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Recommended Seabird and Marine Mammal Observational Protocols for Atlantic Canada

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RECOMMENDED SEABIRD AND MARINE MAMMAL OBSERVATIONAL PROTOCOLS FOR ATLANTIC CANADA

Prepared by

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for

Environmental Studies Research Funds
444 7th Avenue S.W.
Calgary, AB T2P 0X8

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RECOMMENDED SEABIRD AND MARINE MAMMAL OBSERVATIONAL PROTOCOLS FOR ATLANTIC CANADA

by

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This report – *Recommended Seabird and Marine Mammal Observational Protocols for Atlantic Canada* – was drafted in 2004 and completed in 2005. During its preparation and review there were ongoing consultations with both the Canadian Wildlife Service and Fisheries and Oceans Canada who have accepted its content and recommendations.

At a meeting in March, 2006 with the Canadian Wildlife Service, the CNLOPB and Offshore Operators and the consulting community it was confirmed that this report's contents and recommendations are consistent wit hthe recently drafted *Standardized Protocols for Pelagic Seabird Surveys from Moving and Stationary Platforms for the Hydrocarbon Industry – Interim Ptorocol June 2005* developed by the Canadian Wildlife Service.

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ACRONYMS AND ABBREVIATIONS

The following list shows the meaning of acronyms and abbreviations used in this report:

~	approximately
EA	Environmental Assessment
BBL	Bird Banding Laboratory
CNOPB	Canada-Newfoundland Offshore Petroleum Board
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
DAL	Dalhousie University
DFO	Department of Fisheries and Oceans
ESAS	European Seabirds at Sea
FPSO	Floating-Production-Storage-Offloading
GBS	Gravity-based Structure
GIS	Geographic Information System
GPS	Global Positioning System
h	hour
JNCC	Joint Nature Conservation Committee
m	meter (1 m = 1.09 yards or 3.28 feet)
min	minute(s)
km	kilometer (1 km = 3281 ft, 0.62 st.mi., or 0.54 n.mi.)
kt	knots
MM	marine mammals
MMO	Marine Mammal Observer
MUN	Memorial University of Newfoundland and Labrador
NIOZ	Royal Netherlands Institute for Sea Research
NMFS	National Marine Fisheries Service, U.S. Dept of Commerce
n.mi.	nautical mile (1 n.mi. = 1.15 statute miles or 1.853 km)
NVD	Night Vision Device
OGOP	Oil and Gas Observer Program
PAL	Provincial Airlines Limited
PIROP	Programme Intégré de Recherches sur les Oiseaux Pélagiques
POO	Platform of Opportunity
s	second
VEC	Valued Ecosystem Component

SUMMARY

The objective of this study was to develop standardized and scientifically-acceptable seabird and marine mammal observation protocols for use in fixed-installation and vessel-based surveys in offshore areas of eastern Canada. Protocols were developed based on consultations with individuals from academic, industry, and government parties; a review of the literature on survey techniques; and the experience of LGL Limited (authors' affiliation) in conducting seabird and marine mammal surveys.

For marine mammals, survey protocols were developed for incidental sightings, periodic watches, and monitoring watches. Protocols for incidental sightings are intended for individuals who happen to sight a marine mammal during the course of their regular marine duties, *i.e.*, not during dedicated marine mammal watches. Periodic watches were designed to allow collection of marine mammal data, including survey effort, by trained observers. Monitoring watches were designed to document seismic (or other industrial) activity, marine mammal observations, survey effort, environmental conditions, and the implementation of mitigation measures.

For seabirds, survey protocols from moving vessels were based on the widely used "Tasker Method" which involves counting all birds on the water and using "snapshot" counts (at fixed intervals) of birds in flight over a 10-min period in a 300 m strip. Given the high level of skill required to properly conduct this type of survey, it is recommended that most observers use a "Partial Tasker Method" which eliminates the snapshot component of the count. A similar approach is recommended for seabird surveys from fixed-installations. For both moving vessels and fixed installations, it is recommended that a minimum of three 20-min seabird counts (i.e., two consecutive 10-min counts) per day should be conducted.

SOMMAIRE

L'objectif de cette étude était d'élaborer des protocoles d'observation normalisés, et acceptables scientifiquement, pour les oiseaux marins et les mammifères marins qui seront utilisés lors d'inventaires à partir d'installations fixes et de navires dans des zones en mer de l'est du Canada. Les protocoles ont été élaborés à partir de consultations auprès d'individus provenant de parties académiques, industrielles et gouvernementales; d'un examen de la littérature liée aux techniques d'inventaire; et de l'expérience de LGL Limited (affiliation des auteurs) pour ses inventaires d'oiseaux marins et de mammifères marins.

Pour les mammifères marins, des protocoles d'inventaire ont été élaborés pour les observations occasionnelles, les observations périodiques et les observations de surveillance. Les protocoles pour les observations occasionnelles visent les individus qui observent un mammifère marin au cours d'activités ordinaires en mer, c.-à-d. des observations qui ne se produisent pas au cours de périodes réservées à l'observation des mammifères marins. Les observations périodiques ont été conçues pour permettre de recueillir des données sur les mammifères marins, y compris les efforts d'inventaire par des observateurs qualifiés. Les observations de surveillance ont été conçues pour documenter les activités sismiques (ou autres activités industrielles), les observations de mammifères marins, les efforts d'inventaire, les conditions environnementales et la mise en œuvre de mesures d'atténuation.

Pour les oiseaux marins, les protocoles d'inventaire à partir de navires en déplacement ont été fondés sur la « méthode de Tasker » très utilisée qui consiste à compter tous les oiseaux sur l'eau, et de compter les oiseaux en vol à l'aide « d'instantanés » (à intervalles réguliers) au cours d'une période de 10 minutes sur une bande de 300 m. Étant donné la haute compétence requise pour bien entreprendre ce type d'inventaire, il est recommandé que la majorité des observateurs utilisent la « méthode partielle de Tasker » laquelle élimine le comptage d'instantanés. Une approche semblable est recommandée pour l'inventaire d'oiseaux marins à partir d'installations fixes. Pour les navires en déplacement et les installations fixes, il est recommandé d'effectuer un minimum de trois comptages de 20 minutes (c.-à-d. deux comptages consécutifs de 10 minutes) par jour.

1. INTRODUCTION

In recent years, there has been substantial increase in oil and gas developments in offshore Atlantic Canadian waters. These developments have led to increased concern about potential impacts on the environment. Two groups of fauna that have been consistently classified as Valued Ecosystem Components (VECs) in environmental assessments (EAs) for offshore areas are seabirds and marine mammals (MMs). These groups also receive considerable public attention and a number of species are considered at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003).

Information on the spatial and temporal distribution of seabirds and marine mammals in most offshore areas of eastern Canada is limited and in most cases quite dated. Perhaps one of the main reasons few data exist, especially for pre-industry years, is because of the expensive nature of acquiring data in remote offshore locations. The presence of ships and platforms servicing the offshore oil and gas industry in Atlantic Canada create some environmental risk but also provide an opportunity to conduct surveys of seabirds and MMs in areas that would otherwise receive little attention. Indeed, seabird and MM data are currently being collected, and have been for several years from offshore oil and gas vessels. However, various groups (academic, government, and industry) collecting seabird and MM data use differing techniques and protocols that are not fully documented. This lack of a standardized approach inhibits the pooling of data and therefore limits the potential to address data gaps on seabird and MM distribution and abundance in Atlantic Canada. In response, the Environmental Studies Research Funds has funded this study to develop standardized and scientifically-acceptable seabird and MM observation protocols for use in fixed-installation and vessel-based surveys in offshore areas of eastern Canada. A region-wide standardized data collection protocol will facilitate the collection of data that can be used to address data gaps. An understanding of the natural patterns of abundance and distribution of marine fauna is needed as a basis for studying the potential effects of industry on these fauna.

Approach

Three primary "tools" were used to develop the standardized data collection protocols included in this report. The most important tool was the consultations undertaken with various individuals who are actively collecting seabird and MM data. Another tool was a review of the literature on survey techniques. Finally, we have drawn from our experience as an environmental consulting firm that has been conducting seabird and MM surveys for over 30 years.

Consultations

Numerous individuals from industry, academic and government parties were consulted to determine the seabird and MM monitoring protocols currently in use in Atlantic Canada and elsewhere in the world. We also investigated the level of training that observers had received. Hopefully, the consultations will also assist in avoiding previous shortcomings and mistakes in data collection and that the best possible and most suitable survey procedures are available to be implemented.

A list of individuals consulted and their affiliation is provided in Appendix A. When possible we also collected sample data sheets, coding instructions, and material used to train seabird and marine mammal observers (MMOs). Individuals were asked questions about Survey Protocols, Observer Training, and Data Entry.

Literature Review

A review of available literature on seabird and MM survey techniques for ships and fixed-installations was conducted. A key source of information for birds was the report by Montevecchi et al. (1999). For MMs, the most relevant information on survey techniques was revealed through consultations.

Report Organization

The primary purpose of this report is to provide recommended seabird and MM observation protocols for Atlantic Canada. This report includes five main chapters:

1. background and introduction (this chapter);
2. description of MM survey techniques presently used and recommendations for observation protocols for Atlantic Canada;
3. description of seabird survey techniques presently used and recommendations for observation protocols for Atlantic Canada;
4. discussion of the feasibility of an automatic data entry program, description of a suggested data management system; and
5. suggested data analysis approach for seabird and MM data.

Acknowledgements and Literature Cited sections follow these chapters.

In addition, there are four Appendices: ***(A)*** a list of consulted individuals; ***(B)*** a MM data collection handbook; ***(C)*** a seabird data collection handbook; and ***(D)*** a summary of sea state scales.

2. MARINE MAMMALS

Review of Current Survey Protocols and Consultation Results

Eight primary MM survey techniques were reviewed. These included techniques used by the Joint Nature Conservation Committee (JNCC), Oil and Gas Observer Program (OGOP), Department of Fisheries and Oceans (DFO), Memorial University of Newfoundland (MUN), Dalhousie University (DAL), Provincial Airlines Limited (PAL), Sea Watch Foundation, the National Marine Mammal Laboratory's Platform of Opportunity (POO) program, and LGL's seismic monitoring program. Review focused on three main aspects, (1) the types of data collected, (2) coding techniques, and (3) observer training. Most of the survey techniques that were reviewed apply to observations acquired from moving ships for the purposes of obtaining data on the occurrence and distribution of MMs. Some techniques that were reviewed were specifically designed for monitoring and mitigating potential influences of industrial activity (i.e., seismic surveys) on MMs.

Shipboard Observations

During the review of MM shipboard survey procedures, three basic types of data collection were encountered:

(1) incidental sightings of MM seen by individuals not conducting dedicated MM watches,

(2) periodic watches conducted at different times during the day by a dedicated observer, and

(3) monitoring watches used to monitor activities of industry and to implement mitigation measures. These watches are conducted by a dedicated observer.

In addition, most MM survey techniques that were reviewed allowed for the collection of three types of data: general survey information (see Table 1), environmental conditions (Table 2), and details about MM sightings (Table 3). However, the specific data fields, units of measurement, and recording format varied greatly. Tables 1-3 provide a summary of the types of data fields collected during MM surveys by various organizations. In many instances where dedicated watches were conducted, there was poor or in some cases no means of recording the amount of survey effort. Effort information is critical to analyses. If the number of hours spent observing for MMs is unknown then it is unclear if the absence of animals simply means that no or little watching was conducted. There was also much variation in the level of training and experience of MMOs who collected data. Table 4 provides an overview of the MM survey protocols reviewed as well as some of the advantages and disadvantages of each approach.

Department of Fisheries and Oceans

DFO personnel in Atlantic Canada have been collecting and compiling data on MMs for many years. Data collection protocols have varied over the years and between regions. DFO personnel in St. Andrews, NB and St. John's, NL implement two types of data collection: one for incidental sightings and the other for continuous MM watches. Presently, DFO researchers from St. Andrews, NB follow similar protocols to those used by University of Rhode Island scientists (S. Smith, DFO, St. Andrews, pers. comm.). These continuous data forms are used for ship-based surveys that occur twice yearly in the Bay of Fundy where the primary focus is gathering information on endangered North Atlantic Right Whales (*Eubalaena glacialis*).

