom	3	3	2									
								19:46	urlom	1	1	2									Ice cover = 1
								19:48	urlom	3	7	1					90				
									urlom	1	4	2									
									ritri	2	1	2	ad								Flying up
								19:50	bamys	1	0	2						15	600		Ice cover = 2
								19:52	ritri	1	2	2									
3	73	46.774	58	31.350	8	96	0	19:54													

Figure 5. Example of how a field recording sheet might look after a (very short) transect has been completed.

5 Miscellaneous topics

5.1 Combining the normal survey procedures with total counting

Only under special circumstances

This section describes how to combine the normal survey procedures with so-called total counting. Unless specifically instructed by DCE, observers should not do total counting at all. Thus, under normal circumstances this section can simply be skipped.

Characteristics of total counting

When doing normal survey, birds observed outside the transect strip and flying birds observed between the snapshot counts are generally not recorded. When the systematic survey is combined with total counting, it simply means that all these birds are also consistently recorded. The sightings resulting from the total counting are given the off transect distance code (0). This makes it possible to distinguish them from normal sightings made within the transect strip.

Scan sector

Generally total counting is only performed in a 90 degree sector ahead of the side of the ship, where the normal bird survey takes place (fig. 6). In some cases a 180 degree sector is employed instead, which corresponds to everything ahead of the ship. However, although a 180 degree sector is scanned in the total counting, the normal bird survey should still be constrained to the optimal side of the ship.

Total counting attributes

Information about total counting procedures is recorded on the level of transects via the attribute TotalCounting. It can have the values 0, 90 or 180 corresponding to no total counting (default), 90 degree total counting and 180 degree total counting respectively.

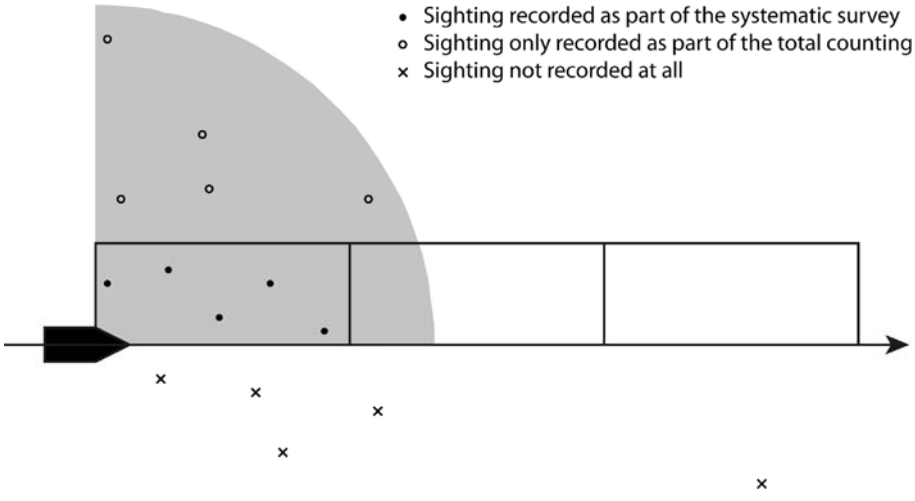


Figure 6. Example of systematic survey combined with 90 degree scan total counting.

Never change survey procedures on a transect

Survey procedures should always be homogeneous on a transect. Thus, if it is suddenly decided to combine the systematic survey with total counting, the current transect should be stopped and a new transect started. The same applies if the observer wants to change the scan zone of the total counting, or if he or she for one reason or another decides to stop the total counting.

Use of total counting data

Birds recorded by total counting are not used in calculations of densities, and recording them therefore has much lower priority than the sightings from the normal survey. Thus, total counting is only to be included if encounter rate is low and the observers feel they have time to do it without compromising the quality of the normal survey. Total counting data may be used to calculate an index of sighted birds per kilometre transect. Total counting may also enhance assessments of age and sex composition of certain populations or directions of flight by migrants and birds travelling to and from colonies simply by enlarging sample sizes.

5.2 Unsystematic observations

Unsystematic observations during survey

During systematic survey, the occasional interesting bird outside the transect strip/snapshot may always be written down in the recording sheets. It is just important that these sightings are given the distance code corresponding to off transect (DistanceCode = 0).

Unsystematic observations when no survey goes on

Interesting sightings made at times when NO SURVEY goes on may of course also be written down in the recording sheets, e.g. a bird/marine mammal spotted on the way to lunch. All the normal information is recorded for these sightings, e.g. distance codes for birds and angles/radial distances for marine mammals. However, a special status code corresponding to off transect is used for the observation period (Status = 4). This designates it as a dummy observation period. And during digital data entry these observation periods and sightings are all entered under a transect with transect number -99 and the attribute OffTransect specified as True. This is a dummy transect, which holds all sightings from the cruise made at times when no systematic survey goes on.

Summary

In summary, sightings of birds outside the transect strip during systematic survey are recorded in the same way as the other sightings on that transect/during that observation period, the only difference being that the off transect distance code is used (DistanceCode = 0). Sightings made at times when no survey goes on are recorded under the dummy transect -99 (OffTransect = True), and under dummy observation periods with Status = 4. For the latter sightings, the normal distance information is recorded (distance codes for birds, angles/radial distances for marine mammals).

5.3 Constructing a range stick

Estimation of distance

A prerequisite for the survey method is that the observer can delineate the distance bands of the transect strip parallel to the track line of the ship and determine the radial distances to marine mammals. As it is very difficult to estimate distances at sea, a so-called range stick needs to be used.

A range stick

A range stick is merely a transparent ruler with a number of horizontal lines drawn on it with a permanent marker (Fig. 7, left). The top line, which might as well just be the top of the ruler, is called the baseline and needs to be lined up with the horizon. The horizontal lines below the baseline correspond to discrete distances away from the observer when the range stick is held out in a straight arm and the baseline is aligned with the horizon. The distances marked out by the lines below the baseline represent the borders between the distance bands of the transect strip and some distances much further away used when estimating distances to marine mammal sightings.

For distance bands, not for bird sightings directly

With regard to the bird sightings, it is important to bear in mind that the range stick will only show the correct delineation of the distance bands when sighted through perpendicular to the track line of the ship. As bird sightings are generally recorded at varying distances ahead of the ship, the range stick cannot be used directly to determine the distance codes. Its function with regard to the bird counting is merely to maintain a sense of how far away the distance bands are from the track line of the ship. Only for birds that do not perform evasive movement in response to the approaching ship can it be used to verify their distance codes when they are at beam with the ship.

Distances to marine mammals

For marine mammals it is the direct (radial) distance in meters that is recorded in the field. This means that the relevant distance can in principle be estimated directly by sighting with the range stick. However, there is a limit to the usefulness of the range stick in this respect as marine mammals are often spotted quite far away. The further the marked out distances are away from the observer, the closer the marks will be to each other (and the baseline) on the range stick, especially if the platform of observation is not very high. Normally only a few extra marks on the range stick for marine mammals are useful in practice, e.g. 500, 1000 and 2000 meters, depending on how high the observer is above the sea surface (fig. 7 left). The range stick can thus only aid the distance estimation and the observer has to a large extent to rely on experience.

Constant distance between Eye and range stick

The use of a range stick requires certain conditions to be true. Firstly, the range stick only works if the distance between the eye of the observer and the range stick is constant (and known). If each observer has his/her personal range stick, this distance can be held constant simply by holding out the range stick in a straight arm in the same manner each time. Some observers like to control the distance by having the range stick attached by a string around the neck. When used, the range stick is held out so that the string is tight. If you use the string option, then remember to adjust the length of the string according to the thickness of the clothes you wear around your neck.

Constant height above sea surface

Secondly, the height of the eye of the observer above the sea surface needs to be constant (and known), which can be controlled by using the same platform of observation throughout the survey. If you use several different platforms of observation, and they have different heights above sea surface, you should make a range stick for each platform. The eye height above sea surface can be measured by means of a long string with a small weight tied to the end. The weight is lowered down to the sea surface, and the length of the string is measured with a measuring stick (you might have to add the deck curve). Upon digital data entry, remember to record the eye height above sea surface under remarks to the survey. If several platforms of observation with different heights are used, eye height should be recorded under remarks to the transects instead.

Visible horizon

Thirdly, the observer needs to be able to see the true horizon; otherwise the baseline of the range stick cannot be lined up. This means that the range stick does not work when visibility is poor, or if the surveyed side of the ship faces land. The latter is a good reason for always surveying the side of the ship that faces away from land. Under conditions of poor visibility the observer must make best judgement of distances without the range stick, but based on the sense of distances developed using the range stick under better conditions of observation.

Constructing a range stick

Constructing a range stick is a matter of working out where the lines representing the discrete distances are to be placed in relation to the baseline of the range stick. Start by drawing the baseline or cutting off the ruler at zero if you want to use the top of the ruler as the baseline. Then work out the distances from the baseline down to the different distance marks by using the range stick calculator RangeStickCalculation.xlsx located in the folder SeabirdAndMarineMammalSurvey in the MMSO Resource Package. The range stick calculator, which is adapted from JNCC, is based on the following equation (Heinemann 1981):

$$c_i = (bh(v - d_i)) / (h^2 + vd_i)$$

c_i: The distance below baseline to put the mark in centimetres
b: Distance between the observer's eyes and baseline of range stick in centimetres
h: Eye height above sea level in meters
v: Visual horizon constant, $v = 3838(h^{1/2})$
d^i: Distance for which you want to make a distance mark in meters (e.g. the 300 meter transect strip limit).

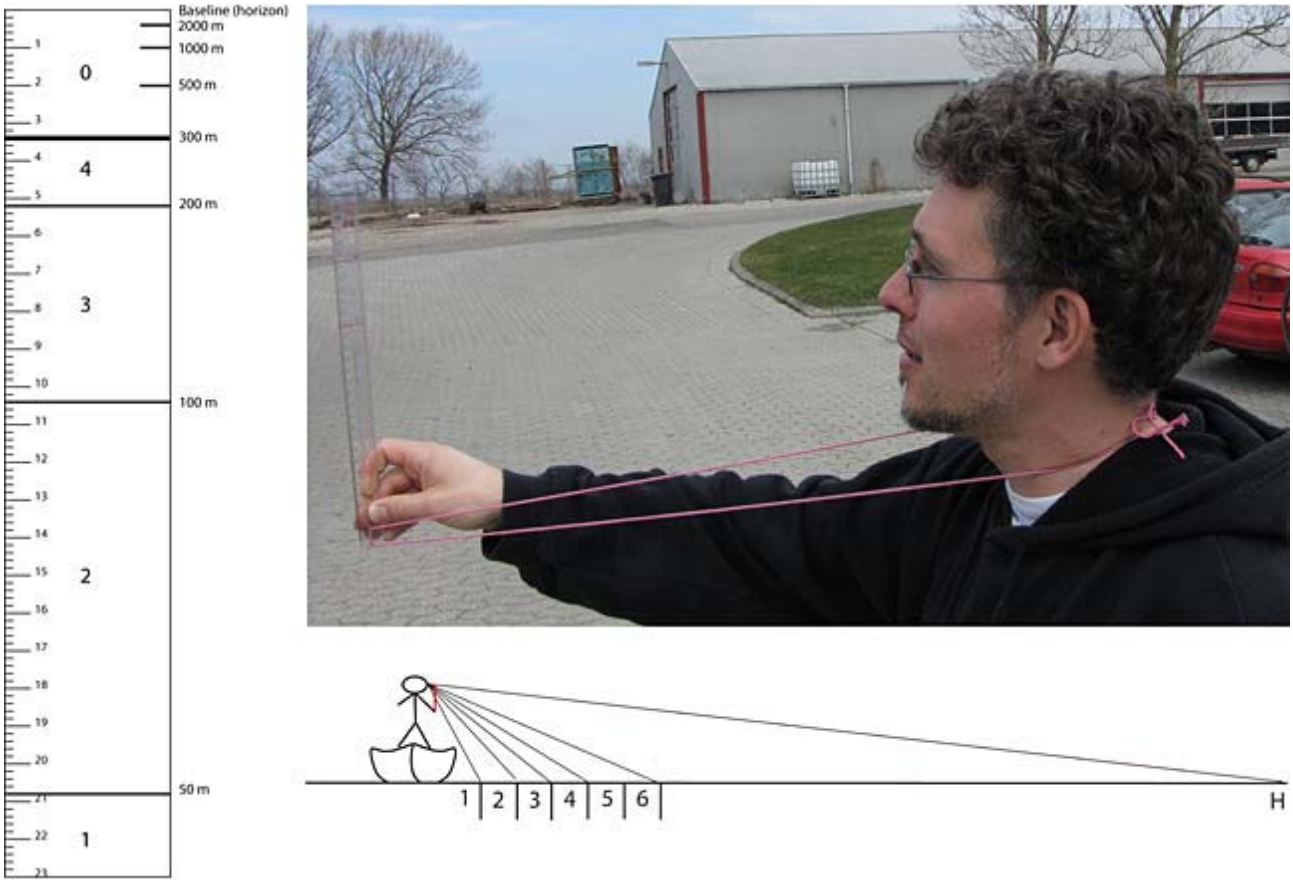


Figure 7. Left: Example of a range stick for transect type A (300 m strip width) with the top of the ruler as baseline. The large figures on the ruler are the distance codes used for the bands of the transect strip. A few additional marks for assessing long distances to marine mammals are included. Upper, right: Illustration of how the range stick may be held at a consistent distance from the eye by means of a string around the neck. Remember to adjust the length of the string according to the thickness of your clothes. Lower, right: Principle sketch of how the delimitation of the distance bands parallel to the track line of the ship are asses-sed by means of the range stick.

Example

As an example, if the eye height above sea surface is 15 m, the distance from eye to range stick is 70 cm, and it is the 300 m distance band limit that needs to be determined, then the 300 meter mark needs to be placed $(70*15*(3838*(15^{1/2})-300)) / (15^2 + 3838*(15^{1/2})*300) = 3.43$ cm below the base-line of the range stick (situation illustrated in fig. 7).

6 Data entry and reporting

Test data entry in the field

The survey data recorded on the paper recording sheets need to be entered digitally before they can be submitted to BMP and DCE. In principle this can wait until the survey has been completed but we strongly recommend to at least start/test the process during vacant hours in the field as it will often highlight problems that can then be adjusted for. You don't have that option if you wait until afterwards.

Install data entry application before cruise

DCE has designed an application specifically for entering the seabird and marine mammal survey data. The installation of this application, how data is entered, and how to create the output that needs to be submitted to BMP and DCE is described in appendix B. Be sure to install the data entry application before you embark on the cruise as you might need Internet connection to complete the installation.

Items to deliver to BMP/DCE

In total the following items need to be delivered to BMP and DCE:

- The seabird and marine mammal survey data entered in the data entry application (see appendix B).
- The marine mammal monitoring data entered in the JNCC Marine Mammal Recording Form.
- GPS trip log files (Excel sheets or delimited text files) from at least all the periods when survey or monitoring were conducted, preferably the whole trip (see section 3.2). The trip log needs to contain at least date and time (precision seconds, time zone UTC), latitude and longitude (decimal degrees, datum: WGS84). Remember to keep the trip log from the different GPS units in separate folders, and indicate in the folder name which one is the master, if one of them is incomplete.
- The MMSO report.

Normally all these items are delivered in the form of a CD.

7 References

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, & L. Thomas. 2001. *Introduction to Distance Sampling. Estimating abundance of biological populations*. Oxford University Press.

Camphuysen, K. J., A. D. Fox, M. F. Leopold & I. K. Petersen. 2004. *Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K.: a comparison of ship and aerial sampling methods for marine birds, and their applicability to offshore wind farm assessments*. NIOZ report to COWRIE (BAM – 02-2002), Texel.

Camphuysen, C.J. & S. Garthe. 2004. Recording foraging seabirds at sea. Stadardised recording and coding of foraging behaviour and multi-species foraging assocations. *Atlantic Seabirds* 6(1): pp. 1-32.

Heinemann, D. 1981. A range finder for pelagic bird censuing. *Journal of Wildlife Management* Vol. 45, No. 2 (Apr. 1981), pp. 489-493.

Kyhn, L.A., D. Boertmann, J. Tougaard, K. L. Johansen & A. Mosbech. 2011a. *Guidelines to environmental impact assessment of seismic activities in Greenland waters*. 3rd revised edition. DCE – Danish Centre for Environment and Energy, Aarhus University, Denmark.
http://www.bmp.gl/images/stories/petroleum/environmental_reports/EIA_Guidelines_to_environmental_impact_assessment_of_seismic_activities_in_Greenland_waters.pdf

Kyhn, L.A., D. Boertmann, J. Tougaard, K. L. Johansen & A. Mosbech. 2011b. *Guidelines to environmental mitigation assessment of seismic activities in Greenland waters*. 3rd revised edition. DCE – Danish Centre for Environment and Energy, Aarhus University, Denmark.
http://www.bmp.gl/images/stories/petroleum/environmental_reports/EMA_Guidelines_to_environmental_mitigation_assessment_of_seismic_activities_in_Greenland_waters.pdf

Tasker, M. L., P. H. Jones, T. J. Dixon & B. F. Blake. 1984. Counting seabirds at sea from ships: a review of methods employed and a suggestion for a standardized approach. *Auk* 101, pp. 567-577.

Webb, A. & J. Durinck. 1992. Counting birds from ship. In: *Manual for aero-plane and ship surveys of waterfowl and seabirds*. Eds. J. Komdeur, J. Berelsen & G. Cracknell. International Wildfowl Research Bureau Special Publication No. 19: 24-37.

Appendix A: The MMSO Resource Package

MMSOs onboard seismic vessels operating in Greenland waters need to obtain the MMSO Recource Package, which contains the documentation and software needed to perform the MMSO duties. It can be downloaded from BMP's webpage http://www.bmp.gl/petroleum/environment/environmental-regulation or it will be mailed on a CD if a request is forwarded to DCE (see Appendix B, section 4 for contact details). In this appendix the contents of the folders in the package are briefly described.

- **Root**: This manual in PDF-format
- **DataEntryApplication**: Folder containing installation files etc. for the data entry application called Shipsurvey (see appendix B).
    - **Codes**: Subfolder containing the code list needed during the installation of the data entry application (see section B.1.3).
    - **Script**: Subfolder containing the SQL-script needed during the installation of the data entry application (see section B.1.3).
    - **Shipsurvey**: Subfolder containing the installation file for the data entry application (see section B.1.2).
    - **SQL Server Express 2008**: Subfolder containing the installation file for Microsoft SQL Server Express 2008 (see section B.1.1).
    - **Windows Installer**: Subfolder containing the installation file for Microsoft Windows Installer which may be needed during the installation of the data entry application (see section B.1.1).
    - **Sqldbx**: Subfolder containing a small application that may come in handy in case DCE support is needed.
- **MarineMammalMonitoring**: Folder containing the things needed to do marine mammal monitoring (can also be downloaded from http://www.jncc.gov.uk/page-1534):
    - **DCE's guidelines** to environmental impact assessment of seismic activities in Greenland waters.
    - **DCE's guidelines** to environmental mitigation assessment of seismic activities in Greenland waters.
    - **JNCC guidelines** for minimising the risk of disturbance and injury to marine mammals from seismic surveys.
    - **JNCC deck forms** to be printed and used for data recording during marine mammal monitoring in the field.
    - **JNCC Marine Mammal Recording Form** to be used for digital data entry of marine mammal monitoring data and submission of these data to BMP/DCE.
    - **JNCC guide to using Marine Mammal Recording Forms**.
    - **JNCC guide to making a range finding stick**.
    - **JNCC angle board** to be printed and used during marine mammal monitoring in the field.
- **SeabirdAndMarineMammalSurvey**: Folder containing the things needed to do seabird and marine mammal survey:
    - **The field recording sheet** in PDF-format to be printed in large numbers and used for data recording during seabird and marine mammal survey in the field (see section 4.3 and 4.4).
    - **The seabird behavior codes from Camphuysen & Garthe (2004)** in PDF-format (see section 3.3 and C.3.12).
    - **An angle board** to be printed and used in the field

- **A Microsoft Excel workbook called RangeStickCalculation.xlsx** containing a function for calculating the placement of distance marks on a range stick (see section 5.3).
- **ExcelDataEntry**: A subfolder containing a Microsoft Excel Workbook for digital data entry and submission of seabird and marine mammal survey data, and a PDF-file describing how the data entry should be done (see section B.3). Only to be used if the data entry application for some reason fails.

Appendix B: Digital data entry and submission of data

The MMSO Resource Package contains installation files for a database application called Shipsurvey Version 2.0. This application is designed specifically for entering and submitting the survey data recorded on the paper recording sheets in the field. This appendix describes the installation and use of this application.

B.1 Installation and upgrading

If you plan to do digital data entry during the survey period, we strongly recommend installing the data entry application before embarking on the survey vessel as problems may arise where easy access to DCE support and the internet will make life a lot easier.

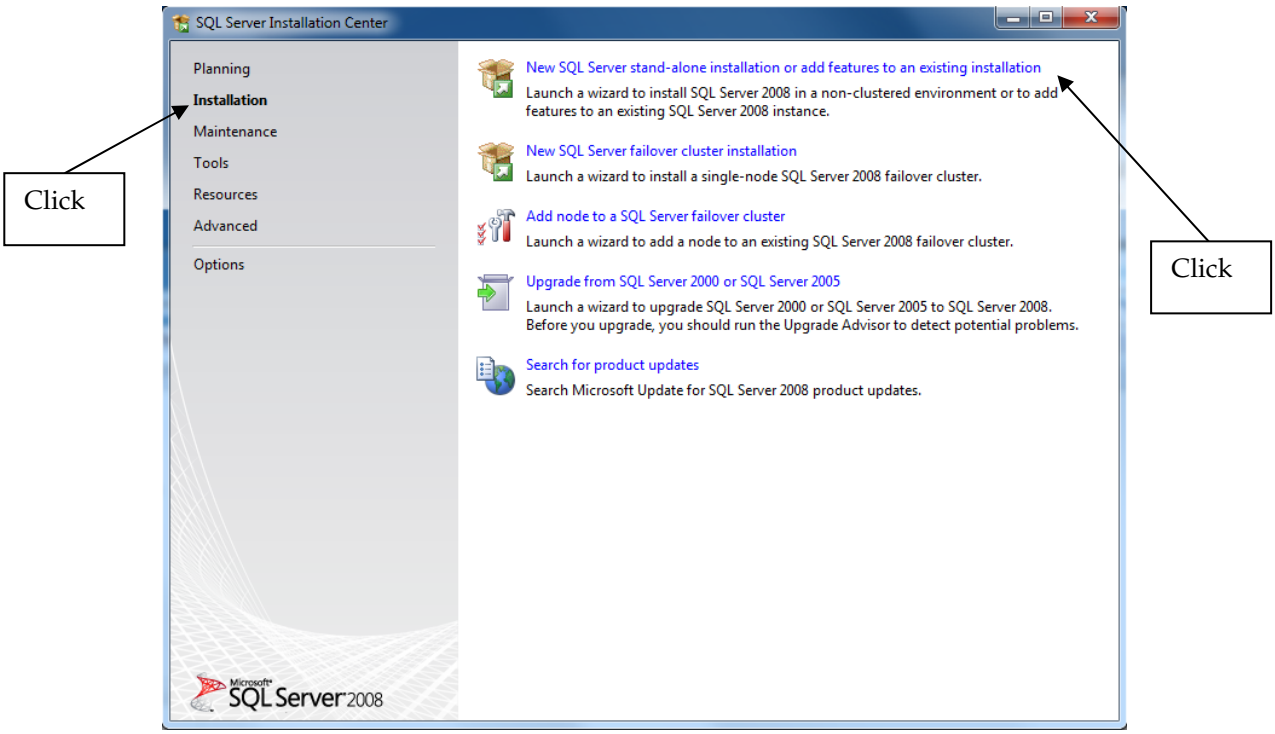
The current version of the Shipsurvey data entry application is version 2.0. If you already have version 1 installed on your computer, please proceed to section B.1.4, which describes how to upgrade from version 1 to version 2. If you don't have version 1 already on your computer then follow the instructions below in section B.1.1 – B.1.3, which describe how to install Shipsurvey version 2.0 from scratch.