Recently, DFO personnel in St. John's have recorded MM survey data directly into a National Marine Fisheries Service (NMFS) program called VOR which runs on a laptop which is connected to a GPS unit. This approach is used for continuous MM watches. The VOR program can write data to a back-up disk automatically at specified intervals (e.g., every second) so the risk of data loss is minimized. A standard incidental sighting form (paper hard copy) is used by individuals who happen to sight a MM during DFO research cruises, fishing trips, etc. (J. Lawson, DFO, St. John's, pers. comm.). Training is available to staff collecting incidental sighting data in the form of a short course or in the form of PowerPoint training project plus identification cards and books.

Memorial University of Newfoundland and Labrador

Recently (1999-2003), researchers at MUN have been collecting data on MM during seabird surveys conducted from supply ships transiting to and from offshore oil and gas facilities on the Grand Banks (Wiese and Montevecchi 1999; Montevecchi and Burke 2002). Incidental MM observations have been recorded during dedicated seabird surveys. Researchers use a DOS program on a laptop linked to a GPS for real-time data entry in the field. Weather, wind and sea conditions were recorded at the start, during (as conditions change), and at the end of surveys. MM observations were collected at the same time bird surveys were conducted and only those MM recorded within a 300 m 90° arc off the port or starboard side of the vessel were counted as on transect (Montevecchi and Burke 2002). However, observers noted "any interesting events", which presumably includes MM, beyond the 300 m zone (Montevecchi and Burke 2002). Also, an earlier report, based on data collected periodically from July–September 1999, during these offshore surveys states that "…mammals were recorded whenever sighted regardless of distance" (Wiese and Montevecchi 1999). Observers collected and recorded MM data for 2-h sessions followed by 20-min breaks when steaming between industry locations during daylight hours (Montevecchi and Burke 2002). Some behaviour codes for marine mammals appear to overlap with bird behaviour codes: 'on water' and 'foraging' (Wiese and Montevecchi 1999).

TABLE 1. Summary of "General Information" data fields collected during MM surveys by various organizations. "Incidental" refers to sightings of MM where effort is not recorded; "Periodic" refers to surveys conducted by MMOs at intermittent times during the day; "Monitor." refers to surveys used to monitor MM during seismic operations; and "Effort" refers to separate data sheet used to record survey effort.

	DFO		DAL	MUN	Sea Watch		NMML	OGOP	JNCC (Monitoring)		LGL	PAL
General Information Data Fields	Incidental	Periodic	Periodic	Periodic	Periodic	Effort	Incidental	Periodic	Periodic/ Incidental	Effort/ Operations	Monitor.	Periodic
Vessel Name	x		[a]		[b]	x	x	x	x	x	x	
Type of Vessel		x			x	x				x		
Purpose of Trip	x	x								x		
Date	x	x	x	x	x	x	x	x	x	x	x	x
Recorder's Name	x	x						x				
Observer's Name		x			x	x	x		x	x	x	x
Time	x	x	x	x	x	x	x	x	x	x	x	x
Duration of Watch		x				x				x	x	
Latitude	x	x	x	x	x	x	x	x	x		x	x
Longitude	x	x	x	x	x	x	x	x	x		x	x
Vessel Speed		x		x		x						
Vessel Heading		x		x	x	x						
Observer Location		x						x				
Obs. Height ASL		x				x						
Field of View					[b]	x						
Human Activity						x		x	x	x [c]	x [d]	
Seismic Line/Block										x	x	
Date Form Filled Out								x				

[a] No data field for Vessel Name but assumed to be the yacht *Balaena*.

[b] These data fields recorded on "Cetacean Encounter Summary Sheet" designed for extended observations of MM.

[c] Recorded info. on timing of ramp ups, when full power of airguns was reached, and when airguns stopped; whether hydrophones were used.

[d] Recorded info. on timing of ramp ups, line shooting, and when airguns stopped; also the number and volume of airguns used.

TABLE 2. Summary of "Environmental" data fields collected during MM surveys by various organizations. "Incidental" refers to sightings of MM where effort is not recorded; "Periodic" refers to surveys conducted by MMOs at intermittent times during the day; "Monitor." refers to surveys used to monitor MM during seismic operations; and "Effort" refers to separate data sheet used to record survey effort.

	DFO		DAL [a]	MUN	Sea Watch		NMML	OGOP	JNCC (Monitoring)		LGL	PAL
Environmental Data Fields	Incidental	Periodic	Periodic	Periodic	Periodic	Effort	Incidental	Periodic	Periodic/ Incidental	Effort/ Operations	Monitor.	Periodic
Wind Direction	x	x		x	[b]					x		
Wind Speed		x		x								
Beaufort Wind Force	x	x		x	x	x	x			x	x	x
Wave Height				x	x	x		x		x		
Visibility	x	x		x	x	x		x			x	x
Cloud Cover		x			[b]							x
Glare		x									x	
Precipitation				x								
Weather		x						x				x
Water Temp.					[b]		x					
Water Depth					[b]				x		x	
Sighting Conditions		x					x			x		
Air Temperature		x										x

[a] No environmental data fields recorded on cetacean sighting form (likely recorded elsewhere).

[b] These data fields recorded on "Cetacean Encounter Summary Sheet" designed for extended observations of MM.

TABLE 3. Summary of "Marine Mammal" data fields collected during MM surveys by various organizations. "Incidental" refers to sightings of MM where effort is not recorded; "Periodic" refers to surveys conducted by MMOs at intermittent times during the day; "Monitor." refers to surveys used to monitor MM during seismic operations; and "Effort" refers to separate data sheet used to record survey effort.

	DFO		DAL	MUN	Sea Watch		NMML	OGOP	JNCC (Monitoring)		LGL	PAL
Marine Mammal Data Fields	Incidental	Periodic	Periodic	Periodic	Periodic	Effort	Incidental	Periodic	Periodic/ Incidental	Effort/ Operations	Monitor.	Periodic
Species	x	x	x	x	x		x	x	x		x	x
Species Certainty	x	x			x		x		x		x	x
ID Features	x				x			x	x			
Sighting Cue		x					x				x	
No. of Animals	x	x	x	x			x	x			x	x
No. of Groups	x	x						x				
Min. Group Size		x			x		x					
Max. Group Size		x			x		x					
No. of Adults					x				x			
No. of Juveniles					x				x			
No. of Calves					x							
Distinctive Markings	x				[a]			x				
Distance		x										
Distance First Seen				x							x	
Closest Approach							x		x			
Angle Off Track		x		x					x		x	
Swim Direction		x			x			x	x		x	
Behaviour		x	x	x	x		x	x	x		x	x
Time First Seen		x			x				x		x	
Time Last Seen				x	x							
Duration Observed								x				
Photo/Video Taken		x		x	x		x		x			
Drawings					x		x					
Body Length					x		x					
Comments	x	x		x				x			x	x

[a] This data field recorded on "Cetacean Encounter Summary Sheet" designed for extended observations of MM.

TABLE 4. Summary of MM survey protocols reviewed, including some of the advantages and disadvantages of each approach.

Organization	Survey Type	Data Recording	Observer Training	Advantages	Disadvantages
DFO (St. Andrews)	Incidental	Paper	None	Ease of use	No survey effort; no training
	Periodic	Paper	Yes	Ease of use	Poor documentation of effort and changing environ. Conditions; unclear data field labels
DFO (St. John's)	Incidental	Paper	None	Ease of use	No survey effort; no training
	Periodic	Laptop	Yes	No keypunching data later	Equip. expense; risky operating laptop in bad weather; no data sheet back-up
DAL	Periodic	Paper	None	Single data sheet; good MM info.; sighting Ids verified by 2nd MMO	Poor documentation of effort and changing environ. conditions; no formal MMO training
MUN	Periodic	Laptop	None	Good record of environ. conditions; no keypunching data later	MMO/bird surveys done same time; no MMO training; 300 m strip width; equip. expense, no data sheet back-up
Sea Watch	Periodic	Paper	None	Ease of access to protocols; clear linkage between sighting and effort forms	Several data sheets; potentially confusing
NMML	Incidental	Paper	None	Ease of use	No survey effort; no MMO training
OGOP	Periodic	Paper	Yes	Ease of use	Poor documentation of effort and changing environ. conditions; MMO/bird surveys done same time
JNCC	Monitoring	Paper	Yes	Ease of access to protocols; good training requirements	3 data forms with no clear linkage; confusing data fields; no record of no. guns/volume
LGL	Monitoring	Paper	Yes	Single data sheet; good record of effort, environ. conditions, MM data	"Crowded" data sheet; MMOs required to learn codes
PAL	Periodic	Paper	Yes	Std. data entry/storage system	Paucity of data fields collected; MMO/bird surveys done same time

Dalhousie University

Researchers from Dr. Whitehead's lab at Dalhousie University primarily conduct detailed behavioural studies of MMs from the yacht *Balaena*. However, opportunistic surveys (using a line transect technique) are conducted during transits to and from research sites (T. Wimmer, DAL graduate, pers. comm.). These sighting data are collected on a paper data sheet. Observers record date, time MM first and last seen, position (latitude, longitude), estimates of minimum and maximum group size, species, distance from boat, bearing from the boat, behavioural description and whether any audio or visual documentation was taken. The data fields collected are summarized in Tables 1-3. Generally, if someone on watch sights a MM, a second person is consulted to verify the identification. Observations are typically made from the highest vantage point—from the deck or crow's nest when weather conditions permit.

Sea Watch Foundation

The Sea Watch Foundation in the United Kingdom is an organization that collects, organizes and distributes cetacean sighting information from volunteer observers in the North Atlantic. Observers can range from marine biologists to individuals using a ferry. Both incidental sightings and sightings made during dedicated MM watches are included in the MM database. Three types of sighting recording forms are available on the worldwide web (www.seawatchfoundation.org.uk). These include a cetacean sighting recording form for detailed recordings of single sightings, a simple sightings recording form for brief recording of multiple sightings, and a cetacean encounter recording form for protracted observations of a group of animals. In addition to these forms, observers who conduct continuous watches must complete an effort recording form. Effort recording forms are cross-referenced to MM sightings by a unique "sighting reference number" assigned to each MM sighting form. Vessel position and environmental conditions are filled out on the effort form every 15 min or when the ship's course changes. Various types of data fields collected are summarized in Tables 1-3. Instructions for completing these forms are provided on the Sea Watch web site. All forms are requested to be returned to the Sea Watch Foundation where data are compiled, analyzed, and reported upon.

National Marine Mammal Laboratory

The National Marine Mammal Laboratory in the United States has been collecting MM sighting information from Platforms of Opportunity (POO) dating back to 1958. Instructions on how to collect data (i.e., fill out the forms) and incidental sighting data forms are available on the worldwide web (nmml.afsc.noaa.gov/CetaceanAssessment/POP). The data forms consist of data fields standard to most of the other MM forms discussed here (Tables 1-3). The data forms also include a section where observers fill out a "Narrative" of body features, markings, colouration, associated organisms, elaborations of behaviour. There is also a space on the data form for sketching the MM. The data forms also consist of a page of MM silhouettes of most MM known to occur in North American waters; observers are asked to circle the appropriate silhouette. The POO program asks observers to document by writing a description any fisheries interactions as well as unusual MM behaviours.

Oil and Gas Observer Program

OGOP provides individuals (retired fishers) who serve as fisheries observers (FO) that also collect marine mammal and seabird data from offshore ships and platforms associated with the oil and gas industry. Work priorities, in the following order of most importance for FO are (1) preventing interactions between oil/gas operations and fisheries, (2) conducting marine mammal observations, and (3) conducting bird surveys. Most FO work has been on vessels offshore Nova Scotia but some have worked offshore Newfoundland in the past. Currently, there are eight core FO that work for OGOP. There are no set

coding instructions provided to FO. MM and seabird surveys are conducted at the same time. For surveys, OGOP has generally followed Tony Locke's (CWS; S. Farwell, OGOP, pers. comm.) recommendation to conduct three 10-min watches consecutively. OGOP has used a data sheet similar to JNCC MM sighting form (see Tables 1-3 for data fields).

Joint Nature Conservation Committee

In United Kingdom waters, all seismic surveys are required to be conducted in accordance with the Joint Nature Conservation Committee (JNCC; see website: www.jncc.gov.uk) *Guidelines for minimizing acoustic disturbance to marine mammals from seismic surveys*. These guidelines include a requirement that seismic surveys must be delayed if MMs are detected within close proximity to the seismic source. As such, a search for MMs is conducted before airguns are activated. Therefore, MMOs on board seismic ships have been collecting data on MMs since the JNCC Guidelines were introduced in 1995. The level of training and the number of MMOs required for a seismic survey is dependent upon whether the seismic surveys occur in an area which is deemed biologically important to individual MM species, especially those species that have special conservation status (see subsection Observer Training for more details). MMOs are required to conduct a "pre-shooting search" during daylight periods; this watch occurs at least 30-min before airguns are ramped up (gradual increase of airgun array volume over at least a 20-min period). The JNCC Guidelines call for delaying the start of airgun operations when marine mammals are sighted (or detected acoustically) within 500 m, but there is no wording calling for suspension of airgun operations when mammals are seen within any specified distance when the airguns are already operating. Also, there is no specific guidance as to how much survey effort is required by MMOs after the pre-shooting search.

MMOs are required to complete three paper data forms including: (1) **Record of Operation** which summarizes seismic operations, (2) **Location and Effort Data** which provides general and environmental condition information, and (3) **Record of Sighting** which provides information on MM sightings. There is no clear linkage between the three data sheets. Various types of data fields collected are summarized in Tables 1-3. Data sheets are returned to JNCC, where they are compiled, analyzed, and reports are produced and made available on the JNCC website (e.g., Stone et al. 2003).

Several organizations (e.g., V. Barbosa do Carmo, Veritas, Rio de Janeiro, Brazil, pers. comm.; M. Thillet, EnCana, Halifax, NS; R. Pitt, Canning and Pitt, St. John's, NL) have adapted the JNCC monitoring approach and data sheets as a template for their MM monitoring programs during seismic surveys. Recently, the Canada-Newfoundland Offshore Petroleum Board (CNOPB) has posted draft requirements that suggest the JNCC forms should be used for reporting MM (and seabird) observations for all seismic monitoring in offshore Newfoundland and Labrador waters (www.cnopb.nfnet.com). The CNOPB suggests that seismic operators should implement a MM monitoring program in consultation with DFO and CWS, and that watches should be conducted at designated times throughout the daylight hours.

LGL Limited

LGL Limited, environmental research associates, has been conducting MM monitoring and implementing mitigation measures from seismic vessels since 1996. This company has developed data collection protocols that allow for continuous monitoring of environmental, industrial activity, and MMs. MMOs have been trained biologists who have often been assisted by native observers (in the case of Beaufort Sea monitoring) and FO (Atlantic Canada) who already are quite knowledgeable about MM and have received training in data collection techniques and MM identification. Typically, one of the key parts of the monitoring programs, is to ensure airguns are ramped up (soft start) and to implement shutdowns if a MM is sighted within a designated safety zone. The data forms allow for these types of

information to be recorded all on one paper sheet. MMOs entered data into a computer-based database (Microsoft Excel) while still in the field. The database was programmed to prevent the entry of out-of-range values and codes. Observers are equipped with 7 x 50 reticle binoculars that provide the means of acquiring distance measures to MM which is especially important when implementing shutdowns of the airguns for MM that occur within a safety zone.

The seismic activity data includes the depth of the airguns, the number of airguns operating, the total volume of the airguns operating, and a data field which indicates whether the seismic ship is ramping up the airguns, shooting a seismic line, testing the airguns, etc. There is also a blank on the top of each data sheet for the exploration license number where data are being acquired. The data fields for MM observations are designed to reflect behaviour relative to the ship's activity. There is a 'movement' field which describes direction of travel relative to the ship, as well as 'behaviour' fields that include codes for numerous behaviour types (see Appendix B). The position of a MM and its direction of travel are also noted on the data form. An important aspect of the LGL data collection protocol is that position, environmental, seismic activity data are collected at least every 30 min or more frequently when conditions change. This allows for analysis of MM sighting information relative to very well-documented observational effort and environmental data.

Fixed-Installation Observations

There are many opportunities to conduct MM watches from offshore oil and gas platforms and ships that are fixed in one location. Ships like the FPSO (Floating-Production-Storage-Offloading) for the Terra Nova oilfield and the GBS (Gravity-based Structure) at Hibernia provide good vantage points for conducting observations. Although the same geographic coverage cannot be obtained compared to a moving ship, the temporal coverage is potentially greater given that MM observations could be acquired throughout the year. Information on MM survey protocols collected from "fixed-installations" were acquired for offshore facilities in Newfoundland and Nova Scotia waters.

Newfoundland

Provincial Airlines Limited (PAL), environmental services, provides weather observers to offshore oil and gas installations. Observations have been undertaken during various stages of Newfoundland's offshore oil developments including construction, development drilling, and production. One of the duties of the weather observer has been to conduct seabird and, recently, MM surveys. Weather observers aboard the drilling platform, the *Henry Goodrich*, on the Grand Banks used the following observational protocols. Observers typically have conducted three 20-min surveys per day; bird and MM observations are collected simultaneously. The surveys have been widely spaced throughout the day taking place in early morning, mid day and late in the day. Surveys were not necessarily conducted from the same part of the platform for the whole 20 min; the observer often walked about in order to broaden the angle of view which was usually 270°. Observations were written on paper (see Tables 1-3 for the data fields collected) and later in the same day entered into a computer and e-mailed to PAL personnel in St. John's where they were stored in a master database. Observers used 7x50 binoculars without reticles. MM were identified to species level whenever possible and basic behaviours like 'swimming past', 'feeding', and 'staying in the area' were recorded (P. Rudkin, PAL, pers. comm.). Data are eventually forwarded to DFO St. John's.

As discussed previously, researchers at MUN collect data on MM during seabird surveys from supply ships servicing the offshore oil and gas facilities on the Grand Banks (Montevecchi and Burke 2002). Different survey protocols were used when the supply ships were standing by (stationary or ship

speed < 4 kt) offshore platforms. Observations are conducted for 30 min of each hour. Continuous scans of 180° field of view within a 500-m range of the ship were carried out for 10 min at one-hour intervals. Observers also take note of industrial activities like helicopter flights, shipping activity, burning of the flare, etc.

Nova Scotia

FO from OGOP have been stationed on stationary drilling structures offshore Nova Scotia. Similar observational protocols to those used on moving vessels are used on stationary structures. There are no set coding instructions provided to FO. MM and seabird surveys are conducted at the same time. For surveys, OGOP has generally followed Tony Locke's (CWS; S. Farwell, OGOP, pers. comm.) recommendation to conduct three 10-min watches consecutively. OGOP has used a data sheet similar to JNCC MM sighting form (see Tables 1-3 for data fields).

Suggestions from Consulted Individuals

A list of individuals consulted and their affiliation is provided in Appendix A. When possible we also collected sample data sheets, coding instructions, and material used to train MMOs. Individuals were asked questions about Survey Protocols, Observer Training, and Data Entry. Some of the questions posed to those consulted are outlined in Table 5.

Survey Protocols

MM experts consulted for this project recognized the need for several approaches to MM data collection in Atlantic Canada, including ways to record: (1) incidental sightings, (2) periodic watches, and (3) monitoring watches for the purposes of monitoring industrial activity and implementing mitigation measures. Several individuals thought that for seismic surveys, particularly those in or near sensitive areas, there should be continuous monitoring for MM during daylight hours. It was suggested that passive acoustic monitoring techniques could be used to supplement visual observations for MM. However, some individuals noted the high cost of operating acoustic monitoring systems. For periodic watches, it was recommended that observers watch for MM as much as possible but that if a MMO cannot watch for the entire day then three watches of 15-20 min duration spread out over the day (morning, noon, late afternoon) or one watch 60 min in duration would provide useful information. Most MM experts had not conducted MM and seabird watches simultaneously and thought that different search patterns were involved for the two different groups.

Some general recommendations were to keep survey protocols as simple as possible and instruct observers to print (vs. write) information onto data sheets. A wide variety of binocular types had been used by MMOs; those consulted recommended 7 x 50 binoculars and thought that reticle binoculars were a good idea for monitoring watches that involved safety zone shutdowns for MM seen within a designated radius of the ship (e.g., seismic vessels). All individuals consulted thought that MM watches should be conducted from the highest suitable vantage point with the largest field of view.

Observer Training

During consultations, we learned that the amount of training MMOs have received varies greatly depending on factors like the organization collecting the data, the purposes of data collection, and the biological sensitivity of the area surveyed. Most individuals consulted for this project agreed that observers should undergo a training course that not only focuses on identifying MM, but also teaches observers how to properly fill out data forms.

TABLE 5. Summary of questions and requests posed during consultations with marine mammal experts.

Questions/Requests
Survey Protocols
What survey protocols have you and/or your group used?
Have protocols been used on ships and/or fixed installations?
Can you provide us with a sample data sheet?
Can you provide us with coding instructions?
Recommended a time of day and location for MMOs to conduct surveys?
What MM behaviour codes and descriptions have you used?
Did you attempt to conduct bird/MM surveys at the same time?
How often did you conduct MM surveys?
How frequently should MM monitoring be conducted from industry platforms?
What survey equipment have you used? (e.g., reticle, big eye binoculars; laser range finders, night vision devices)
What protocol "style(s)" do you think will work? For example,
JNCC-style for incidental sightings (e.g., Stone 2003)
LGL-style for continuous monitoring (e.g., LGL Limited 2003)
Observer Training
What training did observers receive?
Is training material already in place? If yes, can we receive a copy?
How much training (minimal) do you think observers should receive?
Should observers be required to pass an identification test?
Data Entry
Where have the data you collected in the past been sent? How have the data been used?
What do you think should happen to data collected from offshore oil/gas vessels?
What data entry protocol, verification and back-ups have you used?
Is an automated data capture system feasible? If yes, what would be the hardware and software needs?
Others
Please recommend other MM experts we should consult.
Please recommend some available literature on conducting MM surveys.

Recently, in Atlantic Canada, training modules, developed by DFO, have been provided to observers (in in-person training sessions of 3 – 10 participants) in both Nova Scotia and Newfoundland for several organizations. A training course developed by DFO St. John's was developed specifically for MMOs aboard seismic ships. A training course developed by DFO St. Andrews was adapted by DFO from a general shipboard observer program designed to collect MM data for DFO. A typical training session was given by a biologist with expertise in MM and the session lasted for 3-4 h. A PowerPoint presentation focusing on how to identify MM species likely to be observed in the survey area using cues like colouration, size, body shape, body size, and behaviours was given. At the end of the presentation, a "test" session (observing images and completing a form) was given to participants but there was no minimal passing grade implemented. There was no instruction in the St. John's session on how to

complete data forms as this was considered project specific and would be taught by others. The training course offered by DFO St. Andrews did teach observers how to complete data forms.

The JNCC is introducing stricter controls on the qualifications of MMOs who conduct observations from seismic ships in the hopes to raise standards of data collection. The JNCC states that MMOs should be independent of the seismic ship's crew to prevent conflict of interests where the priority is compliance with JNCC Guidelines. The training program developed by the JNCC is comprised of three stages: initial induction training, a probationary period where new MMOs gain experience alongside an experienced MMO at sea, and refresher training at least every four years. Instructors for training courses must have substantial experience and appropriate background knowledge and skills. The JNCC is implementing stricter MMO controls because of a noted association between poorer MMO performance and lack of training, and untrained personnel (Stone 2003) have at times misinterpreted JNCC Guidelines.

Most of the individuals consulted thought that observers should be required to pass some type of MM identification test after their training course. However, there was little consensus as to what a passing grade should entail. For instance, would a trainee need to correctly identify a fin whale or would "a large baleen whale - possibly fin, blue or sei" do? Also, it is sometimes difficult to identify a static image or even a video of a MM and this does not necessarily represent sighting conditions on a ship. It was thought that trainees should show competency in completing data forms.

Also, most of the consulted individuals thought that a 3-4 h training course was not of sufficient duration to teach identification skills and data recording procedures. Some individuals thought that there should be a field component to the training course, which could be held in conjunction with at-sea training for seabird data collection.