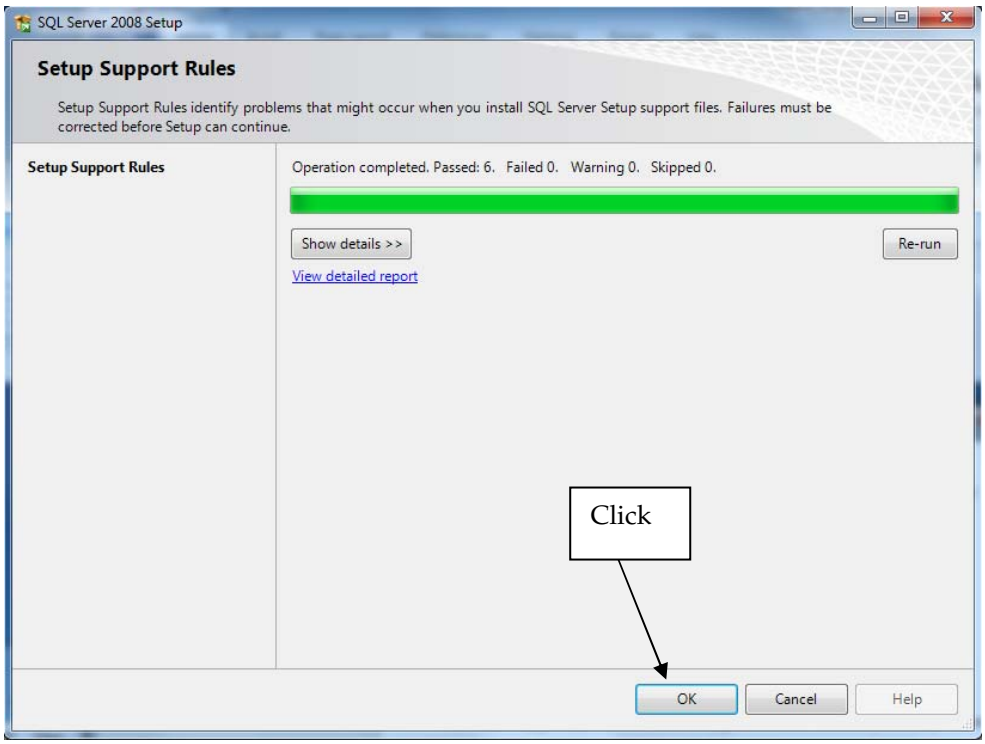
B.1.1 Installation of the Microsoft SQL Server Express 2008

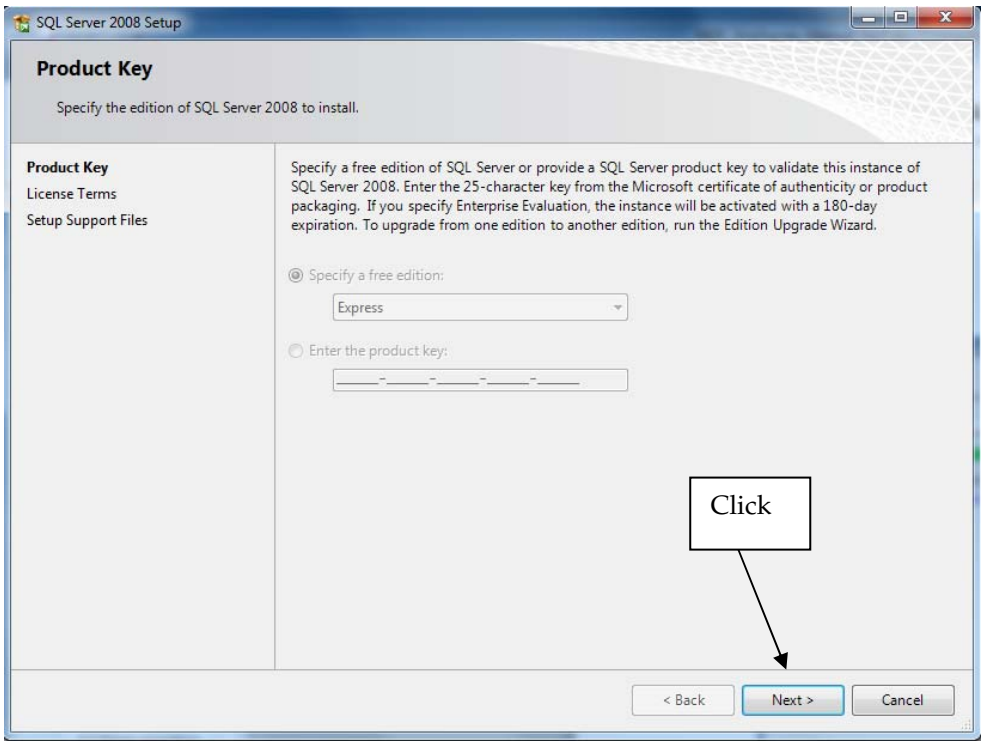
Microsoft SQL Server Express 2008 needs to be installed before the data entry application is installed on your computer. Even if Microsoft SQL Server Express 2008 is already on your computer, you still need to run this installation (in this case the installation will simply create a required namespace called NERI).

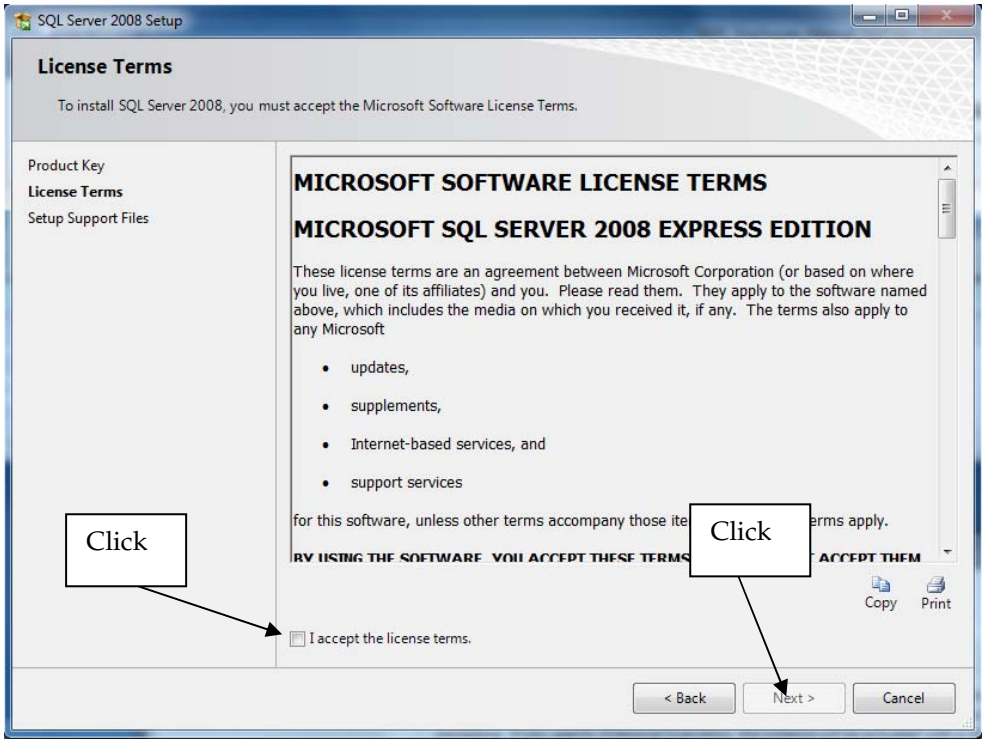
The installation file located in the folder *DataEntryApplication\SQL Server Express 2008* in the MMSO Resource Package. Double click on file *SQLEXPR32_x86_ENU.exe* if you have a 32-bit operating system (all Windows versions earlier than Windows 7 and sometimes also Windows 7). If you have a 64-bit operating system (only Windows 7), double click on the file *SQLEXPR_x64_ENU.exe*. To find out if your Windows 7 is 64-bit: *Start menu -> Computer*, click the tab *System properties* and see what it says under the heading *System type*.

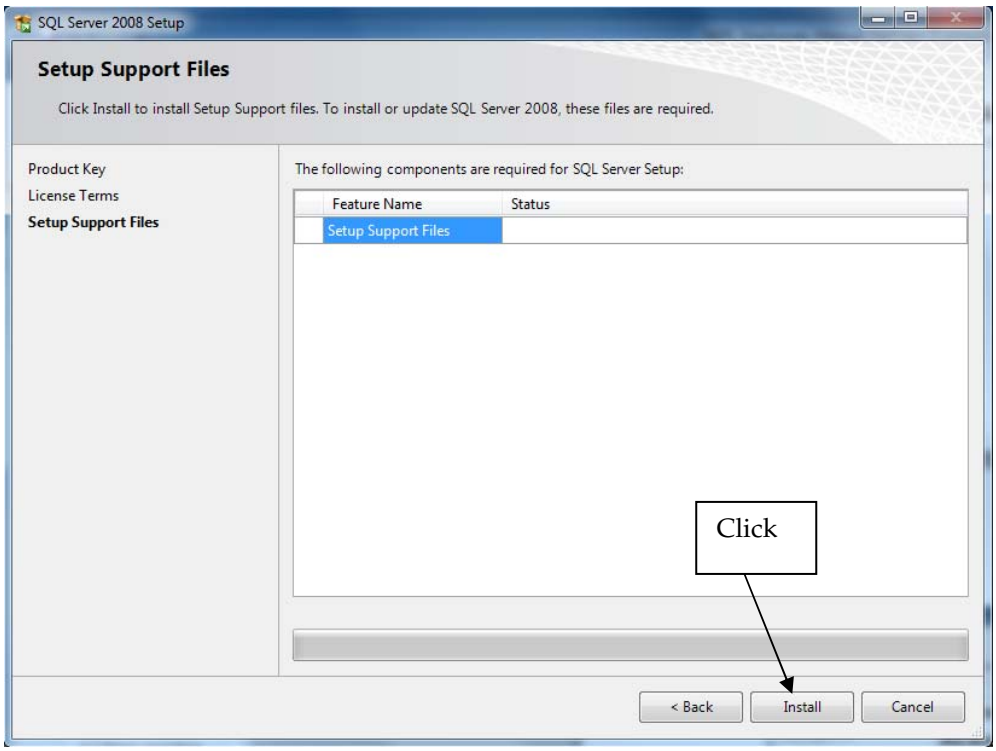
Once you have double clicked the appropriate installation file, carefully follow the procedure illustrated by the screen dumps below. If the installation fails, you may need to install *Windows Installer*. Type the command "msiexec.exe /?" in the *Run…* window (*Start menu -> Run…*) and hit enter to check if it is installed already. To install *Windows Installer 4.5*, double click on the file *WindowsXP-KB942288-v3-x86.exe* in the folder *DataEntryApplication\Windows Installer* in the MMSO Resource Package.

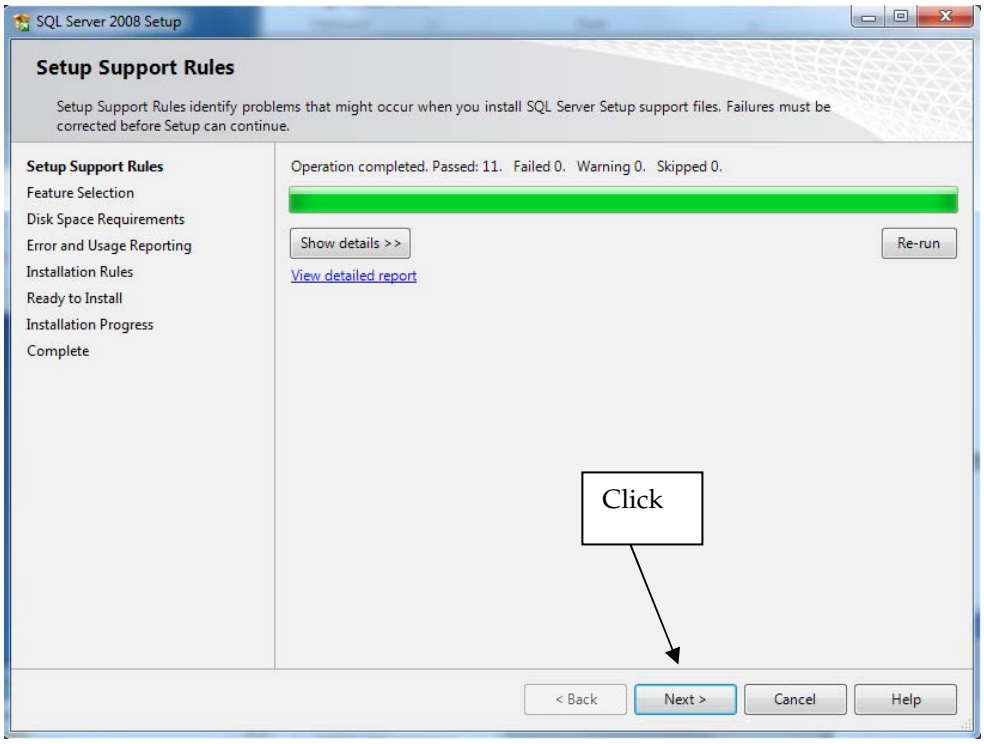

SQL Server Installation Center
Planning
Installation
Maintenance
Tools
Resources
Advanced
Options
New SQL Server stand-alone installation or add features to an existing installation
Launch a wizard to install SQL Server 2008 in a non-clustered environment or to add features to an existing SQL Server 2008 instance.
New SQL Server failover cluster installation
Launch a wizard to install a single-node SQL Server 2008 failover cluster.
Add node to a SQL Server failover cluster
Launch a wizard to add a node to an existing SQL Server 2008 failover cluster.
Upgrade from SQL Server 2000 or SQL Server 2005
Launch a wizard to upgrade SQL Server 2000 or SQL Server 2005 to SQL Server 2008. Before you upgrade, you should run the Upgrade Advisor to detect potential problems.
Search for product updates
Search Microsoft Update for SQL Server 2008 product updates.
Microsoft SQL Server 2008
Click
Click

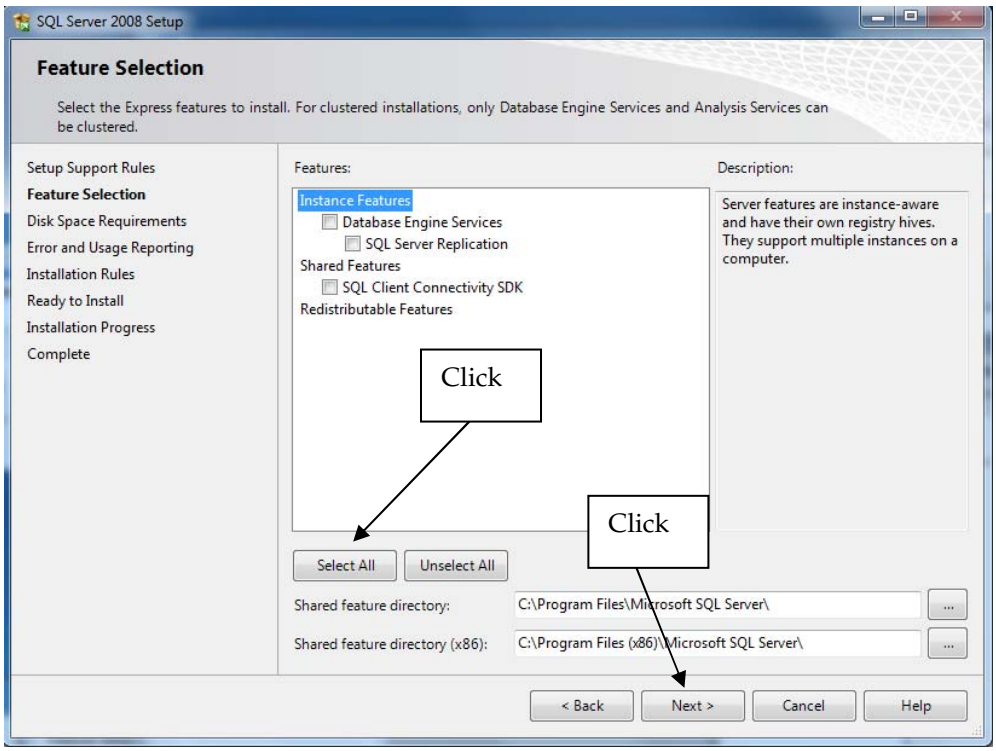

SQL Server 2008 Setup
Setup Support Rules
Setup Support Rules identify problems that might occur when you install SQL Server Setup support files. Failures must be corrected before Setup can continue.
Setup Support Rules
Operation completed. Passed: 6. Failed 0. Warning 0. Skipped 0.
Show details >>
Re-run
View detailed report
Click
OK
Cancel
Help

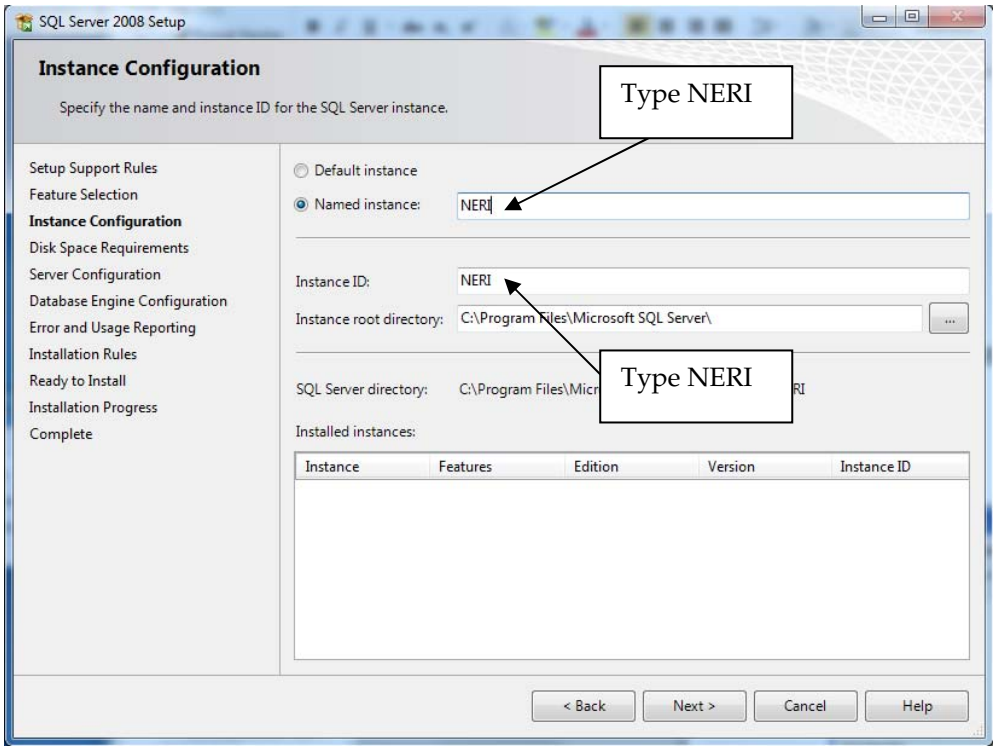

SQL Server 2008 Setup
Product Key
Specify the edition of SQL Server 2008 to install.
Product Key
License Terms
Setup Support Files
Specify a free edition of SQL Server or provide a SQL Server product key to validate this instance of SQL Server 2008. Enter the 25-character key from the Microsoft certificate of authenticity or product packaging. If you specify Enterprise Evaluation, the instance will be activated with a 180-day expiration. To upgrade from one edition to another edition, run the Edition Upgrade Wizard.
Specify a free edition:
Express
Enter the product key:
Click
< Back
Next >
Cancel

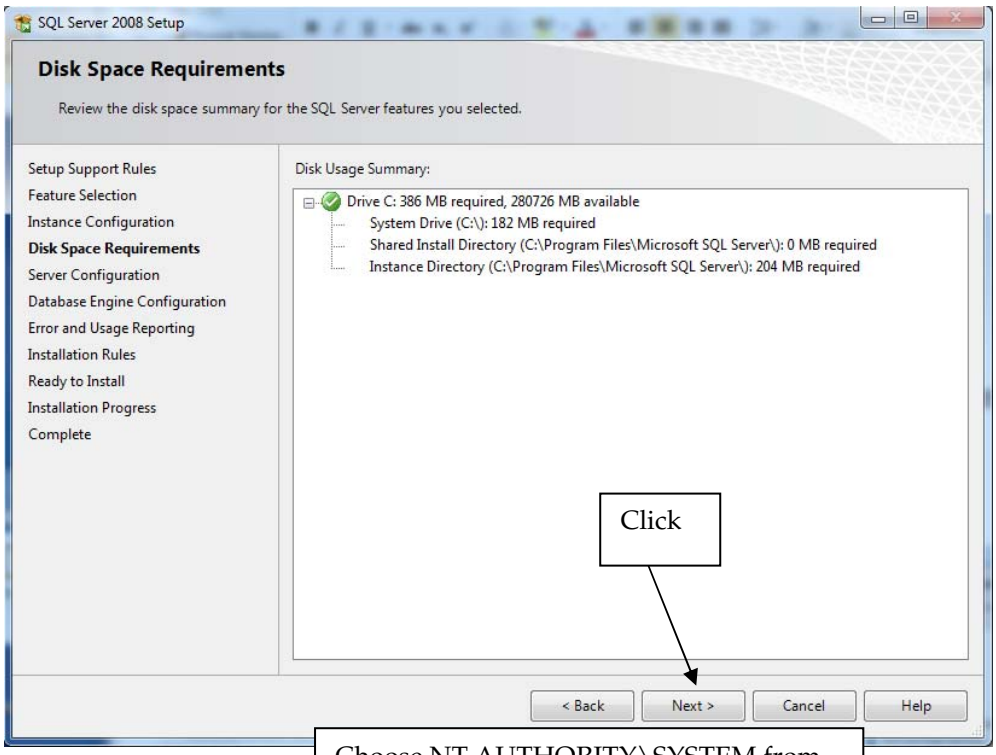

SQL Server 2008 Setup
License Terms
To install SQL Server 2008, you must accept the Microsoft Software License Terms.
Product Key
License Terms
Setup Support Files
MICROSOFT SOFTWARE LICENSE TERMS
MICROSOFT SQL SERVER 2008 EXPRESS EDITION
These license terms are an agreement between Microsoft Corporation (or based on where you live, one of its affiliates) and you. Please read them. They apply to the software named above, which includes the media on which you received it, if any. The terms also apply to any Microsoft
updates,
supplements,
Internet-based services, and
support services
for this software, unless other terms accompany those ite
erms apply.
Copy
Print
Click
Click
I accept the license terms.
< Back
Next >
Cancel


SQL Server 2008 Setup
Setup Support Files
Click Install to install Setup Support files. To install or update SQL Server 2008, these files are required.
Product Key
License Terms
Setup Support Files
The following components are required for SQL Server Setup:
Feature Name
Status
Setup Support Files
Click
< Back
Install
Cancel

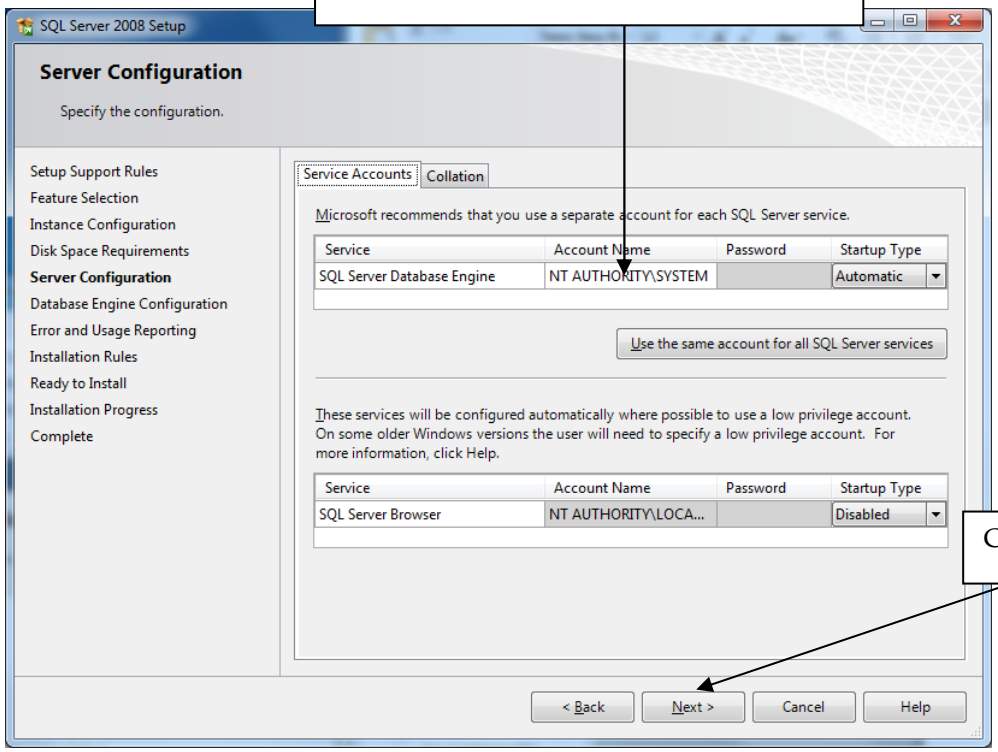

SQL Server 2008 Setup
Setup Support Rules
Setup Support Rules identify problems that might occur when you install SQL Server Setup support files. Failures must be corrected before Setup can continue.
Setup Support Rules
Feature Selection
Disk Space Requirements
Error and Usage Reporting
Installation Rules
Ready to Install
Installation Progress
Complete
Operation completed. Passed: 11. Failed 0. Warning 0. Skipped 0.
Show details >>
Re-run
View detailed report
Click
< Back
Next >
Cancel
Help

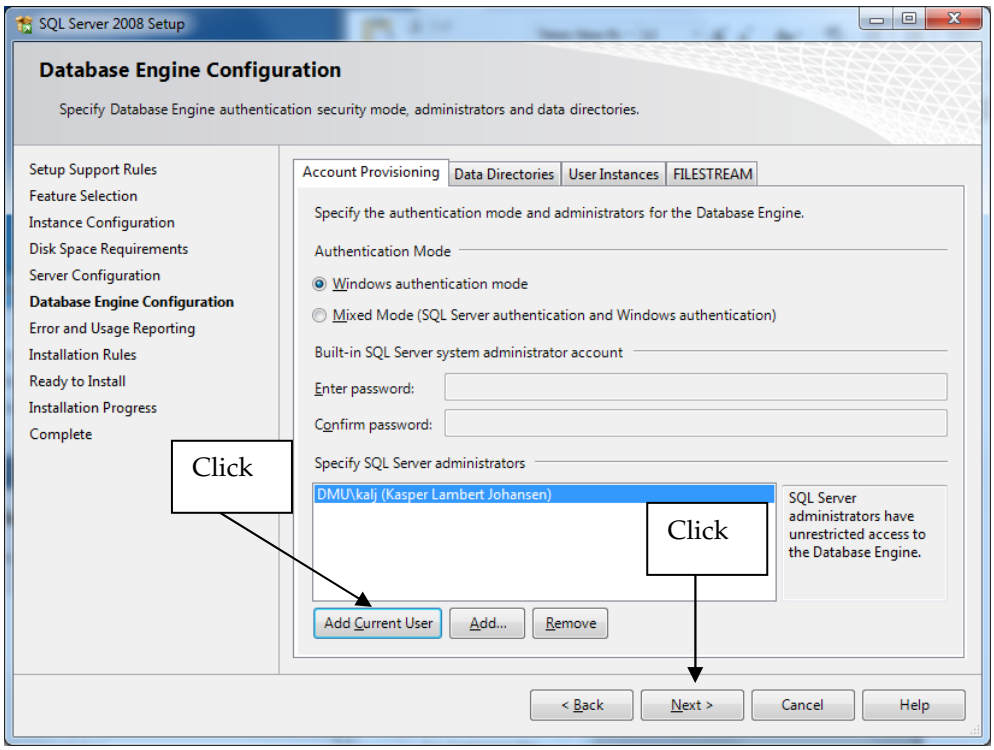

SQL Server 2008 Setup
Feature Selection
Select the Express features to install. For clustered installations, only Database Engine Services and Analysis Services can be clustered.
Setup Support Rules
Feature Selection
Disk Space Requirements
Error and Usage Reporting
Installation Rules
Ready to Install
Installation Progress
Complete
Features:
Instance Features
Database Engine Services
SQL Server Replication
Shared Features
SQL Client Connectivity SDK
Redistributable Features
Description:
Server features are instance-aware and have their own registry hives. They support multiple instances on a computer.
Click
Click
Select All
Unselect All
Shared feature directory:
C:\Program Files\Microsoft SQL Server\
Shared feature directory (x86):
C:\Program Files (x86)\Microsoft SQL Server\
< Back
Next >
Cancel
Help

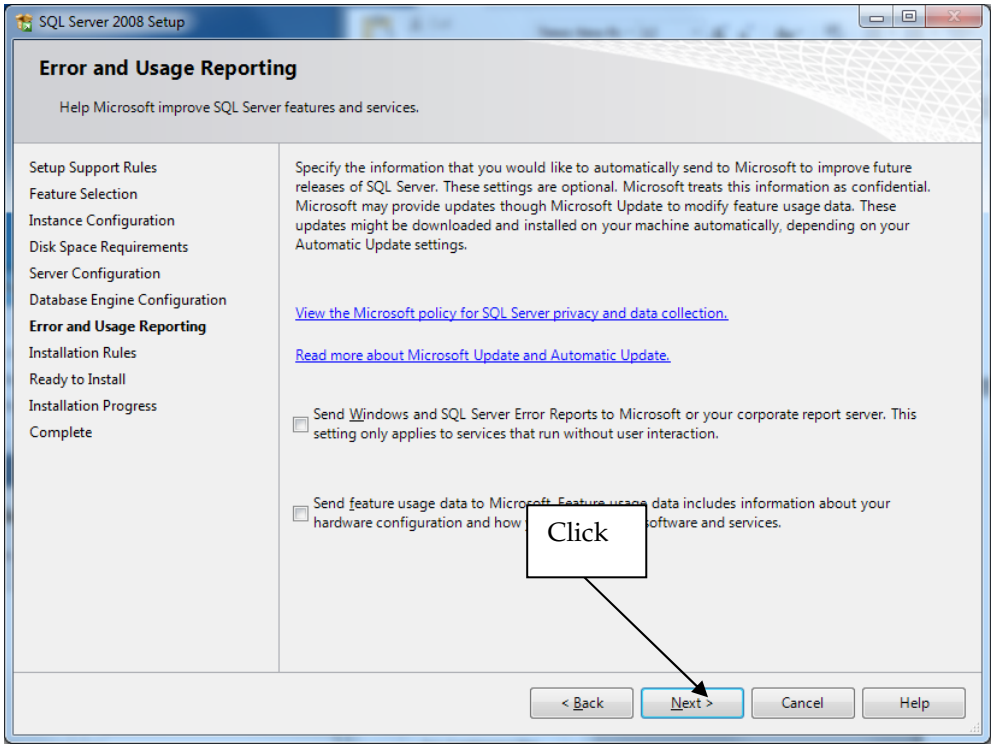

SQL Server 2008 Setup
Instance Configuration
Specify the name and instance ID for the SQL Server instance.
Type NERI
Setup Support Rules
Feature Selection
Instance Configuration
Disk Space Requirements
Server Configuration
Database Engine Configuration
Error and Usage Reporting
Installation Rules
Ready to Install
Installation Progress
Complete
Default instance
Named instance:
NERI
Instance ID:
NERI
Instance root directory:
C:\Program Files\Microsoft SQL Server\
SQL Server directory:
Type NERI
Installed instances:
Instance
Features
Edition
Version
Instance ID
< Back
Next >
Cancel
Help

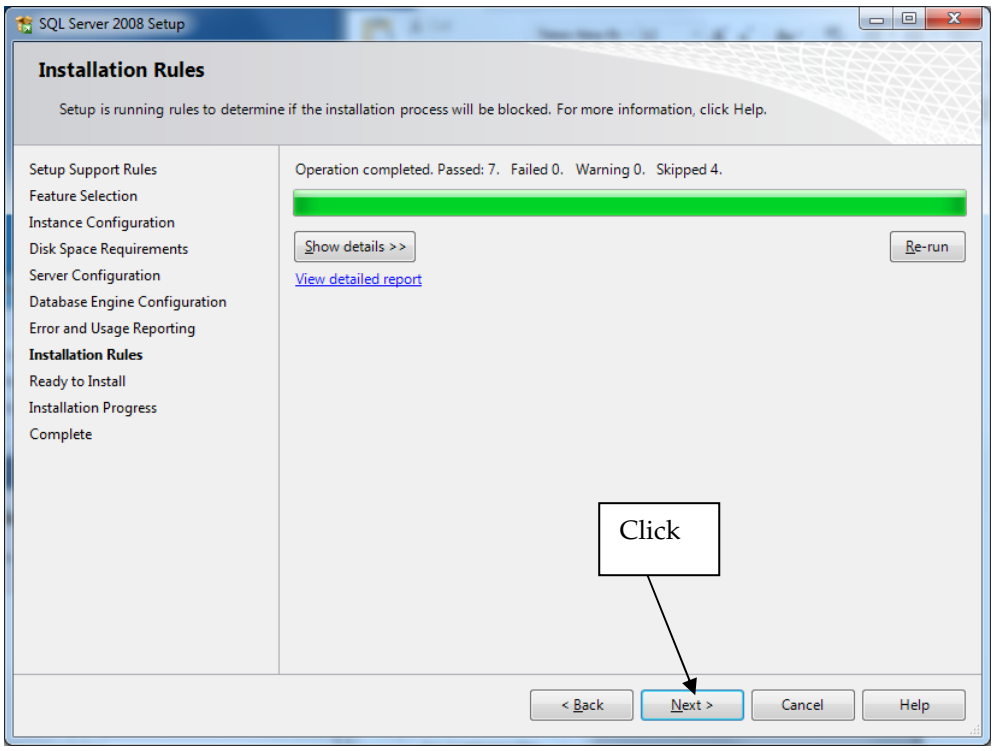


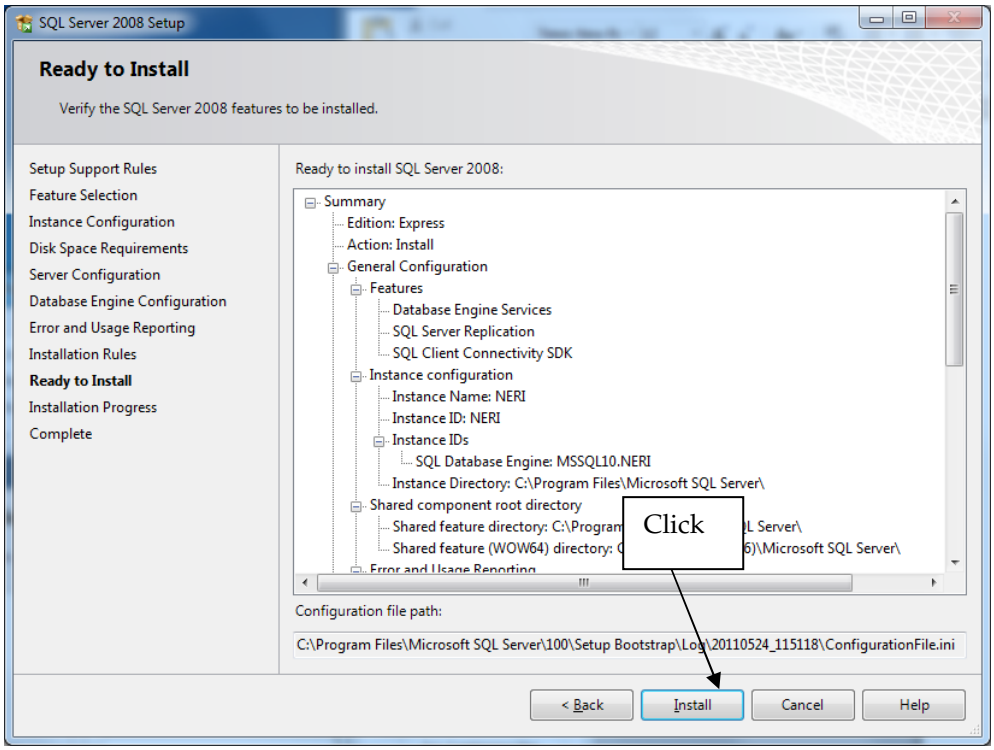
Choose NT AUTHORITY\SYSTEM from drop down menu

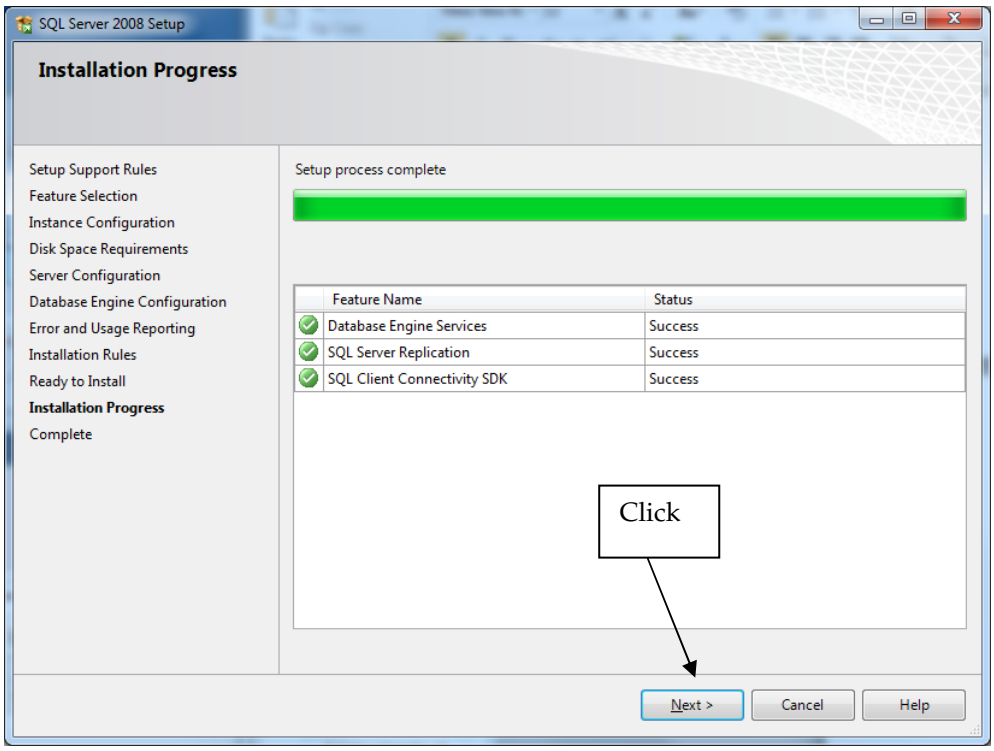


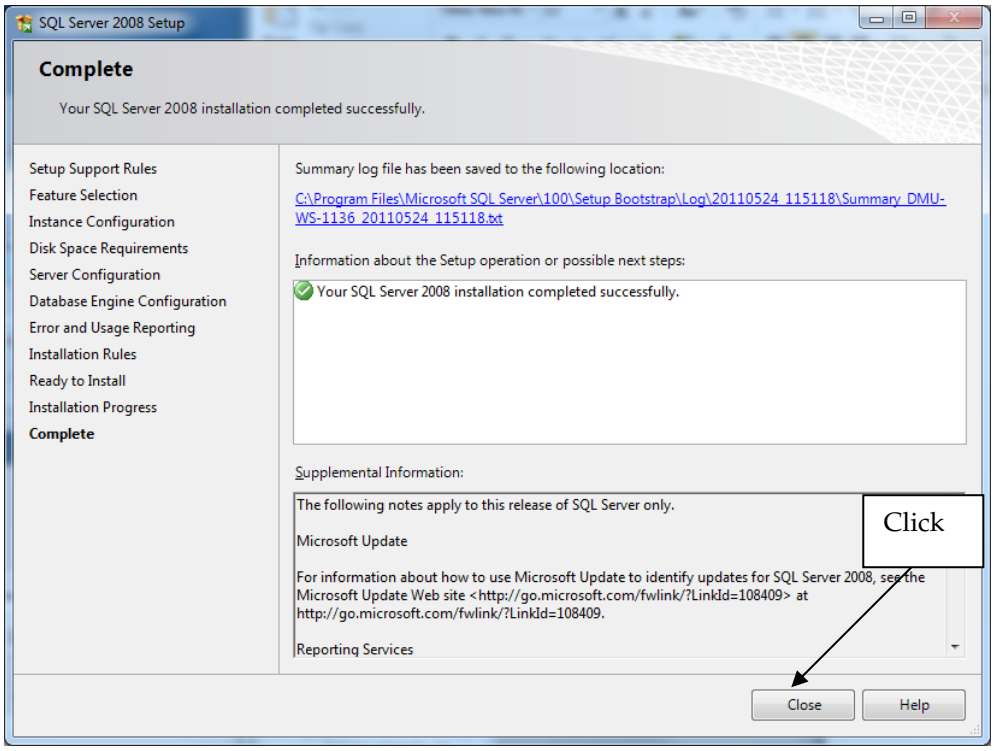

SQL Server 2008 Setup
Database Engine Configuration
Specify Database Engine authentication security mode, administrators and data directories.
Setup Support Rules
Feature Selection
Instance Configuration
Disk Space Requirements
Server Configuration
Database Engine Configuration
Error and Usage Reporting
Installation Rules
Ready to Install
Installation Progress
Complete
Account Provisioning
Data Directories
User Instances
FILESTREAM
Specify the authentication mode and administrators for the Database Engine.
Authentication Mode
Windows authentication mode
Mixed Mode (SQL Server authentication and Windows authentication)
Built-in SQL Server system administrator account
Enter password:
Confirm password:
Specify SQL Server administrators
DMU\kalj (Kasper Lambert Johansen)
SQL Server administrators have unrestricted access to the Database Engine.
Add Current User
Add...
Remove
Click
Click
< Back
Next >
Cancel
Help


SQL Server 2008 Setup
Error and Usage Reporting
Help Microsoft improve SQL Server features and services.
Setup Support Rules
Feature Selection
Instance Configuration
Disk Space Requirements
Server Configuration
Database Engine Configuration
Error and Usage Reporting
Installation Rules
Ready to Install
Installation Progress
Complete
Specify the information that you would like to automatically send to Microsoft to improve future releases of SQL Server. These settings are optional. Microsoft treats this information as confidential. Microsoft may provide updates though Microsoft Update to modify feature usage data. These updates might be downloaded and installed on your machine automatically, depending on your Automatic Update settings.
View the Microsoft policy for SQL Server privacy and data collection.
Read more about Microsoft Update and Automatic Update.
Send Windows and SQL Server Error Reports to Microsoft or your corporate report server. This setting only applies to services that run without user interaction.
Send feature usage data to Microsoft. Feature usage data includes information about your hardware configuration and how
oftware and services.
Click
< Back
Next >
Cancel
Help


SQL Server 2008 Setup
Installation Rules
Setup is running rules to determine if the installation process will be blocked. For more information, click Help.
Setup Support Rules
Feature Selection
Instance Configuration
Disk Space Requirements
Server Configuration
Database Engine Configuration
Error and Usage Reporting
Installation Rules
Ready to Install
Installation Progress
Complete
Operation completed. Passed: 7. Failed 0. Warning 0. Skipped 4.
Show details >>
Re-run
View detailed report
Click
< Back
Next >
Cancel
Help

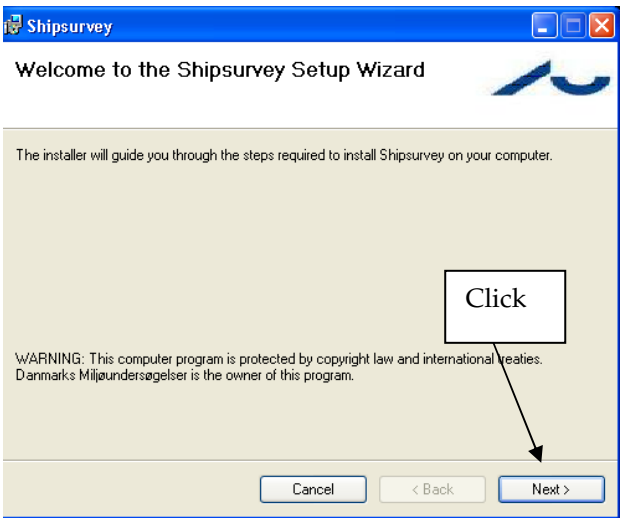

SQL Server 2008 Setup
Ready to Install
Verify the SQL Server 2008 features to be installed.
Setup Support Rules
Feature Selection
Instance Configuration
Disk Space Requirements
Server Configuration
Database Engine Configuration
Error and Usage Reporting
Installation Rules
Ready to Install
Installation Progress
Complete
Ready to install SQL Server 2008:
Summary
Edition: Express
Action: Install
General Configuration
Features
Database Engine Services
SQL Server Replication
SQL Client Connectivity SDK
Instance configuration
Instance Name: NERI
Instance ID: NERI
Instance IDs
SQL Database Engine: MSSQL10.NERI
Instance Directory: C:\Program Files\Microsoft SQL Server\
Shared component root directory
Click
Configuration file path:
C:\Program Files\Microsoft SQL Server\100\Setup Bootstrap\Log\20110524_115118\ConfigurationFile.ini
< Back
Install
Cancel
Help