Data Entry

In most cases, MM data collected by various organizations has been entered onto paper data sheets and later key-punched into a computer. The exceptions were surveys conducted by DFO St. John's and MUN, during which observers entered data directly into a laptop. Most consulted individuals thought that the paper data sheet was most feasible. It was thought that using a laptop or handheld computer would be too costly and may not be practical in situations where observations are conducted in areas exposed to the weather (e.g., platforms). The question also arose as to what organization would finance the purchase and upkeep of laptops and/or handheld computers. Also, many individuals liked the idea of having a paper hard copy of the data sheet as a back-up to computer storage of data. Opinions differed over which computer software program should be use for data entry and storage. Some consulted individuals suggested Microsoft Excel because of its ease of use and ready availability while others suggested a database program like Microsoft Access because of its ability to store more records and to perform queries of the data.

Recently, most MM data collected from offshore oil and gas facilities in Atlantic Canada have been sent to DFO in Dartmouth, St. Andrews, and St. John's. Most of the individuals consulted thought that MM data should be archived and made accessible to the public via a web-based query system; some concerns were raised about the proprietary nature of the data. Many individuals stressed the importance of analyzing and publishing results of MM data, otherwise there is little value in expending effort in gathering data. To date, there have been no primary publications of the MM data collected from offshore oil and gas vessels.

Literature Review

Most of the available literature found and recommended by MM experts dealt with how to derive correction factors for detection and availability biases of surveys (e.g., Garner et al. 1999; Gelatt and

Siniff 1999; Brandon et al. 2002) and were not directly applicable to surveys conducted from offshore oil and gas vessels (e.g., Gaskin 1998). As such, this report relies primarily on the surveying techniques used and recommended by consulted individuals.

Recommended Survey Protocols

Based on consultations and a review of current MM survey techniques, we recommend and have developed three types of survey protocols for collecting MM data from offshore oil and gas vessels. Survey protocols have been developed for:

(1) incidental sightings,

(2) periodic watches, and

(3) monitoring watches.

The procedures for collecting data for each of these survey "techniques" are provided in a Marine Mammal Data Collection Handbook found in Appendix B of this report. The Handbook also provides some guidance on selecting a viewing area, suggested personal and survey equipment, and error checking data. For all three types of protocols, we recommend that paper data sheets be used in the field. Data sheets are provided in Appendix B. Each of the MM protocols developed in this report allowed for the collection of three types of data: general survey information, environmental conditions, and details about MM sightings. A summary of each of the recommended survey protocols is provided below.

Incidental Sightings

Protocols for incidental sightings are intended for individuals aboard a moving ship or fixed-installation who happen to sight a MM during the course of their regular marine duties, *i.e.*, not during dedicated MM watches. It is particularly aimed at the ship's crew. Although the information collected on the incidental data forms cannot be used to provide estimates of MM density (because survey effort is not quantified), it can be used to provide insight into the occurrence of MMs at places and times when little information is available. It was suggested by several consulted MM experts that these data forms should be kept as simple as possible. We have adhered to this, including where possible data code options which can be circled versus requiring observers to write out details. The data sheet for incidental sightings, although accompanied by descriptions of how to fill out the form, can be completed accurately without supporting documentation. Individuals who sight a MM incidentally would provide general information like the vessel's name, position, speed, heading, and activity. Environmental conditions like Beaufort wind force, wind direction, visibility, water depth and water temperature should be recorded as well. Data fields for information on MM sightings include:

- species,
- reliability of the species identification,
- number of MM seen (including minimum and maximum estimates),
- initial and closest distance a MM was sighted from the vessel,
- position and direction of travel of the MM relative to the ship (indicated with a drawing),
- behaviour (options which can be circled and a space provided where further details can be added), and
- physical description of MM (space provided for written description or drawing).

It is recommended that incidental sighting data sheets should be submitted to a designated individual aboard a vessel, like the ship's captain or first mate. This designated individual would be responsible for submitting forms to the appropriate regulatory authority (i.e., DFO or CNSOPB or CNOPB).

Periodic Watches

The protocols developed for Periodic Watches were designed to allow for collection of MM data, including survey effort, by trained observers, which allow for estimates of relative abundance and perhaps even estimates of MM density. Survey protocols can be used from a moving vessel and a fixed-installation. It is recommended (based on suggestions from most consulted individuals) that three observational periods, each 20 min in duration (total of 60 min for the day) be conducted during daylight hours; one watch in the morning, one midday, and one late afternoon. The three 20 min survey periods for marine mammals are suggested minimums and if an observer has more available time watch durations can be extended. The exact timing of these watches would be dependent on visibility conditions. If for example, foggy conditions prevent a watch during the morning, then two watches could be conducted back-to-back at midday or late in the afternoon. An observer should strive for collecting 60 min of data each day. Observers who conduct these surveys should, as a minimum, have received a standard training course recommended in the next section of this report. It would be beneficial if observers had field experience as well. We recommend that MM and bird surveys should not be conducted at the same time. There are different search patterns for MM and bird surveys. In addition, given the attention required to identify and quantify MM, and especially seabirds, the quality of data collected would be compromised if bird and mammals surveys were conducted simultaneously.

The Periodic Watch survey protocols require observers to collect more MM information than the incidental sighting protocols and also the amount of survey effort per watch. Details of the Periodic Watch protocols, including the recommended data sheet are provided in Appendix B. Observers record general and environmental information at the start and end of each watch. If this information has not changed during the watch, MMOs can circle the phrase "*Same as Start*". Also, if observations are conducted from a fixed platform (e.g., drill ship), MMOs can circle the phrase "*Not applicable*" for ship's heading and speed. If there is more than one MM sighting (a sighting can be a single MM or group of MM) seen during a watch, additional form(s) can be used. Data fields for information on MM sightings include:

- species,
- reliability of the species identification,
- time of sighting,
- position (latitude, longitude) of sighting,
- total number of MM seen (including minimum and maximum estimates),
- initial and closest distance a MM was sighted from the vessel,
- duration MM observed in the area,
- position and direction of travel of the MM relative to the ship (indicated with a drawing),
- behaviour (options which can be circled and a space provided where further details can be added), and
- physical description of MM (space provided for written description or drawing).

The MMO should be responsible for key punching data sheets into a data entry program like Microsoft Excel. These files should be sent (via email or on a disk) to the appropriate regulatory authority (i.e., DFO or CNSOPB or CNOPB).

Monitoring Watches

The protocols developed for Monitoring Watches were designed to allow MMOs to document seismic activity, MM observations, survey effort, environmental conditions, and the implementation of mitigation measures. (The protocols could be easily adapted to monitor other types of marine industrial activity like shallow-hazard surveys, etc.) Overall, the Monitoring Watch survey protocols are more complicated, and would require more training and expertise than required for the Incidental and Periodic survey protocols. It should be noted that (see Section 7 *in* Stone 2003) dedicated MMOs vs. FO and ship's crew members sight many more MM, implement mitigation measures more prudently, and complete data sheets more effectively during seismic surveys. More specifically, dedicated MMOs had MM sighting rates double FO and six times that of members of ship's crew (Stone 2003).

A seismic vessel will likely be operating 24 hours per day. It is recommended that there should be two observers available to conduct MM watches on a seismic ship in order to cover periods during "daylight" hours when the airgun array is active. This is especially prudent in situations where safety zone shutdowns are required for MM during seismic data acquisition and in areas where very little information on MM abundance and distribution is available. It is recommended that an observer watch systematically for marine mammals for at least 30 minutes before the airguns start up (during daylight). At least one observer should be required to watch systematically during all hours when the guns are operating during daylight and some (as much as possible) periods when the airguns are inactive. During periods of reduced visibility (i.e., high sea states and fog) during daylight, MMOs should continue to watch for marine mammals if the vessel is acquiring seismic data. To reduce fatigue, MMOs should not watch for continuous periods greater than 4 hours. With two observers available, total observation time per day should not exceed 8 hours. Observers who conduct these Monitoring Watches should, as a minimum, have received a standard training course recommended in section "Recommended Training and Surveying Equipment" of this report and have some field experience. For sensitive MM areas and areas where little baseline data exist, it is recommended that trained biologists conduct observations and implement mitigation measures.

Details of the Monitoring Watch protocols, including the recommended data sheet are provided in Appendix B. The survey approach for seismic monitoring is similar to an approach developed and used by LGL Ltd. for MM monitoring programs designed for the Beaufort Sea, Russia, and Atlantic Canada. Unlike, the JNCC approach for seismic monitoring which uses three data sheets: one for sightings, one for seismic activity, and another for survey effort; the "LGL approach" uses one data sheet.

Observer(s) record general, seismic and environmental information every 30 min or when seismic activity or environmental conditions change. This permits detailed documentation of survey conditions that allows for proper (i.e., accounting for variable sighting conditions and for changes in seismic activity) analysis of the survey data. Data codes are used for several data fields which reduces the amount of writing involved in recording information. Data fields for information on MM sightings include:

- species,
- reliability of the species identification,
- time of sighting,

- position (latitude, longitude) of sighting,
- environmental and seismic conditions at time of sighting
- total number of MM seen,
- initial and closest distance a MM was sighted from the vessel,
- position and direction of travel of a MM relative to the ship (indicated relative to a clock face), and
- behaviour (initial and secondary types plus a written description), and

The MMOs should be responsible for key punching data sheets into a data entry program like Microsoft Excel. These files should be sent (via email or on a disk) to the appropriate regulatory authority (i.e., DFO or CNSOPB or CNOPB).

Recommended Training and Surveying "Equipment"

Training

We recommend that observers undergo a training course that focuses on identifying MM and proper techniques for filling out data forms. This course should be standardized for all MMOs that conduct dedicated MM watches from offshore oil and gas facilities. Course instructors should have experience at sea conducting MM surveys and regulators (i.e., DFO and/or Offshore Petroleum Boards) should approve their credentials, as instructors. The MM identification training course (PowerPoint presentation) developed by DFO St. John's (i.e., Dr. Jack Lawson) would serve as an excellent starting point for standardized training material. This PowerPoint presentation should focus on how to identify MM species likely to be observed in the survey area using cues like colouration, size, body shape, body size, blow shapes, and behaviours. (The PowerPoint file should be available on the vessel's computer for MMOs reference.) Also, estimating group size of MM like dolphins should be a component of training. Photos of MM should be supplemented by video of MMs showing surfacings, diving, blows, various behaviours like breaching, lobtailing, etc. Video would enable trainees to observe a fluid range of behaviours that still photos simply cannot relay; this would help with identifications. If possible, video should include variable sighting conditions, like different sea states that would reflect actual survey conditions. The training course should also introduce observers to MM field guides and supplemental print materials (e.g., laminated MM ID sheets). In addition, MMO trainees should be taught how to properly fill out data sheets and the protocols for entering the data into a computer and later submitting the data.

After the MM identification and data sheet lessons, observers should be given a test, which requires them to properly identify MM photos (or video) and to properly fill out data sheets for different scenarios. A pass mark of 80% is suggested; this standard should be applied for all MMO trainees. If a MMO does not meet this criterion then he or she should retake the classroom training course at a later date. Note that the test should be designed so that most individuals who are diligent during the classroom sessions can achieve the pass mark. We anticipate that this "classroom" component of training should take approximately one day.

We recommend that newly trained MMOs, especially those tasked with monitoring MM in sensitive areas during industrial activities like seismic operations, be accompanied by an experienced MMO (who is ideally a biologist) during their first trip at sea. During this "probationary" period, new

MMOs will gain experience alongside an experienced MMO. The trainee should be competent in conducting MM surveys and completing data sheets (as judged by the trainer) before he or she is permitted to conduct watches on their own.

Surveying "Equipment"

There are several good MM guides for eastern North America. The quality of MM illustrations and photos is variable among them. We recommend the National Audobon Society's Guide to Marine Mammals of the World (Reeves et al. 2002), which is readily available and ranges in cost from ~ $29 to $40. The illustrations, photos, and distribution maps in this book are good for most MM, particularly the most common MM in NW Atlantic waters. Another option is Whales, Dolphins, and Porpoises (Carwardine 1995) which is smaller in size and less expensive; however, seals are not included in this book and it has fewer photos than Reeves et al. (2002). A MM guide should be used in classroom teaching and a copy should be part of the standard gear aboard all vessels with MMOs. A list of page numbers for the pertinent species could be glued inside the front cover. Supplemental print materials should be available as well. Laminated MM ID sheets showing the species of the NW Atlantic and important identification cues, including illustrations of blows, should be provided.

In addition to the PowerPoint presentation developed for classroom training, the field guide, and the supplemental ID sheets, there should be a manual containing information on MM from an Atlantic Canadian perspective. For the regularly occurring species, this would include information on the seasonal and spatial distribution patterns, behaviours and field marks, in addition to information contained in the published MM field guide.

We recommend that MMOs use 7 x 50 binoculars with reticle markings for monitoring surveys. (See Lerczak and Hobbs (1998) and Kinzey and Gerrodette (2001) for guidance on reticle conversion factors.) These binoculars will allow MMOs to accurately record sighting distances which is particularly important when mitigation measures (i.e., shutdown or delay of seismic surveys) are dependant upon the distance a MM is sighted from the vessel. In situations where mitigation measures are not required ("Incidental Sightings" and "Periodic Watches"), a good pair of 7 x 50 binoculars without reticle markings would suffice.

Other Recommendations for Surveys

One of the key recommendations that was repeatedly made during consultations was that MM data collected from offshore oil and gas vessels should be analyzed and published in a credible source, preferably in the primary literature (i.e., peer-reviewed scientific journal). Standardized data collection protocols would facilitate publication and publication would lend credibility to the MM monitoring program. Also, given the paucity of data for MM in the offshore, particularly deep waters, publication would assist in the environmental assessment process. Another recommendation made during consultations was that MM data ultimately be available in a publicly accessible database such as a web site.

3. SEABIRDS

History of Ship-Board Observations

In the late 1960's, there was a growing public awareness of the potential impact of oil spills on seabirds in eastern Canada, and the rest of the world. At that time, very little was known about the abundance and distribution of seabirds off Canada's east coast. In an attempt to establish baseline information, the Canadian Wildlife Service (CWS), in conjunction with the University of Moncton, developed a standardized systematic method of recording seabirds from ships at sea. The method became known as PIROP (Programme Intégré de Recherches sur les Oiseaux Pélagiques). Beginning in 1969, observers were placed on oceanographic research ships working in eastern Canada to collect data on seabird distribution and abundance. By 1972, the Canadian Wildlife Service ran and organized the PIROP system alone. These data were published in the *Atlas of Eastern Canadian Seabirds* (Brown et al. 1975). This document became a cornerstone reference for pelagic seabird distribution and abundance in eastern Canada, as well as a model for other pelagic seabird researchers worldwide.

The PIROP method was simple and easy to use by observers of variable skill levels. Watches were 10 min in duration, a short enough time period to relate observations of seabirds to variable oceanographic conditions. All birds were counted from a ship traveling at a speed of at least four knots. The transect width was unlimited (line transect technique). The observer could be positioned anywhere on the ship with a field of view of 180° to 360°. Details such as type of flock, association with other species, sex, age, direction of movement, position on the water (flying or sitting), behaviour (e.g., feeding, following ship) were recorded. Data could be expressed in relative abundances, i.e., birds per linear kilometre. For analysis purposes, the data were compiled in 30'N X 1°W blocks (10-min counts falling within each block were pooled). The number of individuals of each species per 10-min watch was also averaged by season. This gave relative abundances of birds and provided a trend indicator for populations of birds at sea. PIROP surveys, using the 'original' methods described above, were continued by CWS through the 1970s. Brown et al. (1986) published survey results up to 31 December 1983 in the *Revised Atlas of Eastern Canadian Seabirds*.

Relative abundance of birds on the open-ocean was important new knowledge in the 1970s. The 10-min watch period initiated by the PIROP system was used in pelagic bird surveys around the world. However, the PIROP technique (line transect) could not provide density estimates, which allow for direct temporal and spatial comparisons of seabird abundances and can also be used as a tool for estimating population levels. However, if a 'strip' of ocean with a known width and length was surveyed, densities of birds at sea could be determined. In the late 1970's, Alaskan researchers confined the 10-min watches to birds observed within a 300-m band of the ship (Gould et al. 1978). The results of this 'Strip Transect' technique allowed birds to be expressed as a number per unit area.

Birds flying through the survey area during a 10-min counting period could cause an overestimate of birds present. A solution to this problem was developed and first used in Alaska by Gould et al. (1978). It involved a series of consecutive instantaneous or 'snapshot' counts over the course of a 10-min transect. The frequency of snapshot counts is determined by the speed of the ship and the linear distance viewed ahead of the ship so that the whole transect length during each 10-min count that is surveyed by snapshot counts. The sum of stationary birds and flying birds on the snapshot counts are used to determine overall densities. The snapshot method was popularized when Tasker et al. (1984) proposed it, in conjunction with the 300-m band strip transect and 10-min counting period, as a standardized method

for surveying birds at sea. The 'Tasker Method' as it is became known, is presently one of the most widely used methods of shipboard observations of seabirds. The method is used by scientific researchers and oil industry monitoring in the North Sea (Komdeur et al. 1992; Camphuysen 2001) and has been incorporated into the PIROP system in Atlantic Canada by CWS.

The original 'Tasker Method' was comprised of two techniques.

180°/90° scan – This technique entails an observer scanning a 180°/90° forward view from the front of the ship. Observers count birds seen at all distances from the ship but only those birds observed first with the unaided eye. Binoculars may be used to aid in identification. Scanning ahead with binoculars may be recommended in concentration areas of difficult-to-see species (murres, puffins, and waterfowl), which are prone to flush off the water too far ahead of an approaching ship to be accurately counted or even detected. A 90° field of view is better for surveying alcids and some waterfowl.

300-m band transect – This technique entails an observer counting birds in a 300-m wide band off one side of the ship, usually the side with the best visibility. Birds on the water and those flying are counted differently:

Birds on the water. All birds on the water within the 300-m band are counted during a 10-min time period.

Birds in Flight. Flying birds are counted separately and using a different method. Ideally, all the flying birds in the whole length of the 300-m band would be counted with one snapshot. However, the distance in which flying birds can be detected ahead of the ship within the transect strip is considered 500 m under good conditions. Therefore, several snapshots are needed to cover the entire distance traveled by the ship in the ten-minute period. The number of counts is dependent on the speed of the ship. For example, if a ship was traveling at eight knots, it will cover 2.5 km in ten minutes (see Table C-1 in Appendix C for other scenarios). If the maximum distance flying birds could be detected was 500 m then five snap-shots counts spaced at two minutes intervals would be required. A snapshot count should be close to instantaneous. Flying birds observed between the snap-shots are not counted.

Since the mid-1980s, the 'Tasker Method' has been the methodological backbone of the European Seabirds At Sea (ESAS) program in which various institutes from countries around the North Sea stored data in a common format and database. Various groups attempted to refine the techniques of the 'Tasker method' (Franeker 1994; Camphuysen and Garthe 2001). Small birds on the water, especially those from *Alcidae* (murres, puffins, Dovekie), are difficult to detect. The 300-m transect width was further divided into bands of 100 m and 200 m (Hunt et al. 1981). Densities of the "difficult-to-detect" birds were derived from the inner bands. However, even these inner bands were not always adequate for detection of all small seabirds on the water. Briggs and Hunt (1981) found that inconspicuous seabirds were not adequately counted at distances beyond 150 m. Also, adding inner bands to the 300-m limit creates a more labour intensive survey. When surveying for species (e.g., loons) prone to diving underwater ahead of the ship, the use of binoculars to scan ahead was introduced (M. Tasker, JNCC, pers. comm.). Other groups have collected information on foraging behaviour and multi-species foraging associations through the addition of a second observer. A detailed account of methods and a coding manual occur in Camphuysen and Garthe (2001). The benefit of recording detailed foraging behaviours is documenting the potential correlations between the presence of seabirds and oceanographic features or other factors related to prey availability. However, this method requires two astute observers with excellent skills in identification.

A summary of different techniques used worldwide is provided in Table 6.

Table 6*. Summary of major methods of shipboard seabird survey used around world.

Original Authors	Location	Type of Survey	Angle of View	Width	Time Period	Flying Birds	Ship Followers	Type of Results	Comments
Brown et al. 1975; Brown 1986	Atlantic Canada, eastern Arctic	Line Transect	90°- 360°	Unlimited	10 min	All included in total	Recorded with other birds	Relative Abundance – birds/linear km	Ship followers inflate totals. Easy to use.
Tasker et al. 1984; Webb and Durinck 1992	Europe	Strip Transect	90°	300 m (with 100 m inner divisions)	10 min	Snapshot counts	Recorded separately	Density – birds/km²	Adjustment for flying birds gives most accurate density.
Tasker et al. 1984; Webb and Durinck 1992	Europe	Line Transect	90°- 180°	Unlimited	10 min	Snapshot counts	Recorded separately	Relative Abundance – birds/linear km	More accurate relative abundance index than Brown et al. 1975. Can be used in conjunction with Strip Transect but labour intensive.
Gould 1983	North Pacific	Strip Transect	90°	300 m	10 min	All included in total	Recorded separately	Density – birds/km²	No adjustment for flying birds inflates densities.
Miller et al. 1980	NW Atlantic	Strip Transect	90°	300 m	15 min	All included in total	Recorded separately	Density – birds/km²	No adjustment for flying birds inflates densities
Spear and Ainley 1992a, 1992b	California	Vector Method	90°	300-600 m	15-30 min	All included in total	Recorded separately	Density (absolute)	Requires two observers.

*modified from Montevecchi et al. (1999)

TABLE 7. Summary of seabird survey methods used in Atlantic Canada.

Company	Location	Type of Survey	Angle of View	Data Type	Time Period	Advantage	Disadvantage	Observer Skills	Computer/ handwritten
OGOP[1]	Nova Scotia: offshore supply ships, seismic ships.	Line Transect[3]	180° Bow	Birds/linear km	3-4 consecutive 10-min counts.	Ease of use	No population density	Moderate to good.	Handwritten, then entered on computer.
CWS[2] Older method	Atlantic Canada	Line Transect	90° - 360°	Birds/linear km	10-min counts	Ease of use	No population density	Moderate to Good	Handwritten, then entered on computer
CWS Newer method	Atlantic Canada	Line Transect	90°	Birds/linear km	10-min counts	Population density	Learning curve	Good	Handwritten, then entered on computer
Weise and Montevecchi 1999	Grand Banks, NL	Strip Transect[4]	90° off one side	Birds/linear km	Continuous	Ease of use	No population density	Moderate to good.	Entered directly into computer or handwritten.

[1]OGOP – Oil and Gas Observer Program
[2]CWS – Canadian Wildlife Service
[3]Strip Transect – survey line with a defined width
[4]Line Transect – survey line with unlimited width

Review of Current Survey Protocols and Consultation Results

Shipboard Observations

Seabird survey techniques used in Atlantic Canada are summarized in Table 7.

Canadian Wildlife Service

The CWS has conducted shipboard surveys on an opportunistic basis throughout Atlantic Canada since 1969 (Brown et al. 1975; Brown 1986). They developed the PIROP method of shipboard observation of seabirds. Key characteristics of this procedure include the line transect technique, with an angle of view 90-360°, unlimited viewing distance, and watch durations of 10 min. This method produces estimates of relative seabird abundance and information on their seasonal distribution but does not provide density estimates. An important aspect of this technique is that it is relatively easy to use.

Since the early 1990s, the CWS has used the 'Tasker Method' for shipboard surveys. The survey area is 300-m wide band at a 90° angle off to one side and front of the boat. Time periods are 10 min in length and may be a series of back-to-back counting periods. All birds on the water within a 300 m survey band are counted but flying birds are counted in a series of snapshot counts over the length of the transect (dictated by the distance the vessel travel in a 10-min time period). The results provide density estimates (number of birds per unit area) as well as indices of relative abundance and seasonal distribution. One of the disadvantages of the Tasker method is that it requires a skilled observer who can identify birds on the wing instantaneously and can juggle two survey techniques – birds on the water and birds in flight, at the same time or separately, all within one ten-minute survey period.

Oil and Gas Observer Program

The Oil and Gas Observer Program (OGOP) in Nova Scotia uses the original PIROP system with a 180° field of view of the front of the ship and unlimited distance away from ship. Survey periods are 10 min in duration. Usually three counts per day are conducted– one early in the morning, one midday and one late in the afternoon. Recently, the three 10-min surveys have been conducted consecutively resulting in one 30-min observation period per day (S. Farwell, OGOP, pers. comm.; T. Lock, CWS, pers. comm.). The results provide information on relative abundance and seasonal distribution of seabirds.