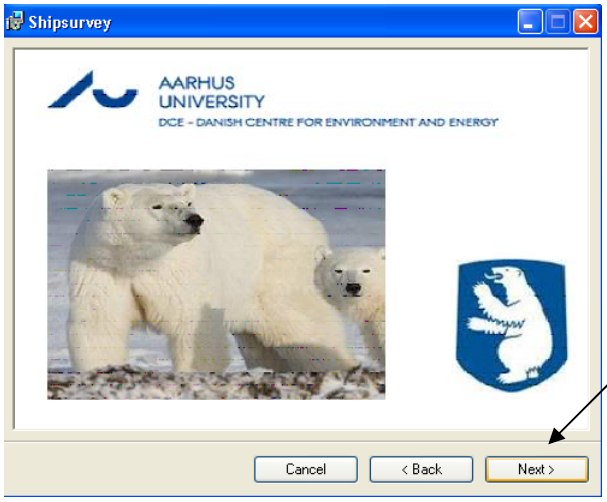


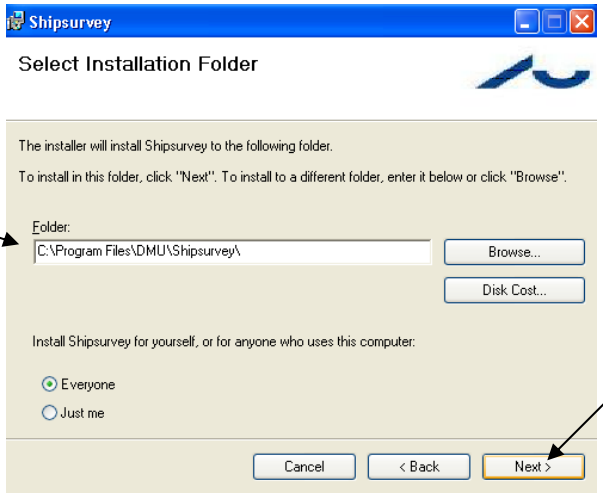


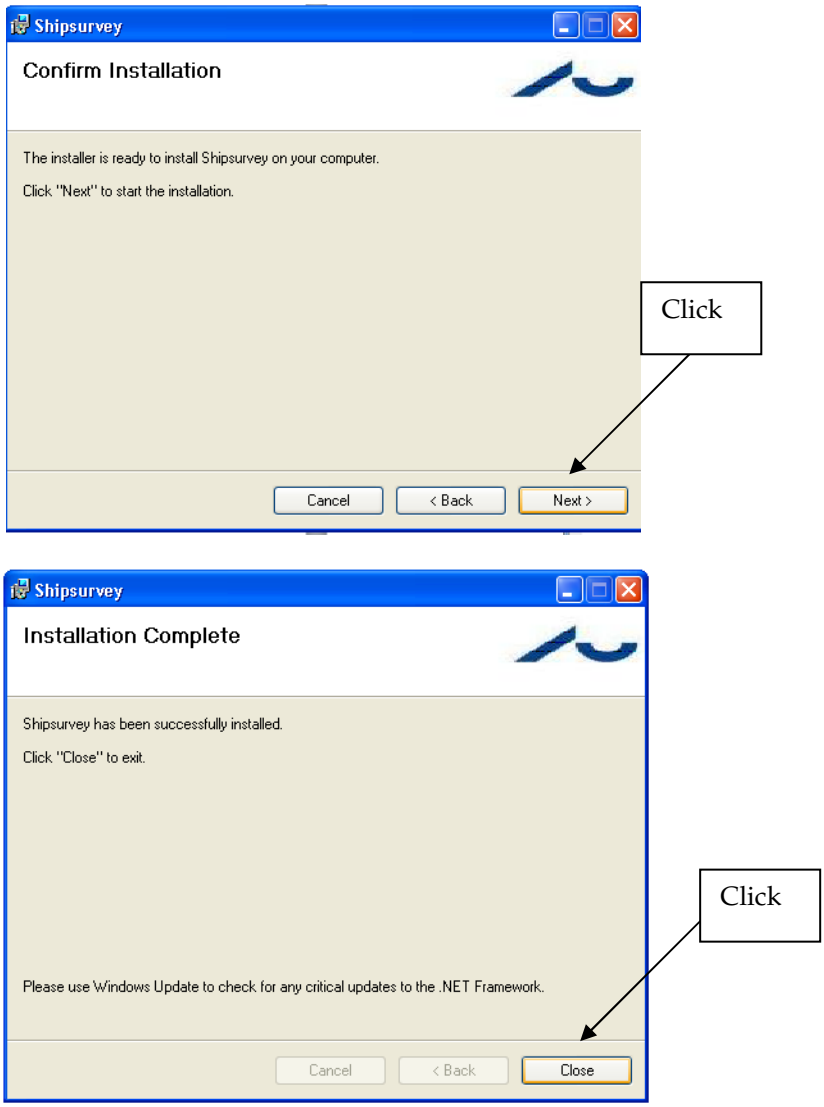
B.1.2 Installation of the Shipsurvey data entry application

When Microsoft SQL Server Express 2008 has been successfully installed, you can proceed to the installation of the data entry application. Double click on the file *setup.exe* in the folder *DataEntryApplication\Shipsurvey* in the MMSO Resource Package, and carefully follow the procedure illustrated by the screen dumps below.


Shipsurvey
Welcome to the Shipsurvey Setup Wizard
The installer will guide you through the steps required to install Shipsurvey on your computer.
Click
WARNING: This computer program is protected by copyright law and international treaties.
Danmarks Miljøundersøgelser is the owner of this program.
Cancel
< Back
Next >

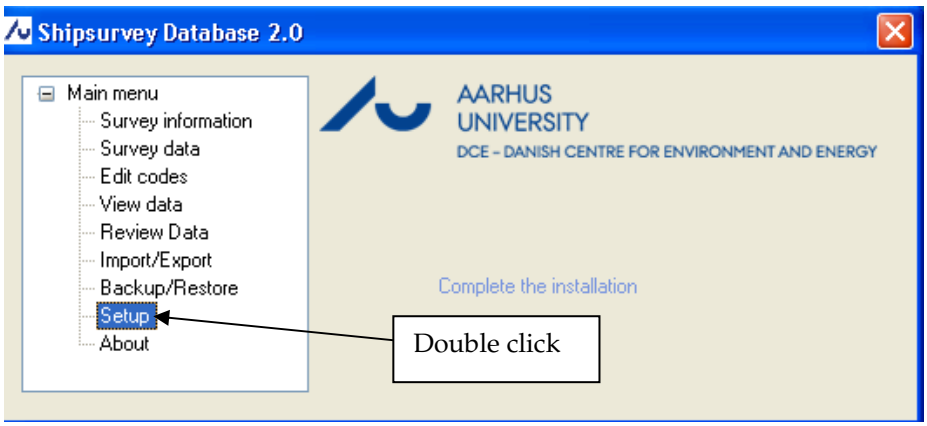

Shipsurvey
AARHUS
UNIVERSITY
DCE – DANISH CENTRE FOR ENVIRONMENT AND ENERGY
Click
Cancel
< Back
Next >

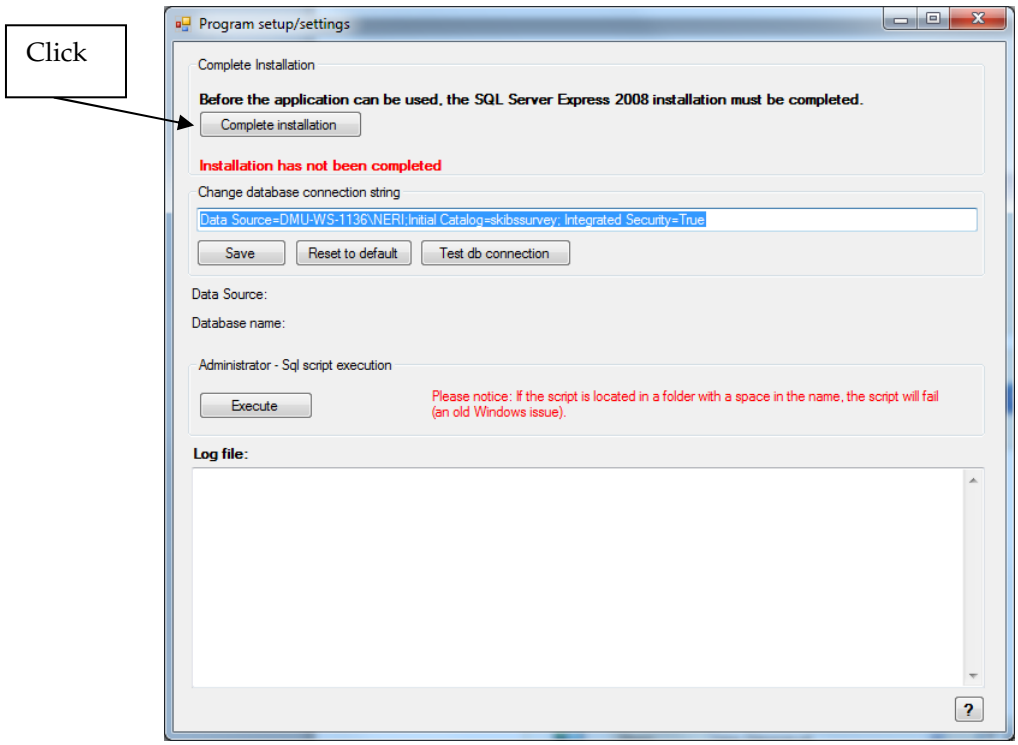

Shipsurvey
Select Installation Folder
Change if you like
The installer will install Shipsurvey to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
Folder:
C:\Program Files\DMU\Shipsurvey\
Browse...
Disk Cost...
Click
Install Shipsurvey for yourself, or for anyone who uses this computer:
Everyone
Just me
Cancel
< Back
Next >



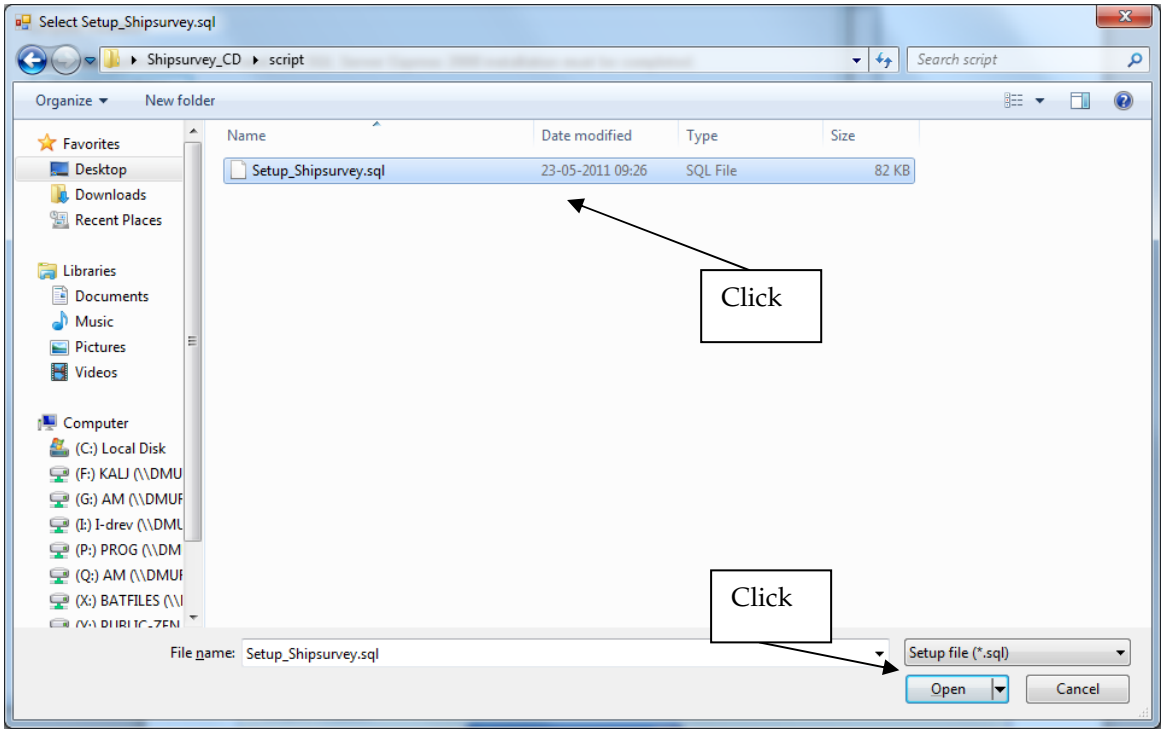
B.1.3 Complete installation by setting up the data entry application

Now start the Shipsurvey application by clicking on *Start menu->Programs->Shipsurvey* or double clicking the shortcut generated on the desktop during the installation process. Carefully follow the procedure illustrated by the screen dumps below to setup the application.

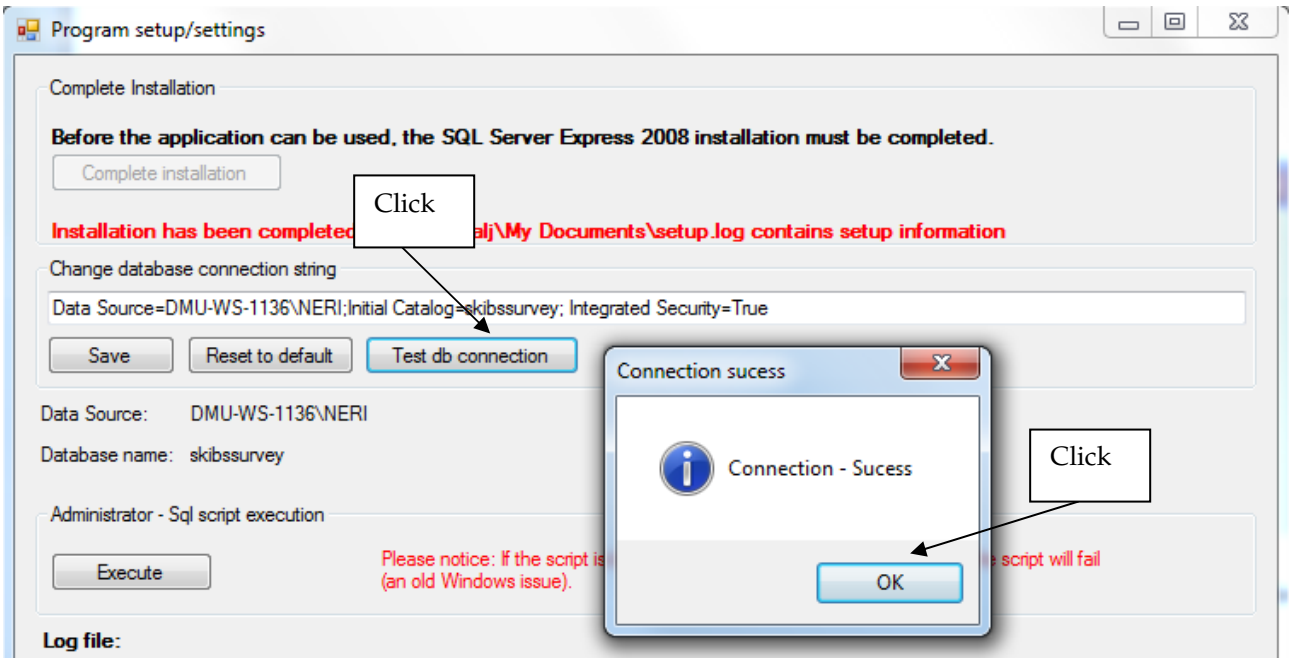




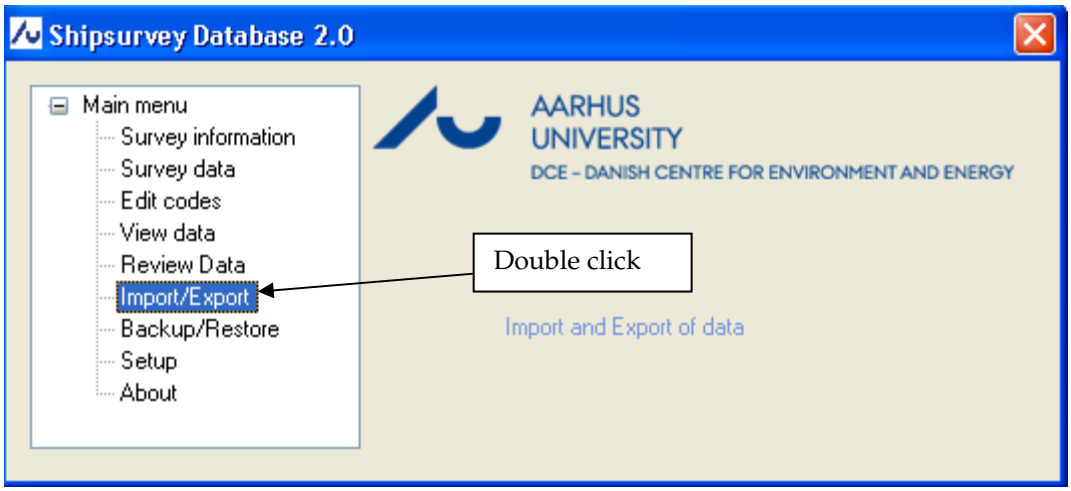
You will now be prompted to point to the file *Setup_Shipsurvey.sql* which is located in the folder *DataEntryApplication\Script* in the MMSO Resource Package.

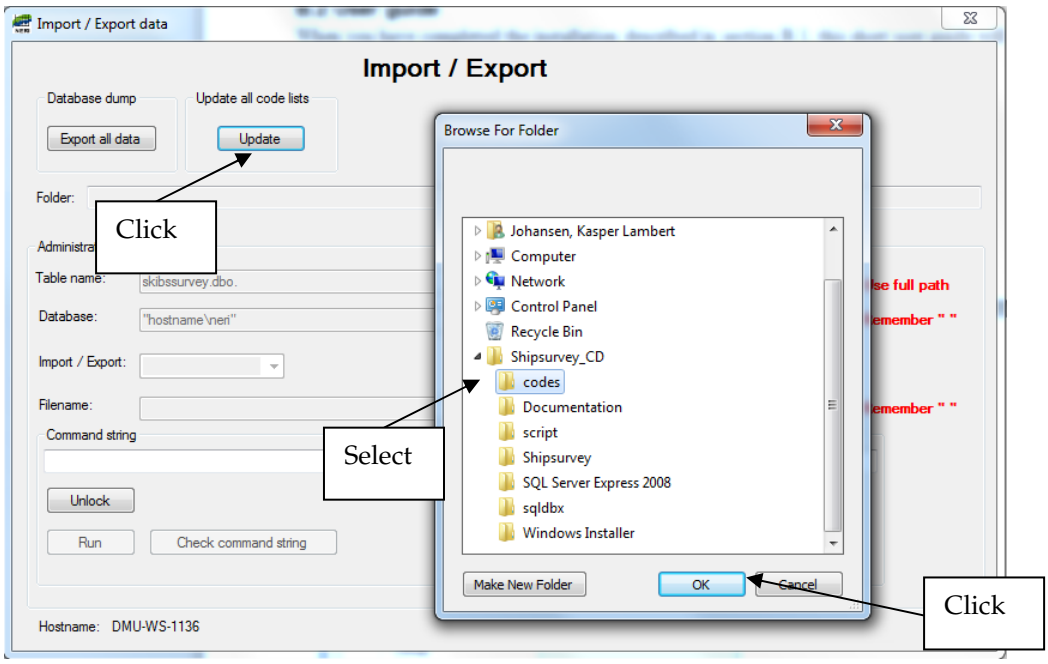


Next you press *Test db connection* to test the database connection.

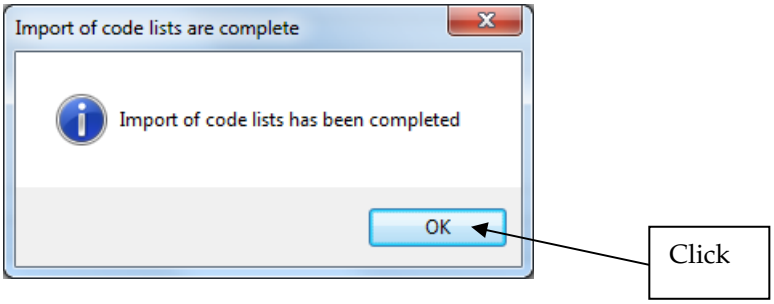


The last thing that needs to be done is to import the code list that the application uses to validate the data, which are being entered. Close the current window to get back to the main menu and follow the procedure outlined by the screen dumps below.





The folder that you are prompted to locate is *DataEntryApplication\Codes* in the MMSO Resource Package.

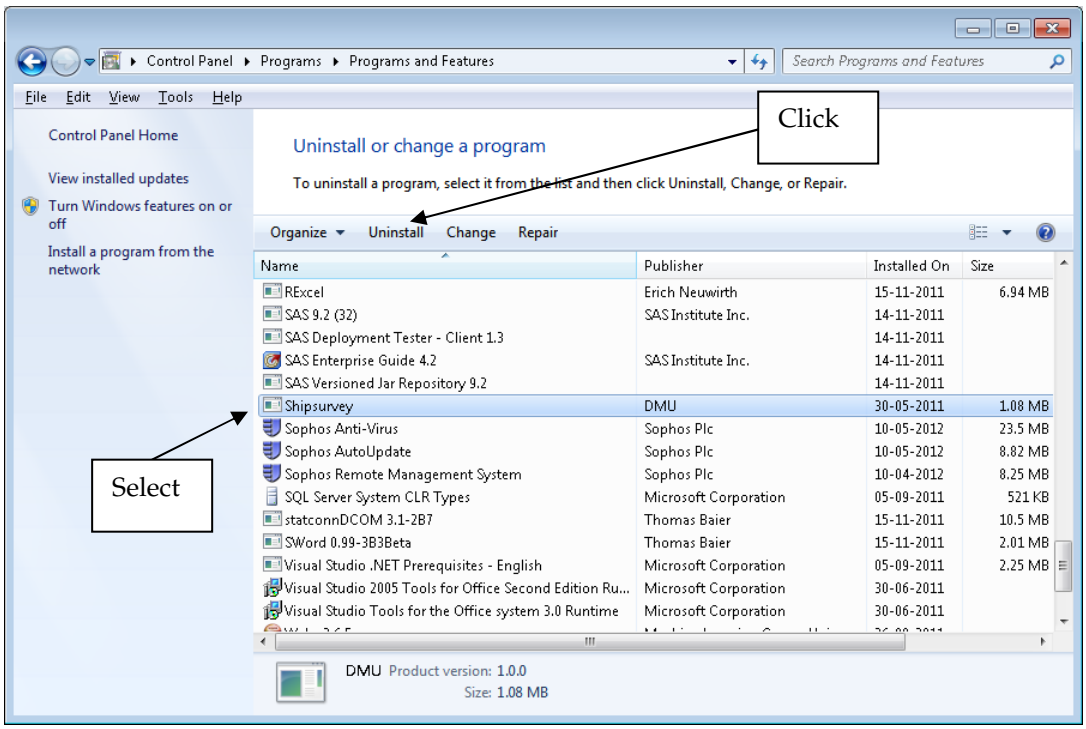


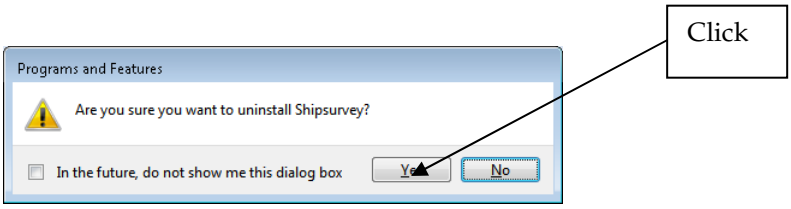
The installation of the Shipsurvey data entry application version 2.0 is now complete.

B.1.4 Upgrading from version 1 to version 2

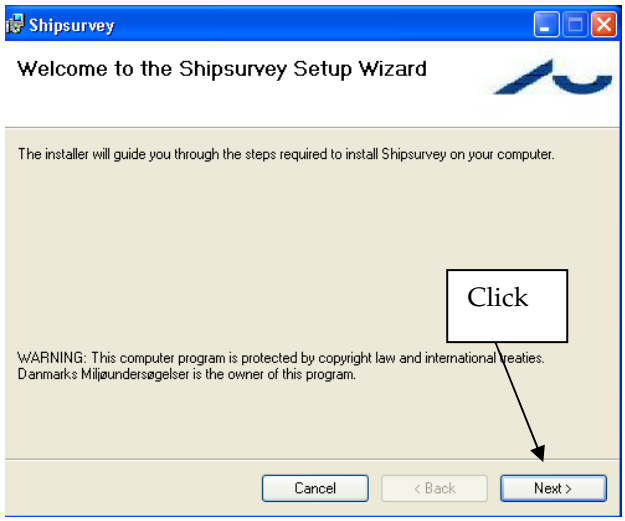
If you already have version 1 of the Shipsurvey data entry application installed on your computer, you need to follow the procedure described in this section to upgrade from version 1 to version 2. The upgrade procedure ensures that all data entered in version 1 is still accessible in version 2.

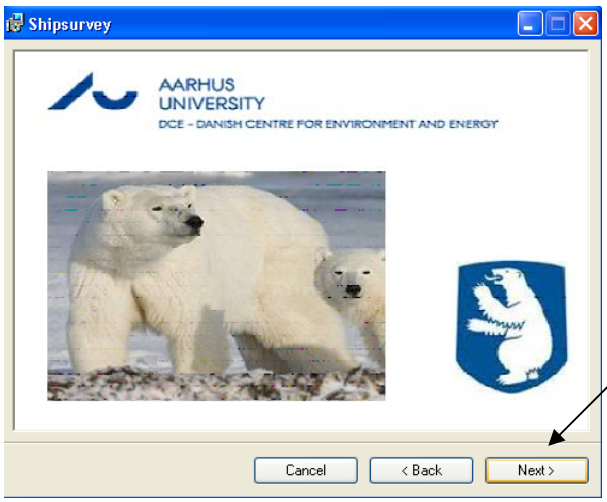
The first thing to do is to uninstall version 1. Under Windows 7 you do this the following way: *Start Menu -> Control Panel -> Uninstall a program*. Highlight "Shipsurvey" on the list of installed programs and press uninstall.



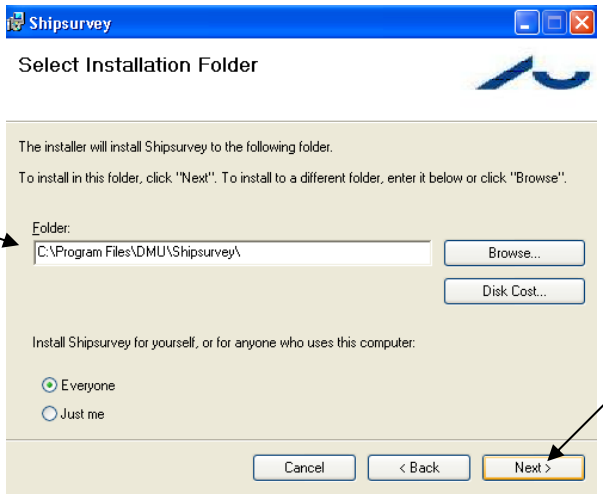


Once version 1 is removed from your system (don't worry, your data are not removed), you need to install version 2.0. Double click on the file *setup.exe* in the folder *DataEntryApplication\Shipsurvey* in the MMSO Resource Package, and carefully follow the procedure illustrated by the screen dumps below.



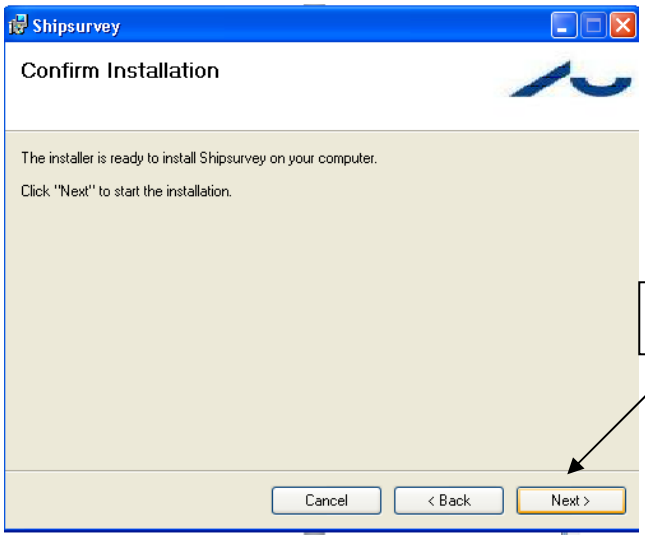


Click

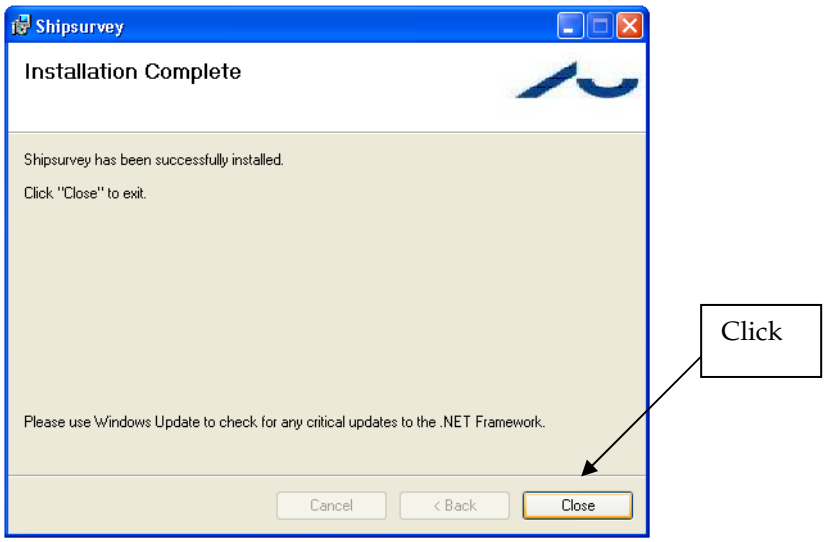


Change if you like

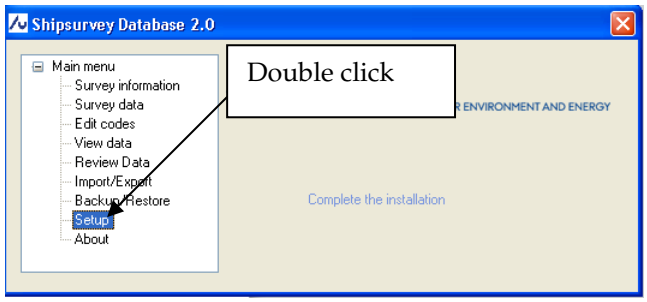
Click

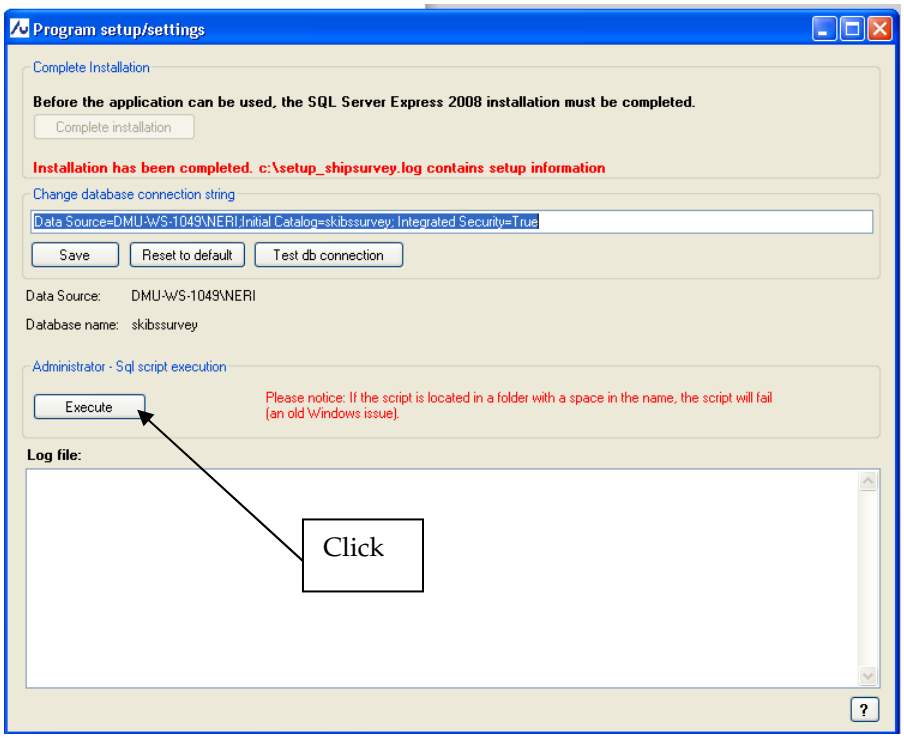


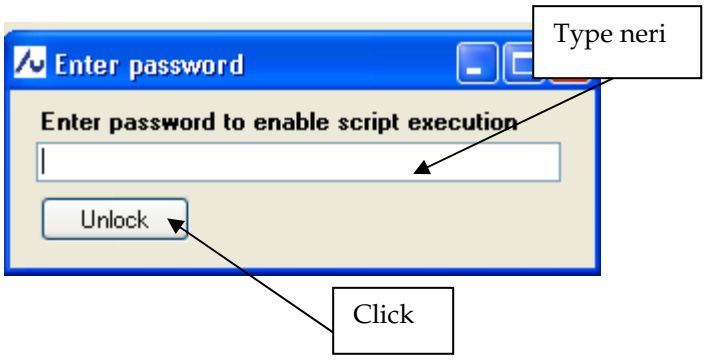
Click



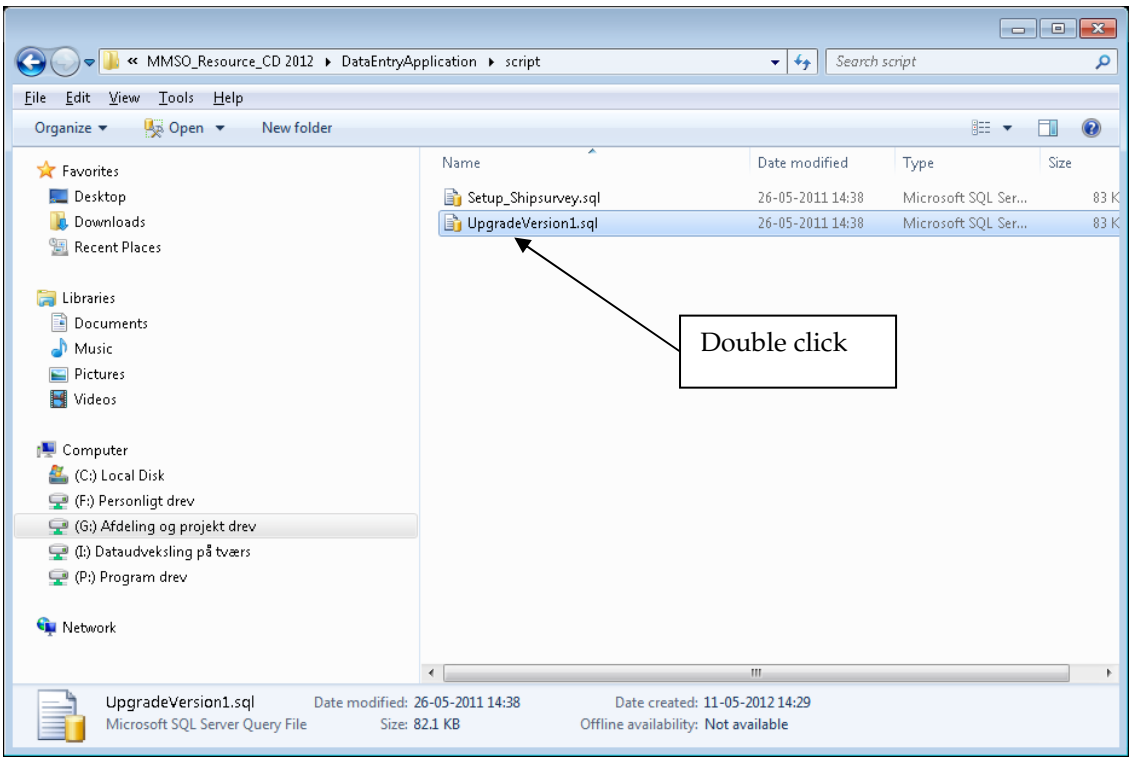
Version 2.0 is now installed on your computer. However, to reconnect to and upgrade the data you have already entered in version 1, you need to follow the procedure illustrated by the screendumps below.



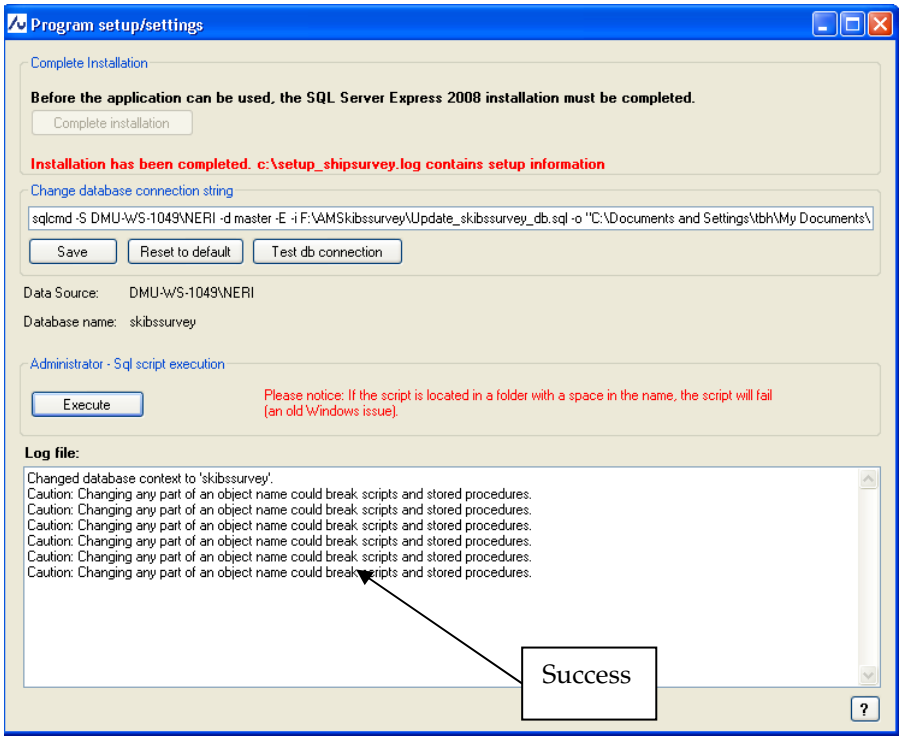




You will now be prompted to point to the file *UpgradeVersion1.sql,* which is located in the folder *DataEntryApplication\Script* in the MMSO Resource Package.



The script will now execute and produce the following output, which despite of the cautions implies success.



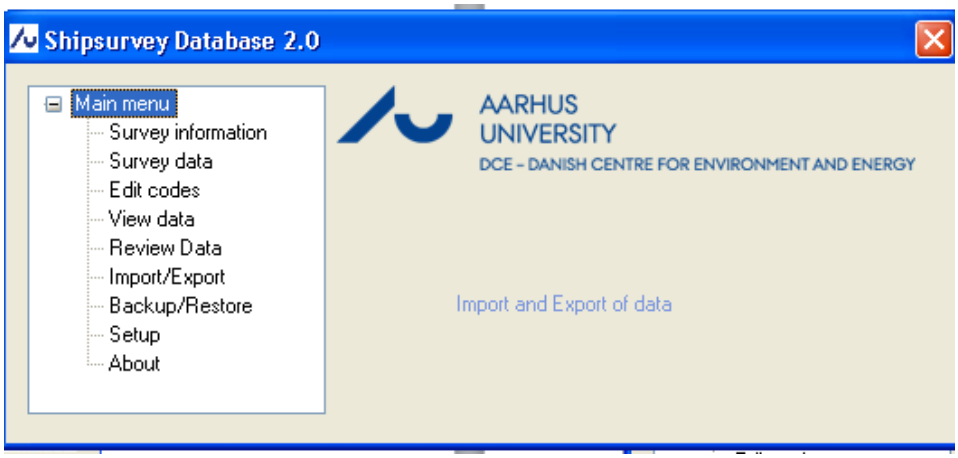
Version 2.0 is now ready for use and all data entered in version 1 should be updated and accessible.

B.2 User guide

When you have completed the installation or upgrade described in section B.1, this short user guide will help you getting started.

B.2.1 Main menu

When you start the Shipsurvey application you will encounter the main menu.

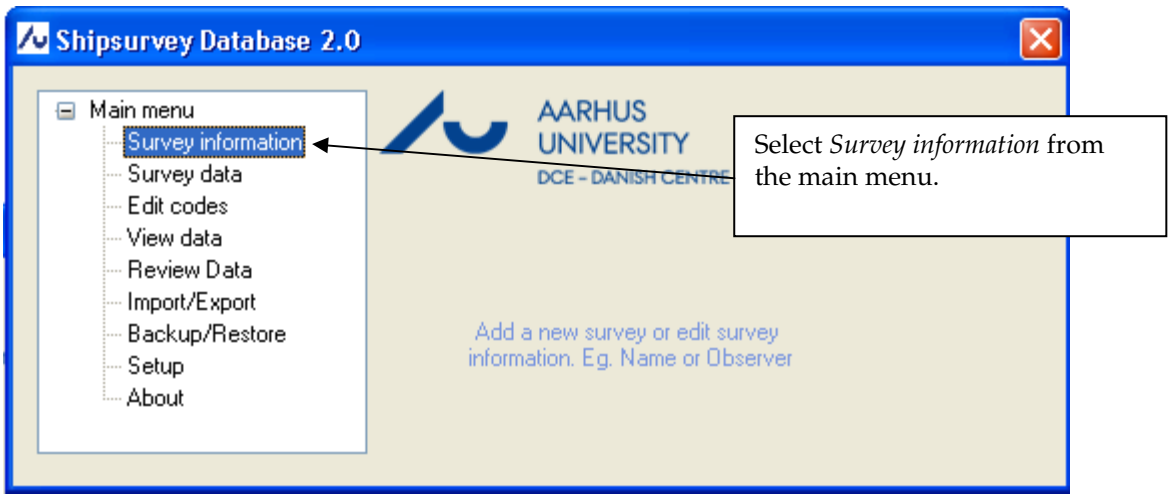


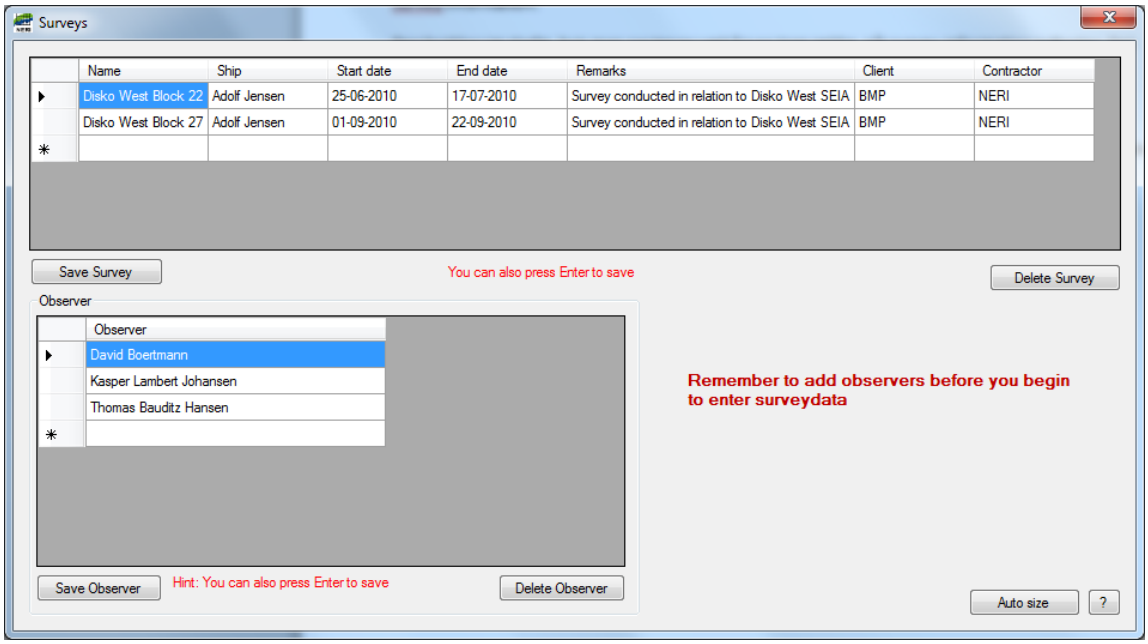
- **Survey information**: Create new surveys and enter/edit basic information about the surveys (ship, start date, observers etc).
- **Survey data**: Enter/edit survey data (information about transects, observation periods and sightings).
- **Edit codes**: Add new codes to the code lists, e.g. a new species code or a new age code.
- **View data**: Get an overview of the complete survey data in table format and create data extracts that can be exported to other programs.
- **Import/Export**: Here you can extract the files that need to be submitted to DCE when the data entry has been completed. An import function allows new versions of code lists released by DCE to be imported, thereby updating the application without having to do a complete re-installation.
- **Review Data**: Here you can review your data and make the last corrections before you submit your data to DCE.
- **Backup/Restore**: Here you can make a complete backup of the database. You can also perform a complete restore of the database from a backup file.
- **Setup**: Here you complete the installation of the application.
- **About**: Application version and contact information in case support is needed.

When you click on a node on the main menu a description of the node will be displayed in the right side of the menu. Double click or press enter to select an item from the main menu.

B.2.2 Where do I begin?

To get started, a new survey needs to be created and the basic information about the survey (ship, start date etc.) and the list of observers need to be entered.