Memorial University of Newfoundland and Labrador

Researchers at Memorial University (MUN) use a modified version of the 'Tasker Method'. Continuous counts are made in a 90° angle covering 300 m off one side and the front of the ship. Position and times of all bird sightings are automatically recorded on computer. However, snapshot counts of birds in flight are not conducted and hence, density estimates are not readily obtained. Presumably, birds per unit area could be extrapolated from the GPS positions and times recorded continuously during the survey route. The results provide information on relative abundance and seasonal distribution of seabirds.

North Sea (Europe)

The common methods used in the North Sea by researchers from the United Kingdom and the Netherlands is the basic 'Tasker Method' and three variations of the 'Tasker Method' (M. Tasker, JNCC, pers. comm.; C. J. Camphuysen, NIOZ, pers. comm.). The three variations of the 'Tasker Method' are: (1) using binoculars to look ahead for birds that disturb easily on the water, (2) the use of distance bands within the 300-m transect to calculate densities, and (3) use of two observers to record foraging behaviour.

Fixed-Installation Observations

Newfoundland

Methods used on the *Henry Goodrich* on the Grand Banks in 2003 were as follows. One of the duties of the weather observer has been to conduct seabird and, recently, marine mammal surveys. Observers typically have conducted three 20-min surveys per day. The surveys have been widely spaced throughout the day taking place in early morning, mid day and late in the day. Surveys were not necessarily conducted from the same part of the platform for the whole 20 min; the observer often walked about in order to broaden the angle of view which was usually 270°. Observations were written on paper and later in the same day entered into a computer and e-mailed to PAL where they were stored in a master database. Observational details of birds were limited to the 20 min total of each species on the water and in flight. Observers used 7x50 binoculars without reticles. Birds were identified to species level whenever possible and information on basic activities such as flying or sitting on the water was recorded (P. White, weather observer, pers. comm.).

Nova Scotia

In Nova Scotia, methods for fixed-platform seabird observations have been similar to the shipboard surveys conducted by OGOP. There are three 10-min counts spread throughout the day: morning, noon and afternoon. Recently this has been changed to combining the survey effort into three consecutive 10-min counts with the count conducted near the same time each day; no limitation on the distance of birds were counted and there has been a variable field of view used for observations. Bird information recorded has been limited to totals of species < 300 m and > 300 m from the platform. Bird activity such as flying, on water or flock size was not recorded.

Europe

At present, there are no systematic seabird surveys conducted from oil platforms in the North Sea (M. Tasker, JNCC, pers. comm.). In the early 1980s, the common method was to record all passing birds in 100-min bouts and rig-associated birds once every 100 min (M. Tasker, JNCC, pers. comm.).

Suggestions from Consulted Individuals

Methods for Shipboard Observations

In Europe, senior seabird researchers want to see the current standardized methods for shipboard observations, data collection and storage in Europe maintained (M. Tasker, JNCC, pers. comm.; C.J. Camphuysen, NOIZ, pers. comm.).

In Atlantic Canada, T. Lock (CWS, pers. comm.) advocates streamlining shipboard methods with the well-established European protocols. Researchers on both sides of the Atlantic agree that seabird observational data would be more useful, with a wider array of applications, if it were collected, tabulated and processed in a common format.

Tony Lock realizes the difficulties of implementing the Tasker Method via observers currently available with limited experience and skills in seabird identification. He advocates getting the best quality data from the observers that are available.

The OGOP method currently in use involves conducting three consecutive 10-min counts in a 180° arc off the bow at an unlimited distance (S. Farwell, OGOP, pers. com.; T. Lock, CWS, pers. comm.). Originally, the three 10-minute counts were spaced throughout the day. The three 10-min counts were

consolidated into three consecutive counts. This was to increase the quality of the observations by allowing time for the observer to get adequately adjusted from their other job to focusing on a seabird survey. T. Lock felt that good data from one area of the ocean were better than poorer data from three places.

Tony Lock now suggests increasing the counts to six consecutive 10-min counts for a total of 60 min of observation time. Adding 30 min for computer data entry, results in a total of 1.5 hours per day that would be required for an individual to devote to bird surveys.

Bill Montevecchi (MUN, pers. comm.) expressed concerned that monitoring of seabirds in relation to the oil and gas industry should be conducted by a group independent of the industry. He thought this would eliminate the potential of results being biased in favour of industry.

Methods for Fixed Platform Observations

Tony Lock (CWS, pers. comm.) thought that seabird data collected from fixed-platforms were important for determining patterns of occurrence, timing of movements and seasonal abundance. Data collected during winter are lacking for offshore areas, partly because rough weather conditions inhibit the ability to collect data from moving ships. Fixed-platforms present a good way to collect data during the winter.

Observer Training

The quality of observers on ships and fixed-installations is an issue of concern for seabird biologists on both sides of the Atlantic. In an effort to create a joint European database of shipboard seabird observations there is a minimum quality standard of observers from which data will be accepted (C.J. Camphuysen, NOIZ, per. comm.). Only data collected by observers trained by European Birds at Sea (ESAS) trainers are accepted. Data are not accepted from observers reading from an instruction book only. Usability of the method (Tasker Method), detection abilities and identification skills have been found to vary greatly between untrained and trained observers. Observer differences have been found to have a significant effect on abundance estimates of seabirds from shipboard surveys (Van der Meer and Camphuysen 1996).

Tony Lock (CWS, pers. comm.) emphasized the importance of observer quality in Atlantic Canada: observers do not necessarily have to be experienced biologists, but could be industry people and others who receive adequate training. Training qualifications should include proper motivation and attitude. Some industry personnel have considered the job of seabird counting little more than a break from their regular job. An upgrade in the general attitude toward the job of counting birds is recommended.

Tony Lock's suggestions for improvement include in-the-field training and/or on-the-job training. Birds like Herring Gull and Northern Fulmar look similar in a text book but have a different manner of flight. A training video would be a good aid in teaching important identification characteristics of seabird behavior that are difficult or impossible to attain from still pictures and written text. T. Lock recognized the fact that no such video exists at present but he thought one could be produced from existing footage from various sources in Europe and North America.

Tony Lock also suggested there are 20-25 species of seabirds in Atlantic Canada that need to be studied for identification purposes for seabird observations in the Northwest Atlantic. T. Lock also identified a need for distance-estimation training. Accurate distance estimation is critical for estimating bird densities from the data. Practice and field testing are necessary to fulfill this requirement.

Urban Williams (Petro-Canada, pers. comm.) thought that an afternoon of classroom training on seabird identification was not sufficient training and that in-the-field training was also needed. He stated that in-the-field training was not feasible on the offshore platforms because of accommodation logistics and work schedules. However, field training from supply ships was logistically feasible because of accommodation availability.

Perry White, a weather observer trained for Provincial Airways Limited (PAL) who currently works on the stationary platform *Henry Goodrich* situated on the Grand Banks, took a seabird identification course (1-2 h in duration) given by K. Knox of Jacques Whitford Environment Limited. Mr. White had some experience with seabirds from working on the rigs and from other boats before he took the course. The course provided assistance, however, he felt that someone with less than his experience might not be prepared to conduct seabird surveys after only a 1-2 h instruction session. A bird identification guide enabled Mr. White to distinguish species like Black-legged Kittiwake and Northern Fulmar and identification of immature gulls.

Baillie (2003) suggested a training course of no less than two weeks which would involve classroom, laboratory and field work. Classroom sessions would use learning aids as field guides to seabirds, video of birds at sea and study skins. Trainees should have in-the-field training sessions with qualified instructors that would act both as instructor and a quality control person.

Data Recording

Baillie (2003) suggested recording observations directly onto computer (handheld palm pilot, data logger, or laptop computer). However, in the event of computer malfunction, paper data sheets must be available for use. Baillie (2003) expressed a concern for quality of data being recorded by observers at oil and gas sites on the Grand Banks of Newfoundland. She reports that relatively simple data (e.g., a survey where no birds were seen but the data sheet was not completed), but nonetheless important data, were sometimes not recorded by oil industry personnel tasked with collecting seabird data. The report (Baillie 2003) stresses the importance of completing all the data fields on a data sheet including environmental conditions, survey times, location etc., including surveys where no birds were observed.

Recommended Survey Protocols

Moving Vessels

Opportunities for shipboard seabird surveys will occur on offshore supply ships and seismic exploration ships. Methods of seabird observations for these ships and any other industry related ships can be adjusted to meet most seagoing vessels traveling at a speed of least four knots.

The quality of seabird observers within the oil and gas industry has been an issue with biologists for some time. Training, both classroom and in-the-field, is an essential step in producing qualified observers. Experience adds immeasurably to overall qualification of an observer. However, it is unlikely that oil and gas industry trained seabird observers will attain the identification expertise of professionally trained and dedicated seabird biologists.

The so-called Tasker Method of recording seabird observations from moving ships has been widely adapted. This is the method used for most shipboard seabird surveys by various countries in the North Sea and by the CWS in Atlantic Canada. The important advantage of the Tasker Method is that birds per unit area, or densities can be calculated from the resulting data. This permits direct comparisons of seabird populations between surveys in any area and at different times of the year.

The Tasker Method requires quick identification of birds in flight without the aid of binoculars. The observer is already taxed by other duties such as keeping track of time for the upcoming snapshot flight counts as well as watching for and recording birds on the water continuously during each ten minute watch period. Given the current observer training regime in place for industry personnel in Atlantic Canada, most of these industry personnel will not attain the identification skill level required to comfortably carry out the full suite of duties involved in the Tasker Method (T. Lock, CWS, pers. comm.; Baillie 2003).

Therefore, it is proposed here that the Standard Method of seabird observations conducted on industry ships consist of a partial Tasker Method. By removing the snapshot count component and keeping the 90° arc view off the bow beam, the method becomes more manageable for observers with average identification skill levels. This will be called **Method 1** in the following sections.

The complete Tasker Method would be of secondary use but used only when qualified observers are available. It will be called **Method 2.** Exceptional oil and gas workers may attain adeptness in seabird identification as well as have an aptitude for involved methodology. As well, professionally trained biologists may be on ships from time to time. The complete Tasker Method is the preferred method of shipboard seabird observations when fully-qualified observers are available.

There should be a minimum of three 20-min counts per day. The three surveys should be spread through the day – morning, mid day and late afternoon. Each of the three 20-min counts should be recorded in two consecutive 10-min watches.

Method 1 (Partial Tasker Method)

180° scan.—A 300-m wide band arcing from the bow beam to 90° off each side of the ship would serve as the survey area. Only birds initially sighted with the unaided eye are counted. Binoculars can be used to confirm identification of birds first spotted by the unaided eye. Binoculars may also be used conducting surveys specifically for alcids (murres, puffins, guillemots), waterfowl, and loons which are prone to flush or dive too far ahead of an approaching ship to be accurately counted or even observed.

Method 2 (Complete Tasker Method)

300-m band strip transect.—Each count is 10 min in duration. The transect area is a 300 m wide band arcing from the bow beam to 90° off one side of the ship. Within the 300-m band, all birds on the water are counted but all the flying birds are not necessarily counted.

Birds in Flight.— Flying birds are counted separately using a different method. Ideally, all the flying birds in the whole length of the 300-m band would be counted with one snapshot. However, the distance in which flying birds can be detected is 500 m under good conditions. Therefore, several snapshots are needed to cover the entire distance travelled by the ship in the 10-min period. The number of counts required is dependent on the speed of the ship. If the ship was traveling at 8 kt, it will travel 2.5 km in 10 min (see Table C-1 for other scenarios). If the maximum distance flying birds could be detected was 500 m, then five snap-shots counts spaced at two-min intervals would be required. A snapshot count should be close to instantaneous. Flying birds observed between the snap-shots are not counted.

Fixed-Installations

Fixed-installations differ from moving vessels in that they are stationary in the water and the birds pass by the platform or are attracted to it. Surveys will be similar to moving vessel surveys in that they will last for 10 min in duration and birds will be recorded using a similar data recording sheet.