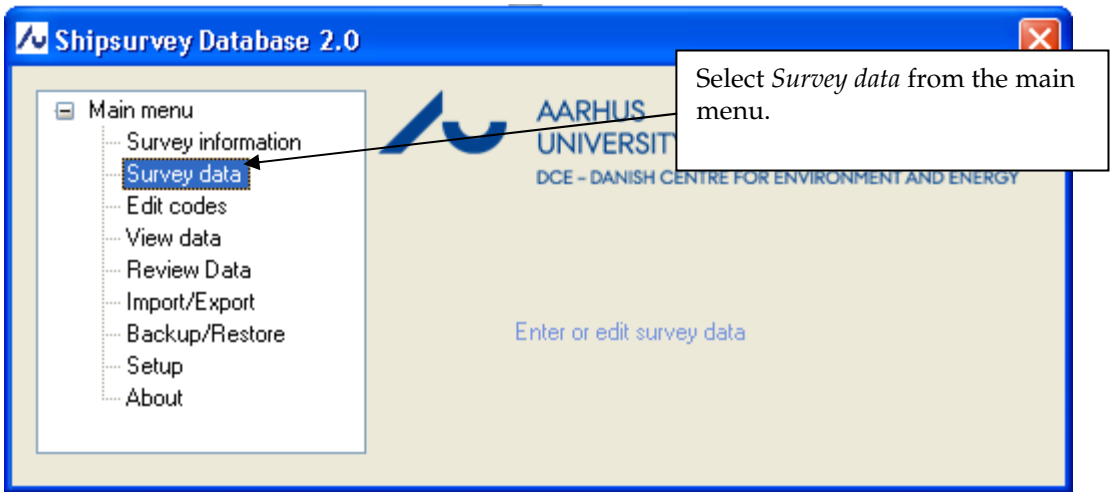


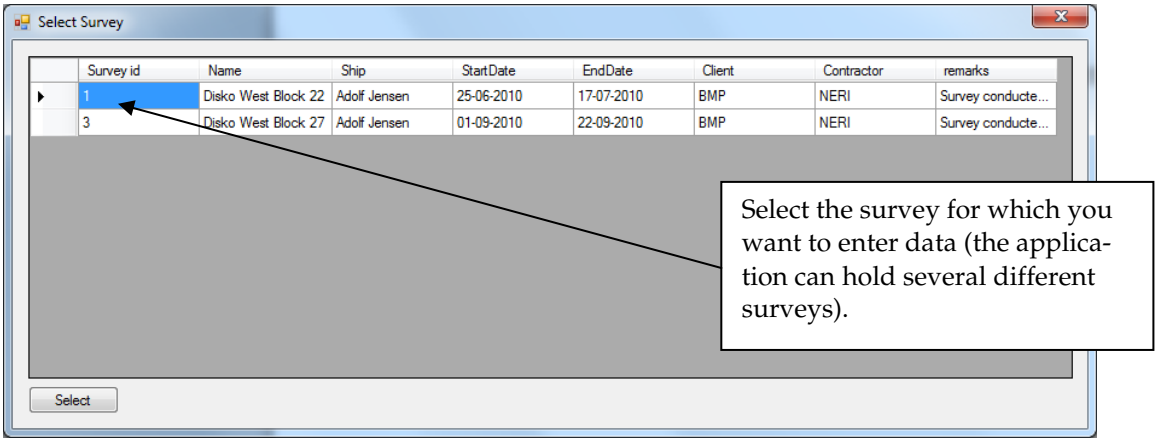
On this form you can create a survey and enter basic data about the survey. If you do not have the end date yet, 01-01-9998 will automatically be inserted. The end date can be corrected later. The basic data about your survey(s) can always be edited using this form. Hit save/press enter to save your edits.

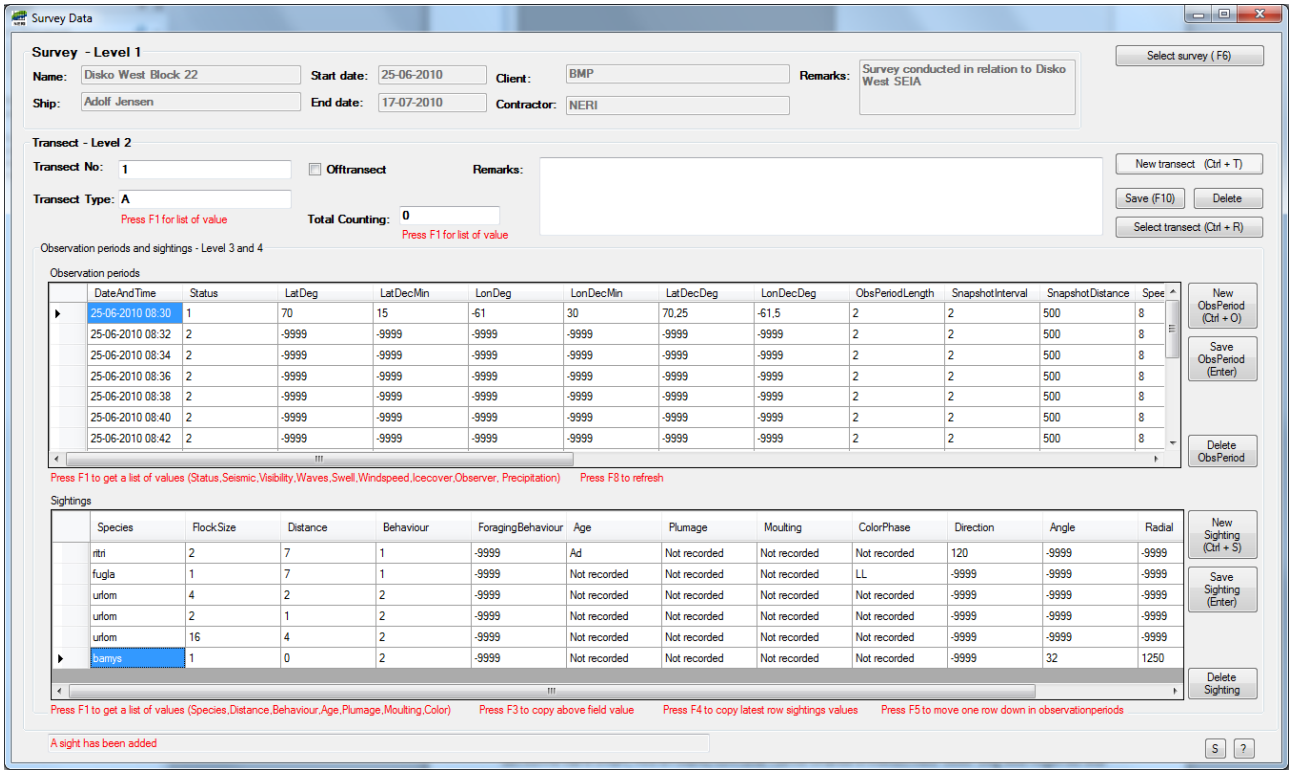
As is evident from the form, the application can hold data on several different surveys. Notice that the list of observers is a complete list for all surveys entered in the application, and it is no problem that some of the observers on the list were only working on some of the surveys entered in the application.

B.2.3 What is next?

With the survey created and the observer names entered, you are now ready to enter the actual survey data (information about transects, observation periods and sightings).


Shipsurvey Database 2.0
Main menu
Survey information
Survey data
Edit codes
View data
Review Data
Import/Export
Backup/Restore
Setup
About
AARHUS
UNIVERSIT
DCE – DANISH CENTRE FOR ENVIRONMENT AND ENERGY
Enter or edit survey data
Select *Survey data* from the main menu.

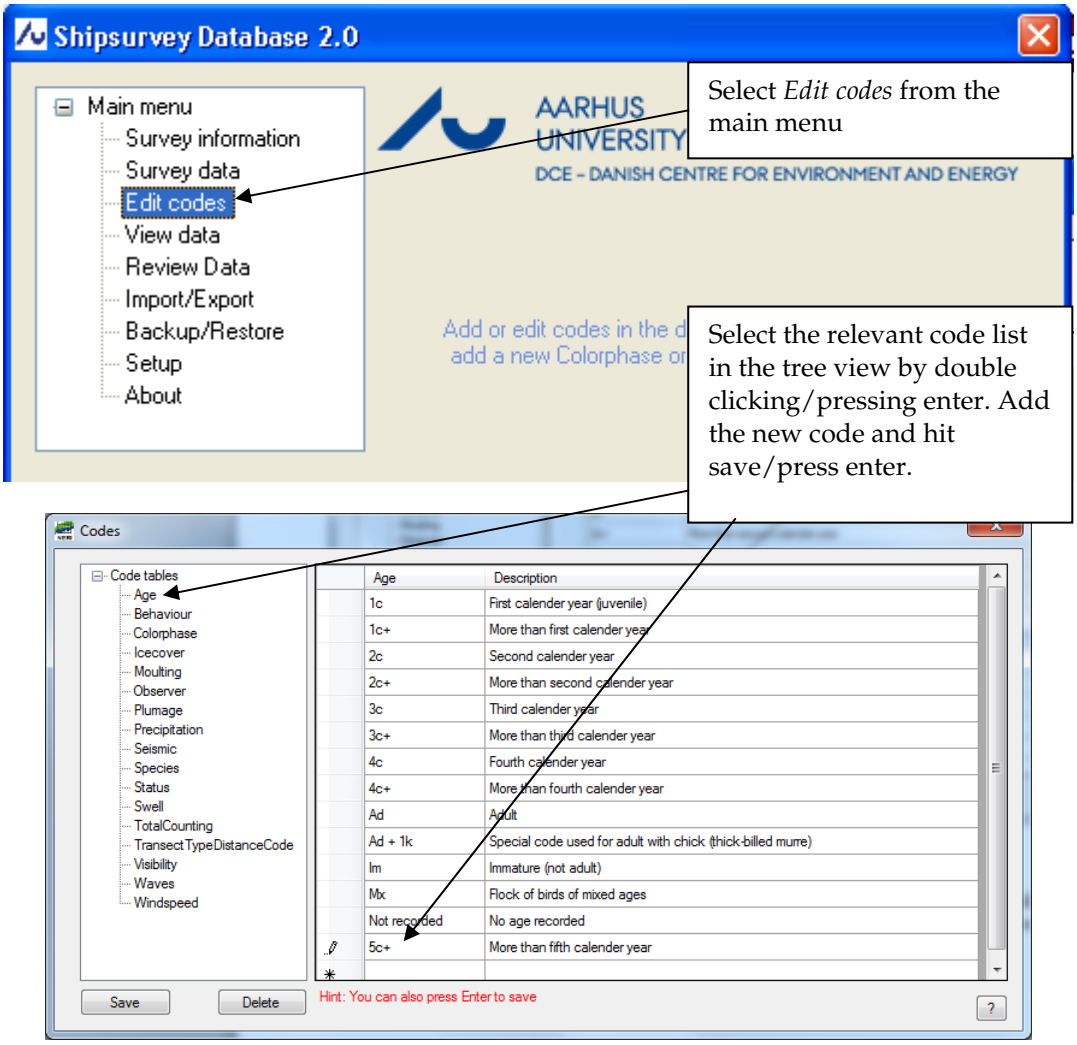

Select Survey
Survey id
Name
Ship
StartDate
EndDate
Client
Contractor
remarks
1
Disko West Block 22
Adolf Jensen
25-06-2010
17-07-2010
BMP
NERI
Survey conducte...
3
Disko West Block 27
Adolf Jensen
01-09-2010
22-09-2010
BMP
NERI
Survey conducte...
Select
Select the survey for which you want to enter data (the application can hold several different surveys).


Survey Data
Survey - Level 1
Name: Disko West Block 22
Ship: Adolf Jensen
Start date: 25-06-2010
End date: 17-07-2010
Client: BMP
Contractor: NERI
Remarks: Survey conducted in relation to Disko West SEIA
Select survey (F6)
Transect - Level 2
Transect No: 1
Transect Type: A
Press F1 for list of value
Offtransect
Total Counting: 0
Press F1 for list of value
Remarks:
New transect (Ctrl + T)
Save (F10)
Delete
Select transect (Ctrl + R)
Observation periods and sightings - Level 3 and 4
Observation periods
DateAndTime
Status
LatDeg
LatDecMin
LonDeg
LonDecMin
LatDecDeg
LonDecDeg
ObsPeriodLength
SnapshotInterval
SnapshotDistance
25-06-2010 08:30
25-06-2010 08:32
25-06-2010 08:34
25-06-2010 08:36
25-06-2010 08:38
25-06-2010 08:40
25-06-2010 08:42
New ObsPeriod (Ctrl + O)
Save ObsPeriod (Enter)
Delete ObsPeriod
Press F1 to get a list of values (Status,Seismic,Visibility,Waves,Swell,Windspeed,Icecover,Observer, Precipitation)
Press F8 to refresh
Sightings
Species
FlockSize
Distance
Behaviour
ForagingBehaviour
Age
Plumage
Moulting
ColorPhase
Direction
Angle
Radial
ritri
fugla
urlom
bamys
New Sighting (Ctrl + S)
Save Sighting (Enter)
Delete Sighting
Press F1 to get a list of values (Species,Distance,Behaviour,Age,Plumage,Moulting,Color)
Press F3 to copy above field value
Press F4 to copy latest row sightings values
Press F5 to move one row down in observationperiods
A sight has been added

On the form illustrated above, the survey data are entered and/or edited. Data is basically entered in the following way: Create a transect, enter the data on the transect, and save it (or select a transect you have already created). Then enter data on all the observation periods on that transect. When the observation periods on the transect have been created, you are ready to enter the sightings made during the different observation periods on the transect. Before you start to enter any data please read section B.3 for a detailed description of the recommended data entry procedure.

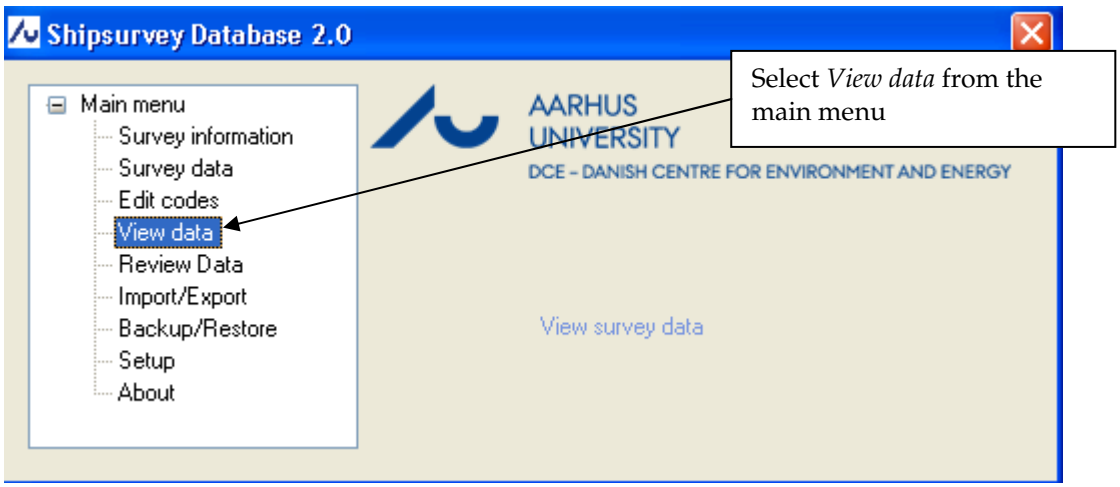
B.2.4 Missing codes?

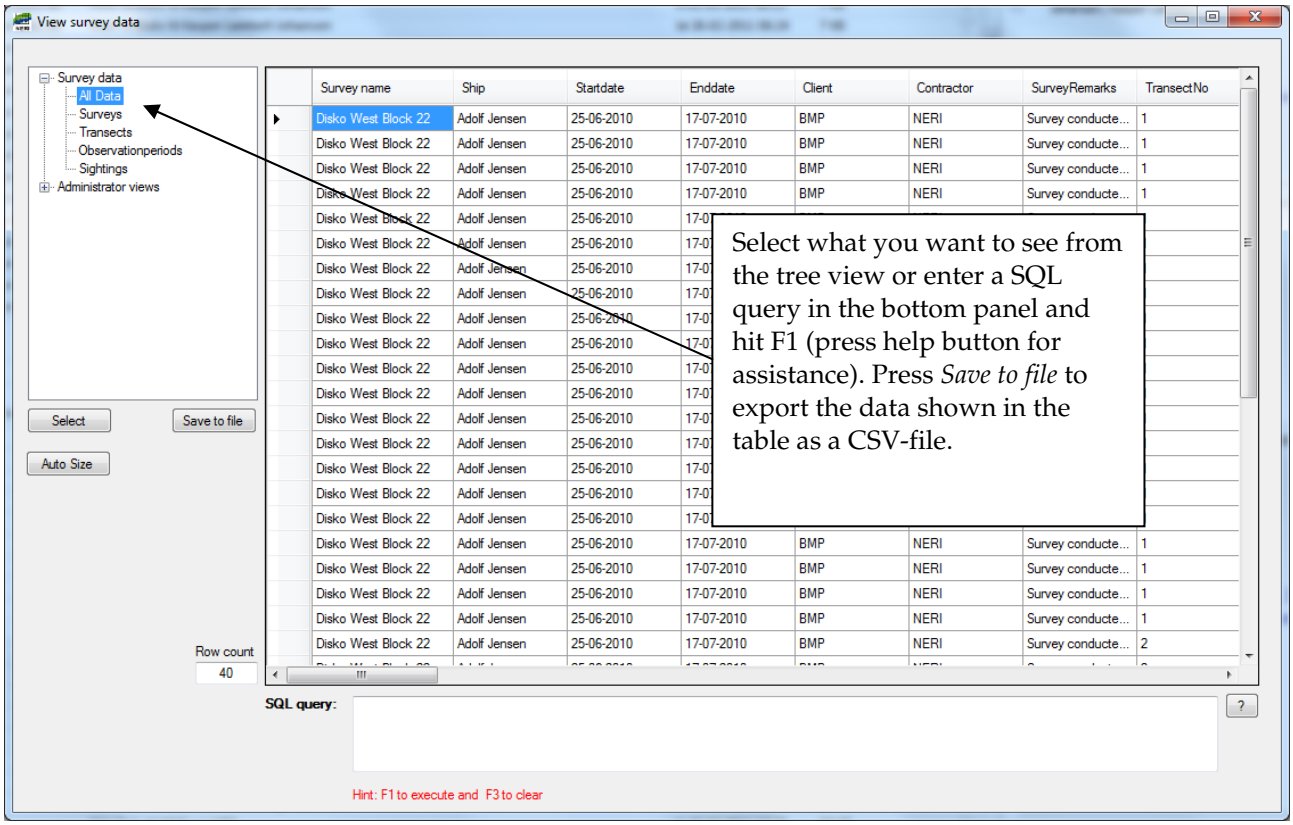
When you are entering data you may run into the problem of missing codes. For instance you may have observed a species which is not already on the species list and therefore cannot be entered, or perhaps you need some additional age codes. The application allows addition of new codes in all code lists:



B.2.5 Data overview and data exports to other applications

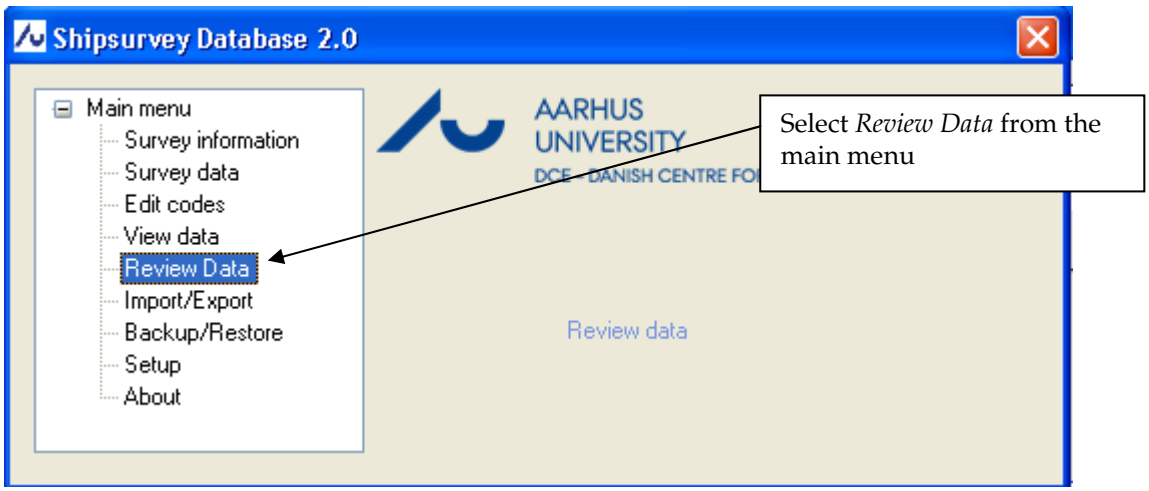
It is possible to get table views of the entered survey data and it is also possible to export all your data to other applications (e.g. Microsoft Excel which directly reads the CSV files generated by the application).

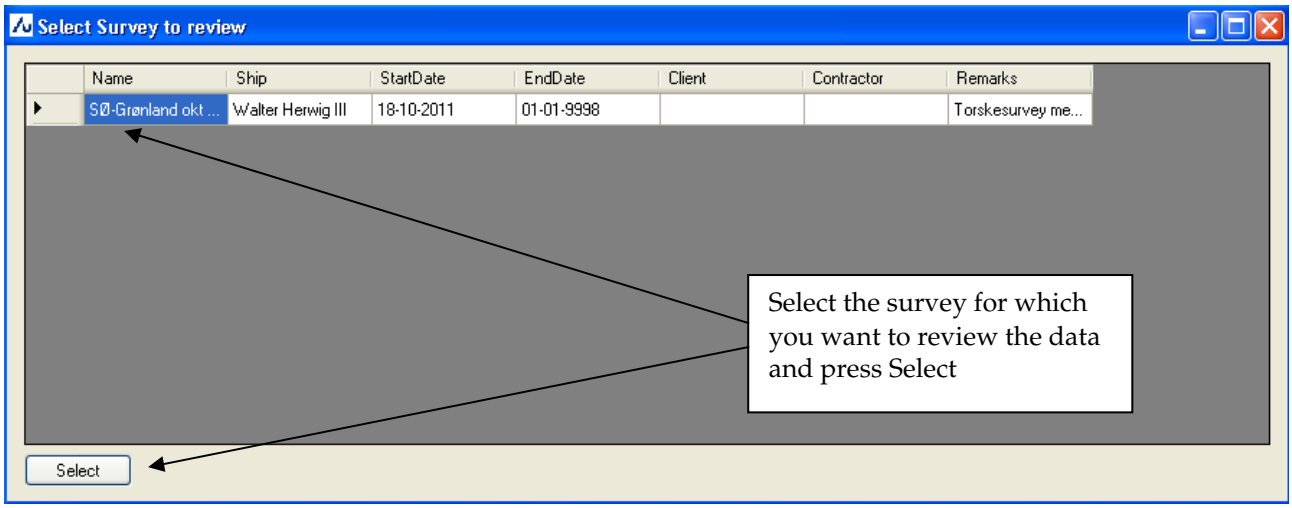


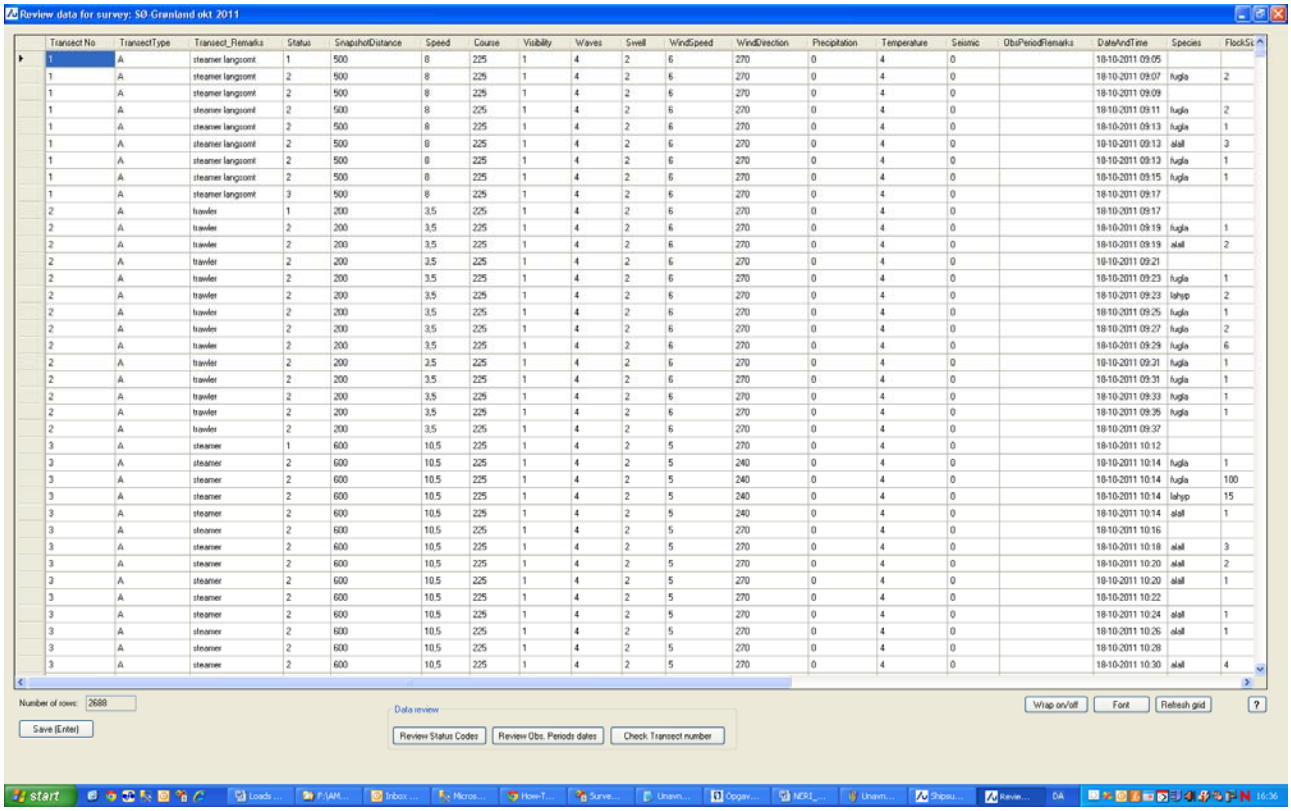


B.2.6 Data Review

When you have completed the data entry, it is time to make a data review.


Shipsurvey Database 2.0
Main menu
Survey information
Survey data
Edit codes
View data
Review Data
Import/Export
Backup/Restore
Setup
About
AARHUS
UNIVERSITY
Review data
Select *Review Data* from the main menu


Select Survey to review
Name
Ship
StartDate
EndDate
Client
Contractor
Remarks
SØ-Grønland okt ...
Walter Herwig III
18-10-2011
01-01-9998
Torskesurvey me...
Select the survey for which you want to review the data and press Select
Select


Review data for survey: SØ-Grønland okt 2011
Save (Enter)
Review Status Codes
Review Obs. Periods dates
Check Transect number

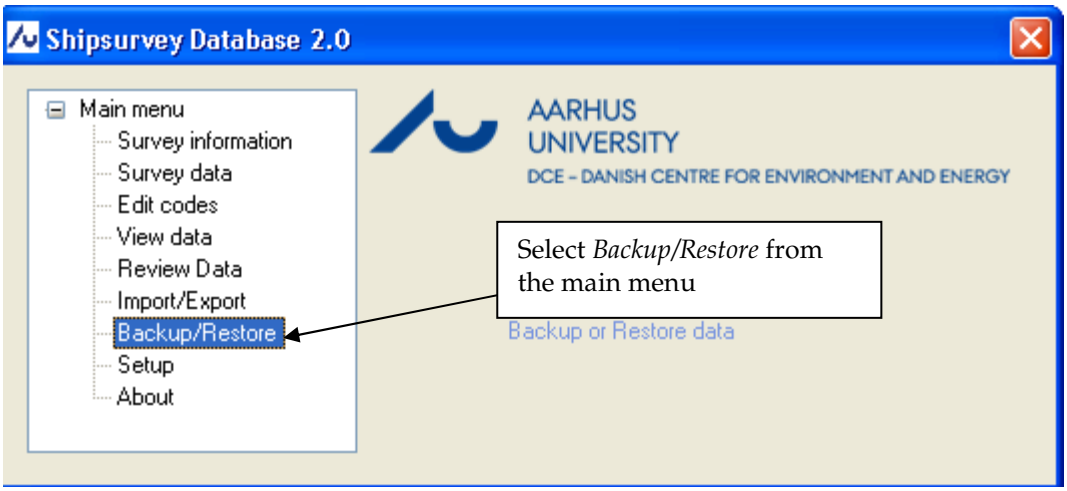
In this table you can review your survey data. You cannot add new observation periods or sightings, only correct existing data. You edit data in the cells and press Enter to save the edits. To speed things up, there are no dropdown boxes for the columns based on a code list (e.g. Species and Age). If you are entering a non-existing code, you will be prompted with an error message. Thus the quality of the data is not compromised during the review.

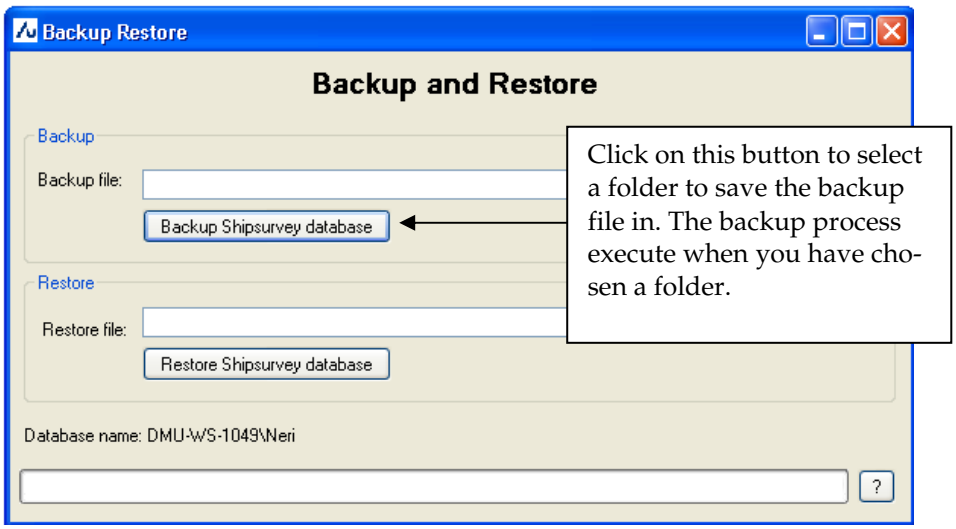
At the bottom of the screen there are 3 buttons: "Review Status Codes", "Review Obs. Period dates" and "Check Transect number". These will perform various automatic checks and point out errors that need to be corrected by the MMSO.

Please spend some time checking the data quality before exporting and submitting the data to DCE/BMP.

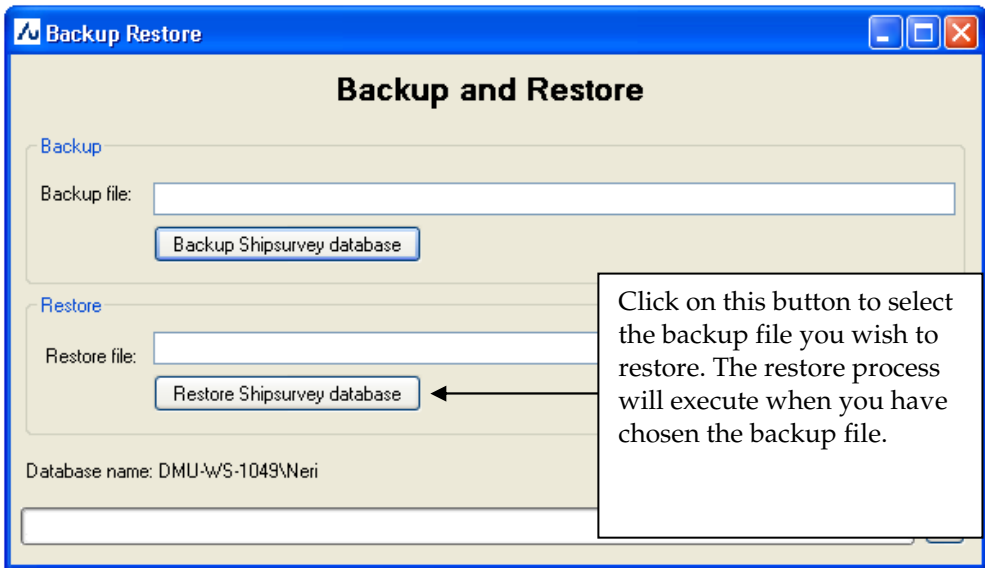
B.2.7 Backup/Restore

This menu is used to create a backup of the entered survey data or to restore the data entry application to a backup made at an earlier point in time. You can create a backup file as often as you like. Remember it is a good idea to save the backup file on a different drive than the one on which the data entry application is installed (e.g. a USB-stick or an external hard disk).

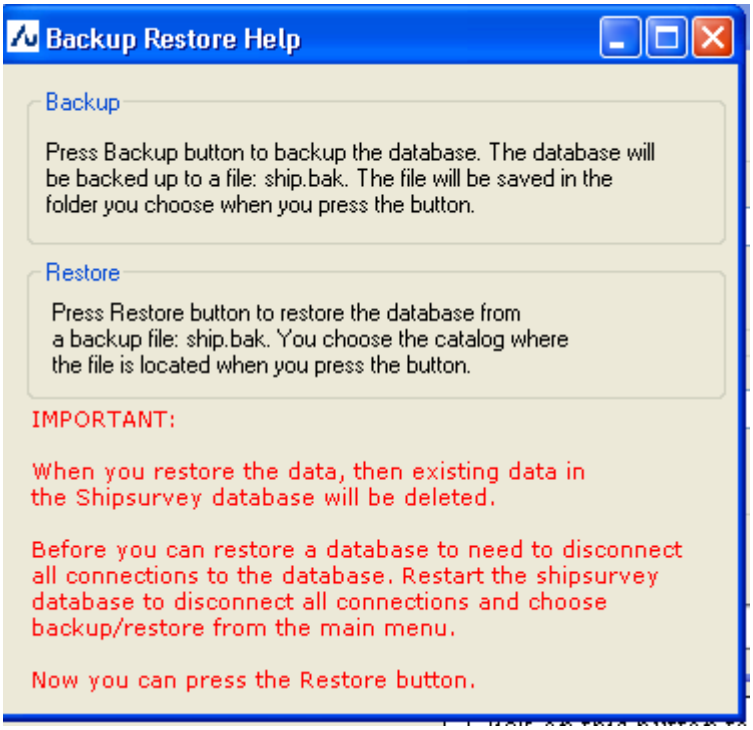




The backup file, which is named Ship.bak, contains both the database structure and the entered survey data. This means that everything can be restored on any computer with the Shipsurvey data entry application installed. IMPORTANT: When you restore from a backup, everything entered in the data entry application since the backup file was created will be lost!!!

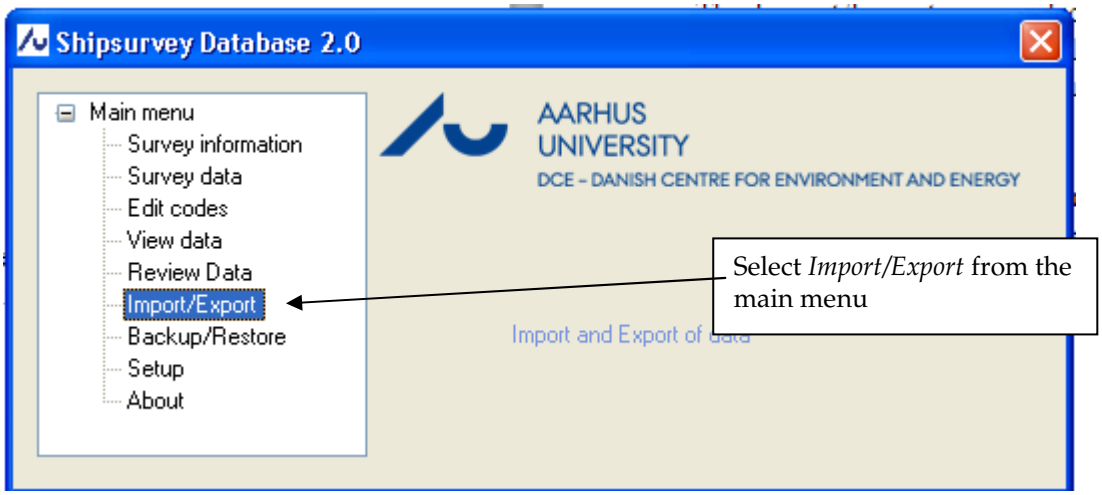


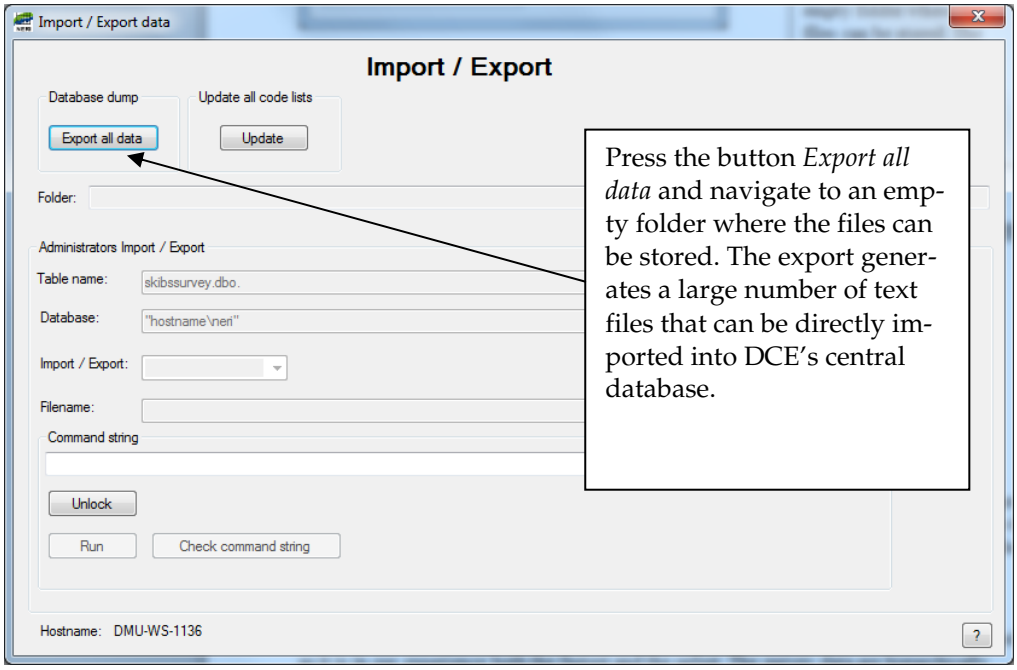
Before backing up data or restoring data from a backup file, please be sure to read the help text (press the ?-button in the lower right corner of the form).



B.2.8 How do I submit the data to DCE?

When you have entered and carefully reviewed the survey data it must be submitted to BMP and DCE along with the MMSO report, the JNCC Marine Mammal Recording Form and the GPS trip log files. The item Import/Export on the main menu allows you generate the export files that you need to submit to DCE/BMP:

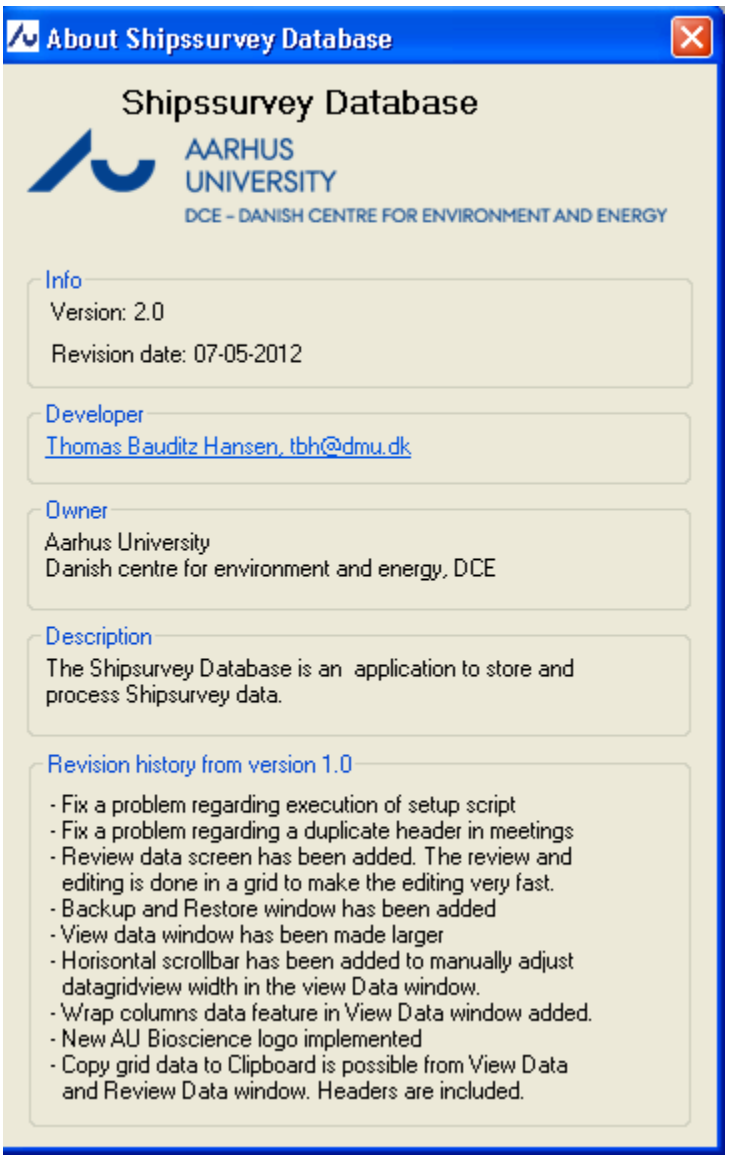




The Import/Export screen also contains button called *Update*. This function is used to import new versions of code lists released by DCE, thereby updating the application without having to do a complete reinstallation. The update function is also used when the application is installed for the first time (see section B.1.3).

B.2.9 About

The about menu (the last item on the main menu) contains information about the version of the data entry application installed on your computer and contact information on the programmer. It further lists all the modifications made since version 1, the review function and the backup/restore function being the two most significant improvements. Several of the new features have been added as a response to user requests. Please do not hesitate to send an e-mail to tbh@dmu.dk, if you have experience bugs or have suggestions of how to improve the application.



B.3 Suggested data entry procedure

Data can be entered in many different ways, but we suggest following the procedure detailed below as it is in our experience both the fastest and the safest. The survey data are hierarchically structured, Survey -> Transects -> Observation periods -> Sightings, and the suggested data entry procedure reflects this structure.

1. **Create a new survey** in the *Survey Information* form (*Main menu -> Survey Information*). Fill in the information in the table and press enter to save. Remember also to create the list of observers and save it.
2. **Create the first transect**. Choose *Survey data* in the main menu and select the survey you have just created on the next form that pops up. Press Ctrl + t or click the button *New transect* to create a new transect, fill in the information about the transect and press F10 to save.
3. **Select the transect**. Before you can start to enter data on observation periods and sightings you need to select the transect to which these belong. When you create a new transect as specified in step 2 that particular transect is automatically selected. However, if you want to enter observation periods and sightings on a transect that has been created earlier press

Ctrl + r or click the button *Select transect* and select the relevant transect in the window that pops up.

4. **Create the first observation period of the transect**. Now that the relevant transect has been selected you can press Ctrl + o or click *New ObsPeriod* to create the first observation period. Fill in the information you have on this observation period. As a minimum the mandatory fields listed in red below the observation period table/data grid need to be filled out. When filling out a field where the valid values are constrained to a specific code list (eg Visibility, Waves, Swell, IceCover etc.), you can view the code list and choose the relevant value by pressing F1 when the field is highlighted.
5. **Create the rest of the observation periods on the transect semi-automatically**. When you press Ctrl + o or click the button *New ObsPeriod* once more the application automatically creates the next observation period by transferring values from the last entered observation period. DateAndTime is automatically incremented by the value specified under ObsPeriodLength for the last observation period entered, and Status is automatically changed from 1 to 2 if the last entered observation period is the first on the transect. Coordinates and Remarks are of course not transferred from one observation period to another. With the help of this feature all the observation periods of a transect can be created within a very short time. The person entering the data just needs to carefully create the first observation period and then keep pressing Ctrl + o until there is a change in one or more of the recorded values or the last observation period of the transect is reached. For instance, Visibility may at some point have changed from what was initially recorded when the transect was started. When this point in time is reached, you stop pressing Ctrl + o, change the value for Visibility and press enter/click *Save ObsPeriod*. Next time you press Ctrl + o it is this new visibility value that is transferred. Thus, Ctrl + o always creates a new observation period by copying the values of the last observation period and incrementing DateAndTime by the ObsPeriodLength specified for the last observation period. When the very last observation period on the transect is reached, Status manually needs to be changed to 3 and you need to press Enter or click *Save ObsPeriod* to save (during the process described above Ctrl + o automatically saves the records). You can always edit information in the observation period table/data grid by navigating around with the arrow keys.
6. **Enter the sightings**. Select the first observation period during which sightings were made by clicking on the left pane of the row (this highlights the row). Press Ctrl + s or click *New sighting* to create a sighting under this observation period. Fill in the information you have on the sighting. As a minimum the mandatory fields listed in red below the sightings table/data grid need to be filled out. Press Enter to save or click *Save sighting*. If more sightings were made during the observation period in question press Ctrl +s to create the next sighting. If no more sightings were made during the observation period in question, press F5 to move to the next observation period. You can keep pressing F5 until you get to the next observation period during which sightings we made and enter the sightings by the procedure just described. When you need to enter several sightings under one observation period, there are some useful shortcuts. Once you have created an empty (new) sighting by pressing Ctrl + s, you can press F4 to copy all the values entered for the previous sighting and just edit these before you save. Also, when you have created an empty (new) sighting by pressing Ctrl + s, you can press F3 to copy the values entered in the individual fields for the sighting just above.

7. Once all the sightings made during all the observation periods on the transect in question have been entered, you **go back to step 2** and repeat the process until the whole dataset has been entered.

Comments:

- We recommend entering one transect at a time, but under step 2 you may also choose to continue creating transects until all the transects of the survey have been created so that is done once and for all.
- We recommend entering all the observation periods of a transect before any of the sightings made during these observation periods are entered. However, you can also choose to enter the sightings as soon as the relevant observation period has been created.
- The many shortcuts may seem overwhelming and you may prefer to use the mouse and the buttons instead. However, in the long run it is our experience that working exclusively on the keyboard is faster.

B.4 Help, support and contact information

If you get stuck somewhere, then first try to press the help button in the lower right corner of the relevant form. Maybe you can find a solution to your problem here. Also, if you move your mouse over the buttons on the form a yellow help box will be displayed.

If you still can't find a solution to your problem then do not hesitate to contact:

Thomas Bauditz Hansen (application developer)
DCE – Danish Centre for Environment and Energy, Aarhus University
Frederiksborgvej 399, P.O.Box 358
4000 Roskilde, Denmark
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or

Kasper Lambert Johansen (survey protocol)
DCE – Danish Centre for Environment and Energy, Aarhus University
Department of Bioscience
Frederiksborgvej 399, P.O.Box 358
4000 Roskilde, Denmark
Direct telephone: 0045 871 58 679
E-mail: kalj@dmu.dk

In case you can't make the data entry application work and you are stuck on a survey vessel where you can't get support from DCE, we have included the old Excel workbook DCE_Shipsurvey_DataEntry.xls in the MMSO Resource Package as a backup solution for data entry (see the folder SeabirdAndMarineMammalSurvey\ExcelDataEntry).

Appendix C: Code lists

In this appendix the codes used for recording the different information about transects, observation periods and sightings are described in detail. We encourage the observers to print this appendix and bring it to the observation box so that codes can be looked up while surveying.