In order to maintain consistency, an observation post should be selected from which observations can be conducted daily. An observation view area of at least 180° is required. A wider angle of view is acceptable if it can be duplicated every day. There should be a minimum of three 20-min counts per day. The three surveys should be spread through the day – morning, mid day and late afternoon. Each of the three 20-min counts should be recorded in two consecutive 10-min watches. This will provide an indication of which birds are hanging around the fixed-installation versus how many are flying past. Birds should be recorded as inside or outside a 300-m radius from the fixed-installation. Activities of the bird, such as flying or 'on water' and distance from the platform will be recorded. Some birds, especially gulls are attracted to vessels and may be present throughout the day. There will be space on the data recording sheet to record this observation. Surveys from fixed platforms differ from moving vessels in that all birds in flight as well as on the water within the 300-m survey zone are counted as 'on' survey area. In addition it is recommended that there be one nearly instantaneous count of all birds within the 300-m survey zone at the start of each 10-min watch. This will help determine how many birds had been attracted to and were lingering around the fixed-installation. Any oiled birds observed will be recorded, including species identification and the amount of oiling observed.

In addition to the 10-min seabird watches, a daily early morning check of the vessel for stranded seabirds on the deck should be conducted. Leach's Storm-Petrel are attracted to lights at night and are frequently found on ocean-going vessels in the morning. Often unable to fly, the birds must be rescued in the prescribed method (see Williams and Chardine 1999). A fixed walking route that includes accessible areas on the vessel where Leach's Storm-Petrels have a history of being found should be covered once a day (Davoren et al. 2001). The timing of the walk is important. Most strandings take place at night. Once aboard, the condition of the birds will deteriorate due to dehydration and they may accumulate dirt or machinery oil in their plumage, which could jeopardize the successful release of the bird. Early mornings are highly recommended for stranded-bird searches.

Recommended Training

Identification of seabirds at sea is considered one of the more challenging species groups among experienced birdwatchers. Seabirds at sea are frequently difficult to identify because observations are often distant and brief in duration. Correct identifications require quick reaction that comes only with experience and knowledge. As previously stated, senior seabird biologists on both sides of the Atlantic (Lock in Atlantic Canada and Camphuysen in Europe) expressed that the quality of seabird observers on moving vessels and fixed platforms is an issue of concern.

Seabird identification cannot be mastered in the classroom alone. The dynamics of a bird's movement and general habits at sea are often important aids in their identification. Therefore, it is strongly recommended that a combination of classroom and field work be mandatory in a training course for all seabird observers.

All instruction should be by qualified instructor, i.e., a person with extensive experience in observing seabirds at sea. A qualified instructor should be approved by the CWS or one of the Atlantic universities. Some members of the birdwatching community in Atlantic Canada have extensive experience in observing seabirds at sea in Atlantic Canada and should be considered when seeking qualified instructors.

Classroom instruction should cover the identification of all the regularly occurring seabird species in Atlantic Canada (Table 8). The instruction should be about identification of seabirds *at sea.* A picture of an Atlantic Puffin sitting on a grassy slope next to its nesting burrow is of little help to someone who

Table 8. List of common marine birds in Atlantic Canada recommended for study in an identification training course.

Common Name	Scientific Name
Northern Fulmar	*Fulmarus glacialis*
Cory's Shearwater	*Calonectris diomedea*
Greater Shearwater	*Puffinus gravis*
Sooty Shearwater	*Puffinus griseus*
Manx Shearwater	*Puffinus puffinus*
Wilson's Storm-Petrel	*Oceanites oceanicus*
Leach's Storm-Petrel	*Oceanodroma leucorhoa*
Northern Gannet	*Morus bassanus*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*Phalaropus fulicarius*
Pomarine Jaeger	*Stercorarius pomarinus*
Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Great Skua	*Stercorarius skua*
South Polar Skua	*Stercorarius maccormicki*
Herring Gull	*Larus argentatus*
Iceland Gull	*Larus glaucoides*
Glaucous Gull	*Larus hyperboreus*
Great Black-backed Gull	*Larus marinus*
Black-legged Kittiwake	*Rissa tridactyla*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisea*
Dovekie	*Alle alle*
Common Murre	*Uria aalge*
Thick-billed Murre	*Uria lomvia*
Razorbill	*Alca torda*
Black Guillemot	*Cepphus grylle*
Atlantic Puffin	*Fratercula arctica*

must identify a puffin at sea. Atlantic Puffins on the sea are inconspicuous. The bright bill typically depicted in illustrations fades in winter. The young birds have smaller and even darker bills. On the sea, the pale gray face and compact build help separate winter Atlantic Puffins from the larger murres and smaller Dovekie. In flight, the dark under wings also separate puffins from murres, and the dark face separates puffins from Dovekie. The importance of these types of details is known to those with experience in identification of seabirds *at sea*. The best among the plethora of bird guides presently available in bookstores illustrate these field marks, but it takes someone with experience in interpreting such markings to effectively teach them to others.

Classroom aids should include photographs of birds at sea. At present, there is no collection of the necessary photographs in one location. However, most of the photographs required are in the collections of various bird photographers in Atlantic Canada. The use of these photographs should not be a problem for a nominal fee. The photographs could be incorporated into a PowerPoint presentation. It should include all the regularly seen species in Atlantic Canada showing the identifiable plumages when

important for identification. Examples of the importance of variations in plumage include gulls, where the immature plumages are strikingly different than adults, and the alcids where breeding plumage and winter plumage are significantly different. Shearwaters look the same year-round so only one plumage type requires illustration. However, each shearwater species should be shown on the water and in flight, with viewpoints from above and below.

It is anticipated that good photographs of all plumage types, and of birds in flight and on the water will not be attainable for all species. In conjunction with the recommended PowerPoint presentation there should be a text book in the form of a commercial bird identification guide. This will help compensate for the missing photographs and reinforce information in the PowerPoint presentation.

There are several good bird guides for eastern North America. The quality of seabird illustrations is variable among them. We recommend The Sibley Field Guide to the Birds of Eastern North America, written and illustrated by David Allen Sibley, 2003, and published by Knopf. The cost is ~ $30. The illustrations in this book are good for most seabirds and particularly excellent for alcids. The book would be used in classroom teaching and a copy should be part of the standard kit aboard all vessels with seabird observers. A list of page numbers for the pertinent species could be glued inside the front cover. The book would also be useful for identification of stray land birds that might land aboard the vessel.

In addition to the PowerPoint presentation and the field guide, there should be a manual containing information on seabirds at sea from an Atlantic Canadian perspective. For the regularly occurring species, this would include information on the seasonal and spatial distribution patterns, behaviours and field marks, in addition to information contained in the commercial bird guide.

Classroom training should be spread over three days to allow time for new observers to absorb the volume of new information. Half of one day should be devoted to methodology including filling out the field sheets and entering data on computer. A quiz should be held at the end of each day of classroom to help students and the instructor judge the progress of learning. A test on the last day of the classroom work will help dictate those that will go on to the at-sea phase of the training. The test could be multiple choice with at least 80% of the questions based on identification of seabirds and the rest on methodology. A pass mark of 80% is suggested.

At-sea-training with an instructor should be mandatory. Offshore supply ships are probably the best option (there are indications that fixed-platforms do not have accommodation space for an instructor; U. Williams, Petro-Canada, pers. comm.). At-sea-training should consist of two full days at sea in good viewing conditions. The trainer and trainee shall practice conducting seabird surveys together using the prescribed methods. The trainer and trainee will also take time to practice identifying all seabirds. Distance estimation is also important to practice.

By the end of the two days the trainer will make an informal assessment of observer's abilities in identification of seabirds and to carry out the survey method. Assuming the observer has followed the course in a conscientious manner he/she will pass the course. Within six months the trainee should be tested in the field by a qualified seabird identification expert. Ideally this would happen at sea but this may be impractical. Testing for seabird identification and data sheet entry could take place on a boat cruise around the Witless Bay seabird colony or possibly from Cape Spear.

It is recognized that as observers gain experience their abilities to identify birds will improve. It will be stressed that observers not push the identification to a level beyond their own confidence. An inexperienced observer should be reporting a higher percentage of unidentified murres than an experienced observer. A correct identification is far more valuable than a misidentification at any level.

Other Recommendations for Surveys

It is highly recommended that marine mammal and seabird surveys be conducted separately as both groups require different search images. The three 20 min survey periods for seabirds (and marine mammals) are suggested minimums. Longer survey periods would provide more information if the observer had the available time. An observer may not be able to schedule a survey period during morning, noon and evening because of other duties or poor weather. Adjustments can be made to accommodate the schedule of individual observers.

4. DATA CAPTURE AND MANAGEMENT SYSTEMS

Feasibility of Automatic Data-Capture System for Surveys

In determining the feasibility of an automatic data-capture system for MM and seabird surveys, we relied primarily on the experiences and opinions of individuals consulted for this project. Most consulted individuals thought that using automatic data-capture systems like laptops and hand-held computers was not feasible for observational programs conducted from offshore oil and gas vessels. An automatic data-capture system was not deemed feasible because of restrictive costs—not only in initial purchase price of the laptop/hand-held computer, GPS and software—but in the cost of maintaining the data-capture system. Several consulted individuals, especially those responsible for providing observers (e.g., OGOP) questioned who would pay for such a system. Another limitation of using an automatic data-capture system is that it would not be "weather proof" (although using a weather proof pouch to protect the system may be an option). Observations, especially those conducted from fixed-installations, are often conducted in areas that afford little protection from the elements (P. White, pers. comm.); exposure to precipitation could damage equipment and lead to loss of data. Most consulted individuals expressed that relying solely on an electronic file for initial data storage was risky, they preferred to have a hard copy (paper data sheet) and later key punch the data into a computer. Note that during seabird surveys, which utilized an automatic data-capture system (laptop linked to GPS), some data were lost when the laptop "locked up" (Montevecchi and Burke 2002). Those consulted individuals who thought that an automatic data-capture system was feasible felt that eliminating the need to keypunch data from paper data sheets outweighed the negative aspects of using a laptop/hand-held computer. Also, these individuals noted that data entry systems could be designed to back-up data automatically to an external memory source. Nonetheless, given that an automated data-capture system approach was not deemed feasible by most consulted individuals, we have not outlined hardware and software needs in this report.

Data Management System for Surveys

Opinions were divided amongst consulted individuals over which computer software program should be use for data entry and storage. As already mentioned, some consulted individuals suggested Microsoft Excel because of its ease of use and ready availability while others suggested a database program like Microsoft Access because of its ability to store more records and to perform queries of the data. We recommend that if data are keypunched into a computer by an observer when he or she is in the field, that Microsoft Excel should be used given its ease of use (relative to Access) and availability on most vessel computers. (Microsoft Access is not included with the basic Microsoft package whereas Microsoft Excel is included.) A standardized Excel file for data entry should be developed for each of the data sheets recommended in this report that restricts "out of bound" data codes. Generating these restrictions in Excel is a simple task that involves using the "Data Validation" tool. Restricting the entry

of "out of bound" codes will minimize data entry errors and add to the scientific credibility of the seabird and MM data. These Excel files, which should be sent to the appropriate regulatory organization (DFO, CWS, CNSOPB or CNOPB), could later be imported into a larger database management system like Microsoft Access.

5. SUGGESTIONS FOR DATA ANALYSIS

Suggested Statistics and Reporting Techniques

We suggest that reporting techniques should include information on species occurrence, abundance, and seasonal timing. The amount of survey effort should be clearly documented as well. We recommend that statistics and reporting techniques use the simplest approach when possible; this facilitates a reader's understanding of the results. However, if a more sophisticated statistical approach is required (i.e., for publication in the primary literature), we recommend that individuals with appropriate experience be consulted (i.e., biologists or statisticians). Reporting techniques should include maps, graphs, and tables, with corresponding written explanations. In addition, data collected when industrial activity (e.g., seismic operations) is underway should be analyzed, especially relative to comparable periods without industrial activity. This approach would provide some indication as to whether industrial activities are influencing seabirds and MMs.

Marine Mammals

The lists provided below outline some reporting approaches and statistics (tests indicated with **bold font**) for Periodic and Monitoring Watches. Note that in statistical analyses, it is important to account for variable sighting conditions (sea state and visibility) and numbers of observers. Also, it is likely that data will have to be grouped by whales, dolphins, and seals vs. species to provide adequate sample sizes for analyses.