C.1 Transects

C.1.1 TransectNo

A whole number (integer) that uniquely identifies each transect. We suggest using consecutive numbers starting with 1. A dummy transect called -99 is often created to identify miscellaneous unsystematic sightings recorded at times when no systematic survey is carried out. Transects are sometimes numbered in the field, but this may also just be done during digital data entry.

C.1.2 TransectType

Code	Description
A	300 m transect strip on only one side of the ship
B	500 m transect strip on only one side of the ship

C.1.3 TotalCounting

Code	Description
0	No total counting scan is performed
90	Total counting scan is performed on only one side of the ship (90 degree sector)
180	Total counting scan is performed on both sides of the ship (180 degree sector)

C.1.4 OffTransect

A True/False attribute that can be set in the data entry application when data about a transect is entered (not present on the field recording sheets).

When on a cruise, observers often record sightings at times when no systematic survey is conducted, for instance a rare bird spotted on the way to lunch. Such sightings are entered in the data entry application by creating a dummy-transect with TransectNo = -99 and Offstransect = True. This transect is used for all sightings made outside systematic survey periods on the particular cruise (see main text section 5.2).

C.1.5 TransectRemarks

A simple unformatted text field used for recording remarks and comments to the transect.

C.2 Observation periods

C.2.1 Status

Code	Description
1	The current observation period constitutes the beginning of a transect
2	The current observation period is on a transect but is neither the first nor the last observation period on that transect
3	The current observation period constitutes the end of a transect (dummy observation period of zero length)
4	The current observation period is off transect (for unsystematic observations made a times when no survey goes on (TransectNo = -99, OffTransect = True))

C.2.2 DateAndTime

UTC date and time in Microsoft Excel format of the beginning of an observation period. Precision is in whole minutes, for instance 12-09-2009 15:42 (dd-mm-yyyy hh:mm).

C.2.3 LatDeg

Degrees latitude as a whole number (integer). The recorded position should always reflect the position of the ship at the time given under date and time - that is the position of the ship at the beginning of the observation period in question. Latitude coordinates may be given either as a combination of degrees (LatDeg) and decimal minutes (LatDecMin), or simply as decimal degrees (LatDecDeg). The datum should always be WGS84. North of Equator latitudes are recorded as positive; south of Equator they are recorded as negative.

Example: Original coordinate: 72 15.8916 N / 68 33.775 W

LatDeg = 72	LonDeg = -68
LatDecMin = 15.8916	LonDecMin = -33.775
LatDecDeg = 72.26486	LonDecDeg = -68.5629

C.2.4 LatDecMin

Decimal minutes latitude. The recorded position should always reflect the position of the ship at the time given under date and time - that is the position of the ship at the beginning of the observation period in question. Latitudes may be given either as a combination of degrees (LatDeg) and decimal minutes (LatDecMin), or simply as decimal degrees (LatDecDeg). The datum should always be WGS84. See example in section C.2.3.

C.2.5 LatDecDeg

Decimal degrees latitude. The recorded position should always reflect the position of the ship at the time given under date and time - that is the position of the ship at the beginning of the observation period in question. Latitudes may be given either as a combination of degrees (LatDeg) and decimal minutes (LatDecMin), or simply as decimal degrees (LatDecDeg). The datum should always be WGS84. LatDecDeg = LatDeg + (LatDecMin/60). North of Equator latitudes are recorded as positive; south of Equator they are recorded as negative. See example in section C.2.3.

C.2.6 LonDeg

Degrees longitude as a whole number (integer). The recorded position should always reflect the position of the ship at the time given under date and time - that is the position of the ship at the beginning of the observation period in question. Longitudes may be given either as a combination of degrees (LonDeg) and decimal minutes (LonDecMin), or simply as decimal degrees (LonDecDeg). The datum should always be WGS84. East of Greenwich longitudes are recorded as positive; west of Greenwich they are recorded as negative. See example in section C.2.3.

C.2.7 LonDecMin

Decimal minutes longitude. The recorded position should always reflect the position of the ship at the time given under date and time - that is the position of the ship at the beginning of the observation period in question. Longitudes may be given either as a combination of degrees (LonDeg) and decimal minutes (LonDecMin), or simply as decimal degrees (LonDecDeg). The datum should always be WGS84. See example in section C.2.3.

C.2.8 LonDecDeg

Decimal degrees longitude. The recorded position should always reflect the position of the ship at the time given under date and time - that is the position of the ship at the beginning of the observation period in question. Longitudes may be given either as a combination of degrees (LonDeg) and decimal minutes (LonDecMin), or simply as decimal degrees (LonDecDeg). The datum should always be WGS84. LonDecDeg = LonDeg + (LonDecMin/60). The datum should always be WGS84. East of Greenwich longitudes are recorded as positive; west of Greenwich they are recorded as negative. See example in section C.2.3.

C.2.9 ObsPeriodLength

The duration of the observation period in whole minutes.

C.2.10 SnapshotInterval

The time interval between snapshots of flying birds in decimal minutes, e.g. 2 minutes and 15 seconds equals 2+(15/60) = 2.25 decimal minutes.

C.2.11 SnapshotDistance

The distance ahead of the ship (in meters) included in the snapshots of flying birds.

C.2.12 Speed

The speed of the ship in knots during the observation period in question. Can usually be read off the handheld GPS.

C.2.13 Course

The course of the ship in degrees relative to True North (0-360, increasing clockwise) during the observation period in question. Read off the handheld GPS.

C.2.14 Visibility

Code	Description
1	Very good visibility with excellent view to the horizon
2	Good visibility but the horizon is not visible. Still good for observations.
3	Poor visibility only just acceptable for observations. Minimum 500 m visibility.
4	Very poor visibility, less than 500 m.

C.2.15 Waves

Code	Description
0	Beaufort sea state 0. Flat. Wave height: 0 m.
1	Beaufort sea state 1. Ripples without crests. Wave height: 0 - 0.2 m.
2	Beaufort sea state 2. Small wavelets. Crests of glassy appearance, not breaking. Wave height: 0.2 - 0.5 m.
3	Beaufort sea state 3. Large wavelets. Crests begin to break; scattered whitecaps. Wave height: 0.5 - 1 m.
4	Beaufort sea state 4. Small waves with breaking crests. Fairly frequent white horses. Wave height: 1 - 2 m.
5	Beaufort sea state 5. Moderate waves of some length. Many white horses. Small amounts of spray. Wave height: 2 - 3 m.
6	Beaufort sea state 6. Long waves begin to form. White foam crests are very frequent. Some airborne spray is present. Wave height: 3 - 4 m.
7	Beaufort sea state 7. Sea heaps up. Some foam from breaking waves is blown into streaks along wind direction. Moderate amounts of airborne spray. Wave height: 4 - 5.5 m.
8	Beaufort sea state 8. Moderately high waves with breaking crests forming spin-drift. Well-marked streaks of foam are blown along wind direction. Considerable airborne spray. Wave height: 5.5 - 7.5 m.
9	Beaufort sea state 9. High waves whose crests sometimes roll over. Dense foam is blown along wind direction. Large amounts of airborne spray may begin to reduce visibility. Wave height: 7 - 10 m.
10	Beaufort sea state 10. Very high waves with overhanging crests. Large patches of foam from wave crests give the sea a white appearance. Considerable tum-bling of waves with heavy impact. Large amounts of airborne spray reduce visibil-ity. Wave height: 9 - 12.5 m.
11	Beaufort sea state 11. Exceptionally high waves. Very large patches of foam, driven before the wind, cover much of the sea surface. Very large amounts of airborne spray severely reduce visibility. Wave height: 11.5 - 16 m.
12	Beaufort sea state 12. Huge waves. Sea is completely white with foam and spray. Air is filled with driving spray, greatly reducing visibility. Wave height: >= 14 m.

C.2.16 Swell

Code	Description
0	No visible swell.
1	Very low swell not influencing observations.
2	Medium swell influencing observations slightly
3	Very high swell as after an ocean storm influencing observations significantly.

C.2.17 WindSpeed

Code	Description
0	Beaufort 0 (calm, < 0.3 m/s, < 1 kts)
1	Beaufort 1 (light air, 0.3 - 1.5 m/s, 1 - 2 kts)
2	Beaufort 2 (light breeze, 1.6 - 3.4 m/s, 3 - 6 kts)
3	Beaufort 3 (gentle breeze, 3.5 - 5.4 m/s, 7 - 10 kts)
4	Beaufort 4 (moderate breeze, 5.5 - 7.9 m/s, 11 - 15 kts)
5	Beaufort 5 (fresh breeze, 8 - 10.7 m/s, 16 - 20 kts)
6	Beaufort 6 (strong breeze, 10.8 - 13.8 m/s, 21 - 26 kts)
7	Beaufort 7 (near gale, 13.9 - 19 m/s, 27 - 33 kts)
8	Beaufort 8 (gale, 18-25 m/s, 34 - 40 kts)
9	Beaufort 9 (strong gale, 23 - 32 m/s, 41 - 47 kts)
10	Beaufort 10 (storm, 29 - 41 m/s, 48 - 55 kts)
11	Beaufort 11 (violent storm, 37 - 52 m/s, 56 - 63 kts)
12	Beaufort 12 (hurricane, >= 46 m/s, >= 64 kts)

C.2.18 WindDirection

Wind direction in degrees relative to true north (0-360, increasing clockwise) during the observation period in question.

C.2.19 IceCover

Code	Description
0	0 % ice cover
1	10 % ice cover
2	20 % ice cover
3	30 % ice cover
4	40 % ice cover
5	50 % ice cover
6	60 % ice cover
7	70 % ice cover
8	80 % ice cover
9	90 % ice cover
10	100 % ice cover

C.2.20 Temperature

Outside air temperature measured in degrees Celsius.

C.2.21 Precipitation

Code	Description
0	No precipitation
LR	Light rain
HR	Heavy rain
LS	Light snow
HS	Heavy snow

C.2.22 Seismic

Code	Description
0	Seismic air gun array is off
1	Seismic air gun is soft-starting and/or on reduced power
2	Seismic air gun array is on with full power

C.2.23 Observer

The name of the observer conducting the survey during the observation period in question. The full name should be spelled out during digital data entry.

C.1.24 ObservationPeriodRemarks

A simple unformatted text field used for recording remarks and comments to the observation period in question.

C.3 Sightings

C.3.1 Species

The species codes used are listed in the table below. Some codes are rather general, e.g. boat, and when a sighting of this type is made a more detailed description should be included under the remarks to the sighting, e.g. shrimp trawler. Some codes cover very board categories – always choose the most specific code that the identification allows. The data entry application allows you to add new codes to all code lists. Thus if you observe a species that is not on the species list, simply add it during digital data entry.

BIRDS			
Code	**Latin**	**English**	**Danish**
gaimm	*Gavia immer*	Great northern diver/ Common loon	Islom
gaste	*Gavia stellata*	Red-throated diver/loon	Rødstrubet lom
gavsp	*Gavia sp*	Unspecified diver/loon	Ubestemt lom
poaur	*Podiceps auritus*	Slavonian grebe	Nordisk lappedykker
fugla	*Fulmarus glacialis*	Northern fulmar	Mallemuk
cadio	*Calonectris diomedea*	Cory's shearwater	Kuhls skråpe
pugra	*Puffinus gravis*	Great shearwater	Storskråpe
pugri	*Puffinus griseus*	Sooty shearwater	Sodfarvet skråpe
pupuf	*Puffinus puffinus*	Manx shearwater	Alm. skråpe
ocleu	*Oceanodroma leucorhoa*	Leach's storm-petrel	Stor stormsvale
hypel	*Hydrobates pelagicus*	Storm petrel	Lille stormsvale
hydsp	*Hydrobatidae sp*	Unspecified storm-petrel	Ubestemt stormsvale
subas	*Sula bassana*	Northern gannet	Sule
phcar	*Phalacrocorax carbo*	Great cormorant	Skarv

anbra	*Anser brachyrhynchus*	Pink-footed goose	Kortnæbbet gås
analb	*Anser albifrons*	White-fronted goose	Blisgås
anssp	*Anser sp.*	Unspecified grey goose	Ubestemt grå gås
ancae	*Anser caerulescens*	Snow goose	Snegås
brcan	*Branta canadensis*	Canada goose	Canadagås
brleu	*Branta leucopsis*	Barnacle goose	Bramgås
brber	*Branta bernicla*	Brent goose	Knortegås
anpla	*Anas platyrhynchos*	Mallard	Gråand
ancre	*Anas crecca*	Common teal	Krikand
anasp	*Anas sp.*	Unspecified duck	Ubestemt svømmeand
somol	*Somateria mollissima*	Common eider	Alm. Ederfugl
sospe	*Somateria spectabilis*	King eider	Kongeederfugl
somsp	*Somateria sp.*	Common/King eider	Ubestemt ederfugl
hihis	*Histrionicus histrionicus*	Harlequin duck	Strømand
clhye	*Clangula hyemalis*	Long-tailed duck	Havlit
meser	*Mergus serratus*	Red-breasted merganser	Toppet skallesluger
anati	*Anatidae*	Unspecified anatidae (duck, goose, swan)	Ubestemt and/gås/svane
haalb	*Haliaeetus albicilla*	White-tailed eagle	Havørn
facol	*Falco columbarius*	Merlin	Dværgfalk
farus	*Falco rusticolus*	Gyrfalcon	Jagtfalk
faper	*Falco peregrinus*	Peregrine falcon	Vandrefalk
chhia	*Charadrius hiaticula*	Ringed plover	Stor præstekrave
cacan	*Calidris canutus*	Red knot	Islandsk ryle
caalb	*Calidris alba*	Sanderling	Sandløber
cafus	*Calidris fuscicollis*	White-rumped sandpiper	Hvidrygget ryle
camar	*Calidris maritima*	Purple sandpiper	Sortgrå ryle
caalp	*Calidris alpina*	Dunlin	Almindelig ryle
chasp	*Charadrius sp.*	Unspecified plover	Ubestemt vadefugl
arint	*Arenaria interpres*	Ruddy turnstone	Stenvender
phlob	*Phalaropus loabatus*	Red-necked phalarope	Odinshane
phful	*Phalaropus fulicarius*	Grey phalarope	Thorshane
phasp	*Phalaropus sp.*	Unspecified phalarope	Ubestemt svømmesneppe
calsp	*Calidris sp.*	Unspecified sandpiper	Ubestemt ryle
cahia		Unspecified small shorebird	Ubestemt lille vadefugl
stpom	*Stercorarius pomarinus*	Pomarine skua/jeager	Mellemkjove
askua	*Stercorarius parasiticus*	Arctic skua	Almindelig kjove
stlon	*Stercorarius longicaudus*	Long-tailed skua/jeager	Lille kjove
stsku	*Stercorarius skua*	Great skua	Storkjove
stpor	*Stercorarius sp.*	Pomarine or arctic skua/jeager	Mellem/Alm. kjove
stesp	*Stercorarius sp.*	Unspecified skua/jeager	Ubestemt kjove

lasab	*Larus sabini*	Larus sabini	Sabinemåge
lafus	*Larus fuscus*	Lesser black-backed gull	Sildemåge
laarg	*Larus argentatus*	Herring gull	Sølvmåge
lamic	*Larus michahellis*	Yellow-legged Gull	Middelhavssølvmåge
latha	*Larus thayeri*	Thayer's gull	Thayers måge
lagla	*Larus glaucoides*	Iceland gull	Hvidvinget måge
lahyp	*Larus hyperboreus*	Glaucous gull	Gråmåge
lakum	*Larus kumlieni*	Kumlien's gull	Kumliens måge
lahvi	*Larus glaucoides/hyperboreus*	Glaucous/Iceland gull	Hvidvinget- el. Gråmåge
lamar	*Larus marinus*	Great black-backed gull	Svartbag
rhros	*Rhodostethia rosea*	Ross's gull	Rosenmåge
ritri	*Rissa tridactyla*	Black-legged kittiwake	Ride
paebu	*Pagophila eburnea*	Ivory gull	Ismåge
larsp	*Larus sp.*	Unspecified gull	Ubestemt måge
sthir	*Sterna hirundo*	Common tern	Fjordterne
atern	*Sterna paradisaea*	Arctic tern	Havterne
uraal	*Uria aalge*	Common murre	Almindelig lomvie
urlom	*Uria lomvia*	Thick-billed murre	Polarlomvie
urisp	*Uria sp*	Unspecified murre (Common murre/Thick-billed murre)	Almindelig lomvie/polarlomvie
altor	*Alca torda*	Razorbill	Alk
alkur	*Uria sp.*	Thick-billed murre/Common murre/Razorbill	Almindelig lomvie/polarlomvie/alk
cegry	*Cepphus grylle*	Black guillemot	Tejst
alall	*Alle alle*	Little auk/Dovekie	Søkonge
frarc	*Fratercula arctica*	Atlantic puffin	Lunde
urlfr	*Uria lomvia/Fratercula arctica*	Commen murre/Atlantic puffin	Polarlomvie/lunde
alksp	*Uria sp./Alca torda*	Razorbill/Murre/Dovekie/Atlantic puffin	Ubestemt alk/lomvie/søkonge/lunde
ritri/ fugla	*Rissa tridactyla/Fulmarus glacialis*	Black-legged kittiwake/Northern fulmar	Ride eller mallemuk
asfla	*Asio flammeus*	Short-eared owl	Mosehornugle
anrub	*Anthus rubescens*	American/Buff-bellied pipit	Hedepiber
oeoen	*Oenanthe oenanthe*	Northern wheatear	Stenpikker
cocor	*Corvus corax*	Common raven	Ravn
cafla	*Carduelis flammea*	Common redpoll	Gråsisken
cahor	*Carduelis hornemanni*	Arctic redpoll	Hvidsisken
pawar	*Parula warbler*	Unspecified parula warbler	Parulasanger
calap	*Calcarius lapponicus*	Lapland bunting	Laplandsværling
plniv	*Plectrophenax nivalis*	Snow bunting	Snespurv
passp	*Passeriform sp.*	Unspecified perching bird	Ubestemt småfugl
birds		Unspecified birds	Ubestemte fugle
Fugla / larsp		Northern fulmar or unspecified gull	Mallemuk/Ubestemt måge

MARINE MAMMALS			
Code	**Latin**	**English**	**Danish**
urmar	*Ursus maritimus*	Polar bear	Isbjørn
erbar	*Erignathus barbatus*	Bearded seal	Remmesæl
hagry	*Halichoerus grypus*	Grey seal	Gråsæl
phgro	*Phoca groenlandica*	Harp seal	Grønlandssæl
phvit	*Phoca vitulina*	Harbour seal	Spættet sæl
phhis	*Phoca hispida*	Ringed seal	Ringsæl
cycri	*Cystophora cristata*	Hooded seal	Klapmyds
odros	*Odobenus rosmarus*	Walrus	Hvalros
pinsp	*Pinnipediae sp.*	Unidentified seal	Ubestemt sæl
bamys	*Balaena mysticetus*	Bowhead whale	Grønlandshval
baacu	*Balaenoptera acutorostrata*	Minke whale	Vågehval
baphy	*Balaenoptera physalus*	Fin whale	Finhval
bamus	*Balaenoptera musculus*	Blue whale	Blåhval
babor	*Balaenoptera borealis*	Sei whale	Sejhval
menov	*Megaptera novaeangliae*	Humpback whale	Pukkelhval
balsp	*Balaenoptera sp.*	Rorqual sp	Ubestemt bardehval (ikke grønlandshval)
phpho	*Phocoena phocoena*	Harbor porpoise	Marsvin
dedel	*Delphinus delphis*	Common dolphin	Almindelig delfin
laacu	*Lagenorhynchus acutus*	Atlantic white-sided dolphin	Hvidskæving
laalb	*Lagenorhynchus albirostris*	White-beaked dolphin	Hvidnæse
delsp	*Delphinus sp.*	Unspecified dolphin	Ubestemt delfin
grgri	*Grampus griseus*	Risso's dolphin	Rissos delfin
glmel	*Globicephala melas*	Long-finned pilot whale	Langluffet grindehval
hyglm	*Globicephala melas/Hyperoodon ampullatus*	Long-finned pilot whale/Northern bottlenose whale	Langluffet grindehval/Døgling
ororc	*Orcinus orca*	Orca/Killer whale	Spækhugger
hyamp	*Hyperoodon ampullatus*	Northern	Døgling
phmac	*Physeter macrocephalus*	Sperm whale	Kaskelot
deleu	*Delphinapterus leucas*	Beluga/White whale	Hvidhval
momon	*Monodon monoceros*	Narwhal	Narhval
cetsp	*Ceteacea sp.*	Unspecified whale	Ubestemt hval
MISCELLANEOUS			
Code	**Latin**	**English**	**Danish**
boat		Misc. vessels	Diverse fartøjer
front		Front evident on sea surface	Front
garbage		Garbage	Affald
iceberg		Large iceberg	Isfjeld/isskodse
misc		Miscellaneous observations	Diverse observationer

C.3.2 FlockSize

The number of individuals in the sighted flock as a whole number.

C.3.3 DistanceCode

Code	Description
0	Outside transect strip. This code is used for unsystematic sightings outside the transect strip and sightings resulting from total counting.
1	Distance band 1: 0-50 m (transect type A and B)
2	Distance band 2: 50-100 m (transect type A and B)
3	Distance band 3: 100-200 m (transect type A and B)
4	Distance band 4: 200-300 m (transect type A and B)
5	Distance band 5: 300-400 m (only applicable to transect type B)
6	Distance band 6: 400-500 m (only applicable to transect type B)
7	Snapshot of flying birds: 0-300 m on transect type A. 0-500 m on transect type B. This code can also be used for birds on water which were sighted within the transect strip, but for which the observer had no time to record the exact distance band.

C.3.4 Behaviour

Code	Description
1	Flying
2	On water
3	Flying bird following ship

C.3.5 Angle

Angle to sighting in degrees relative to the course of the ship (0-360, increasing clockwise). Only used for marine mammals.

C.3.6 Radial

Radial (direct) distance to sighting in meters. Only used for marine mammals.

C.3.7 Age

Code	Description
1c	First calendar year (juvenile)
2c	Second calendar year
2c+	Second or more calendar years
3c	Third calendar year
3c+	Third or more calendar years
4c	Fourth calendar year
Ad	Adult
Ad + 1k	Special code used for adult thick-billed murre on swimming migration with chick
Im	Immature
Mx	Flock of birds of mixed ages

C.3.8 Plumage

Code	Description
S	Summer plumage
W	Winter plumage
T	Transitional plumage
Mx	Mixed flock (different plumages present)

C.3.9 Moulting

Code	Description
Y	Yes
N	No
Mx	Mixed flock

C.3.10 ColorPhase

Code	Description
LL	Double light (Northern fulmar)
L	Single light (Northern fulmar)
D	Single dark (Northern fulmar)
DD	Double dark (Northern fulmar)
Light	Light (skua)
Dark	Dark (skua)
Mx	Flock of birds of mixed color phases

C.3.11 Direction

The direction of movement of sighted flocks/individuals in degrees relative to True North (0-360, increasing clockwise). Mainly relevant for flying birds and marine mammals.

C.3.12 ForagingBehaviour

Optionally, a detailed behaviour code of sighted seabirds following the system of Camphuysen & Garthe (2004) may be recorded (see the pdf-file in the folder SeabirdAndMarineMammalSurvey in the MMSO Resource Package).

C.3.13 SightingRemarks

A simple unformatted text field used for recording remarks and comments to the sighting in question.

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