Periodic Watches/Monitoring Watches

- A summary of survey effort (in km and/or hours) by week or month.
- Total number of MM observed (individuals and sightings) by species.
- Distribution of dolphins, whales, and seals during surveys (map for each group).
- Temporal distribution (e.g., number of sightings per 100 km or number of sightings per hour) of dolphins, whales and seals (graph: by week or by month, depending on total length of surveys). A **Page's L Test** (Page 1963) can be used to detect significant trends in the sighting rates over time.

Monitoring Watches

- A comparison of sighting rates (for each MM group) during periods with and without industrial activity. This can be tested using a **Wilcoxon's matched-pairs signed-ranks test** (Zar 1999).
- A comparison of sighting distances (for each MM group) during periods with and without industrial activity. This can be tested using a **Mann-Whitney U test** (Zar 1999).
- A comparison of sighting distributions (for each MM group) during periods with and without industrial activity. This can be tested using a **Hotelling's two-sample test** (Batschelet 1981).

(The Hotelling's method tests for a difference in location of the centroid of the sighting distribution.)

- Presentation of behaviours (graphical format) noted for MM (by group) during periods with and without industrial activity.

Seabirds

A similar approach for reporting and statistics is recommended for seabirds. The lists provided below outline some reporting approaches and statistics (tests indicated with **bold font**) for bird counts conducted when no industrial activity is occurring and when there is industrial activity. Note that in statistical analyses it is important to account for variable sighting conditions (sea state and visibility) and numbers of observers. Also, it is likely that data will have to be grouped by larger taxonomic units such as shearwaters/fulmars, storm-petrels, alcids, and gulls vs. species to provide adequate sample sizes for analyses.

Bird Count Data during periods of no industrial activity and with industrial activity

- A summary of survey effort (in km and/or hours) by week or month.
- Total number of seabirds observed (individuals and sightings) by species.
- Distribution of shearwaters/fulmars, storm-petrels, alcids, and gulls during surveys (map for each group).
- Temporal distribution (e.g., number of sightings per 100 km or number of sightings per hour) of shearwaters/fulmars, storm-petrels, alcids, and gulls (graph: by week or by month, depending on total length of surveys). A **Page's L Test** (Page 1963) can be used to detect significant trends in the sighting rates over time.

Bird Count Data during periods of industrial activity

- A comparison of sighting rates (for each seabird group) during periods with and without industrial activity. This can be tested using a **Wilcoxon's matched-pairs signed-ranks test** (Zar 1999).
- Presentation of behaviours (graphical format) noted for seabirds (by group) during periods with and without industrial activity.

6. ACKNOWLEDGMENTS

We thank Dave Taylor for his support and advice throughout the production of this report. The experiences and recommendations on seabird and MM survey techniques provided by numerous individuals consulted for this project provided an integral part of the report. We thank those consulted individuals for sharing their expertise and time. Bob Buchanan of LGL reviewed portions of this report and Anne Wright and Ruby Martin helped format and produce the report.

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APPENDICES

APPENDIX A: List of Individuals Consulted

APPENDIX B: Marine Mammal Data Collection Handbook

APPENDIX C: Seabird Data Collection Handbook

APPENDIX D: Beaufort Wind Force Scale

APPENDIX A: List of Individuals Consulted

TABLE A-1. List of individuals and their affiliations consulted for this project.

Individual	Organization	Location
Shauna Baillie	Canadian Wildlife Service	St. John's, NL
Vinicius Barbosa do Carmo	Veritas	Rio de Janeiro, Brazil
Chantelle Burke	Memorial University of Newfoundland and Labrador	St. John's, NL
C. J. (Kees) Camphuysen	Netherlands Institute for Sea Research	Netherlands
John Chardine	Canadian Wildlife Service	Sackville, NB
Sandra Farwell	Oil and Gas Observer Program	Nova Scotia
Kathy Knox	Jacques Whitford Environment	St. John's, NL
Jack Lawson	DFO	St. John's, NL
Anthony Lock	Canadian Wildlife Service	Dartmouth, NS
William A. Montevecchi	Memorial University of Newfoundland and Labrador	St. John's, NL
Dena Murphy	Marathon Canada Petroleum ULC	Halifax, NS
Rob Pitt	Canning and Pitt	St. John's, NL
Greg Robertson	Canadian Wildlife Service	St. John's, NL
Pip Rudkin	Provincial Airlines Ltd.	St. John's, NL
Sean Smith	DFO	St. Andrews, NB
Mark Tasker	JNCC	Aberdeen, United Kingdom
Dave Taylor	D.G. Taylor Inc.	Conception Bay South, NL
Marielle Thillet	EnCana	Halifax, NS
Perry White	Weather Observer on *Henry Goodrich*	Grand Banks, NL
Urban Williams	Petro-Canada	St. John's, NL

APPENDIX B: Marine Mammal Data Collection Handbook

This handbook presents observation instructions for three types of marine mammal observational techniques.

- **Incidental sightings** by individuals who are not conducting a dedicated MM survey
- **Periodic MM surveys** during periods of daylight by trained observers
- **Monitoring MM surveys** during periods of daylight from seismic ships by trained observers

Selecting Viewing Area

A viewing area should be selected from which MMOs conducting dedicated surveys can conduct observations daily. An observation view area of at least 180° should be selected. A wider angle of view is better if it can be duplicated every day. Also, observations should be conducted from an elevated position. Observations from ships are likely best conducted from the bridge or bridge wings. Observations from a fixed-platform should also be conducted from an area with a elevated and wide field of view which is unobstructed by platform structures. If possible, observations should be conducted from the same location for each survey.

Suggested Personal and Survey Equipment for MMOs

Depending on time of year and location within Atlantic Canada, conditions can be cold, windy, and damp or sunny and hot. Observers should bring appropriate clothing. Sunglasses (polarized) or other protective eyewear are recommended since the sun can be very bright when reflected off the water. We recommend that MMOs use 7x50 binoculars, and that MMOs conducting surveys from seismic ships where distance estimation is critical for correctly implementing mitigation procedures (i.e., shutdowns for marine mammals sighted within a safety zone) use 7x50 binoculars with reticle markings. A good marine mammal identification book is also essential to have on board the ship or platform.

General Introduction to Written Data Sheets

All entries on data sheets should be printed. All observers should complete and proofread the datasheets they have used during the same day the data were collected. This should be done **after** the watch is finished, not during the scheduled observation time. Each observer is responsible for his or her entries, so observers should ensure that they are correct and that all required data fields are filled in.

Procedures for Incidental Sightings

Observers

This form is intended for individuals aboard a ship or platform who happen to sight a marine mammal during the course of their regular marine duties, *i.e.*, not during dedicated marine mammal watches. It is particularly aimed at the ship's crew.

Submission of Data Sheets

All completed data sheets should be returned to the captain or first mate who will later submit the forms to the appropriate regulatory body.

Data Coding Instructions

Please complete each section of the "Incidental Marine Mammal Sighting Form". Use a separate form for each marine mammal sighting. The following is a list of each of the types of data that observers will be recording on the paper datasheets during each watch (see Incidental Sighting data sheet at the end of the Data Coding Instructions). Each of the following **boldface and underlined** category names is the label on the paper datasheets, which denote the type of data to be entered. The text following describes how observers will record the data for that category. [*Data sheets should be modified to indicate the appropriate organization and the corresponding address where data sheets should be sent*.]

General Information

VESSEL The name of the ship or platform where observations are conducted.

OBSERVER The name of the individual who sighted the marine mammal.

OBSERVER LOCATION The location of the person who made the sighting, e.g., bridge

DATE Do not use a number for the month and use four-digit number for the year; write it out. Example: 28 June 2004, not 28/06/04.

LOCAL TIME Hour/Minutes indicated using the 24 hour military clock. Example: 7:30 AM = 0730; 7:30 PM = 1930.

Vessel Information

SHIP SPEED Speed in water in knots. If ship or platform is stationary, circle the "*not applicable*" option.

SHIP HEADING Ship's heading provided in compass points. If headed 45 deg., code as NE. If ship or platform is stationary, circle the "*not applicable*" option.

LATITUDE Record in degrees (e.g., 43) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 43° 38.81').

LONGITUDE Record in degrees (e.g., 58) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 58° 35.26').

SHIP'S ACTIVITY Be specific as possible. Some possible options include: transiting, drilling, laying pipe, receiving oil, laying out streamers, retrieving streamers, shooting seismic, ramping up airgun array, anchored, helicopter visit, etc.

Environmental Conditions

BEAUFORT WIND FORCE Based on the Beaufort Scale for wind force (see Appendix D).

WIND DIRECTION In compass points. If wind from 45 deg., code as NE.

VISIBILITY This is an estimate of the greatest distance from the vessel (in km) at which the observer thinks it is possible to see the sea surface. The maximum value is 10. Use this when the visibility is 10 km or greater. Use decimal values for distances less than 1 km. For example, 100 m = 0.1 km. (1 km = 0.54 nmi).

WATER DEPTH Depth of the water in meters. (1 m = 3.28 ft).

WATER TEMPERATURE If available, provide the water temperature in degrees Celsius.

Sightings

SPECIES Identify marine mammals as far as possible – if you cannot identify to species level then use more general names like: unidentified baleen whale, unidentified seal, unidentified toothed whale, dolphin species, etc. Please remember that an incorrect identification to species level is worse than a correct generalization. The marine mammals that occur in Atlantic Canadian waters are listed below.

Seals

Ringed Seal	Bearded Seal	Harp Seal
Grey Seal	Harbour Seal	Hooded Seal
Unidentified Seal		

Baleen Whales

Blue Whale	Minke Whale	Humpback Whale
Fin Whale	Right Whale	Sei Whale
Unidentified Baleen Whale	Unidentified Whale	

Large Toothed Whales [1]

Sperm Whale	Long-Finned Pilot Whale	Beluga	Narwhal
Killer Whale	Northern Bottlenose Whale	Sowerby's Beaked Whale	
Pygmy Sperm Whale	Unidentified Toothed Whale	Unidentified Whale	

Dolphins

Atlantic White-side Dolphin	Bottlenose Dolphin	Risso's Dolphin
Common Dolphin (short-beaked)	Striped Dolphin	White-beaked Dolphin

[1] The long-finned pilot and killer whales belong to the dolphin cetacean family.

Atlantic Spotted Dolphin Unidentified Dolphin

Porpoises
Harbour Porpoise

IDENTIFICATION RELIABILITY This is an assessment of how certain you are that the marine mammal has been correctly identified. Circle the appropriate code: *Positive*, *Probably*, or *Maybe*.

NUMBER OF INDIVIDUALS There are three data fields: (1) a 'best estimate' of the number of individuals of that species seen. If it is difficult to count the number of individuals in a group, then an estimate of the (2) 'minimum' and (3) 'maximum' numbers can be provided. Minimum group size is the greatest number of animals you see at the surface all at once. Maximum group size could be the estimate from the number of surfacings over a five or ten-second period. This period would be long enough to allow a group travelling animals to surface, but not so long that the same MM is counted more than once.

INITIAL DISTANCE FROM VESSEL Distance in metres the marine mammal(s) was first sighted. For a "loosely formed" group of mammals, use the closest individual to the vessel for the distance estimate.

CLOSEST APPROACH DISTANCE The closest distance in metres the marine mammal(s) came to the vessel. For a "loosely formed" group of mammals, use the closest individual to the vessel for the distance estimate.

POSITION AND TRAVEL RELATIVE TO THE SHIP Draw an arrow on the diagram showing where the marine mammal was initially sighted and where it was moving relative to the ship. If the animal(s) frequently changes its direction of travel, circle the option "*Variable Travel Directions*".

BEHAVIOUR Circle one or more appropriate behaviour codes. If no suitable codes are available, add brief description of behaviour. The behaviour options are described below.

Swim Fast This refers to a marine mammal swimming at a fast pace at the surface.

Swim Medium This refers to a marine mammal swimming at a medium-pace at the surface.

Swim Slow This refers to a marine mammals swimming slowly at the surface.

Flipper Slapping When large whales slap their foreflippers against the surface of the water.

Dive A marine mammal dives beneath the surface, no flukes observed.

Dive Showing Flukes A marine mammal dives beneath the surface and flukes are seen.

Spyhopping When a whale or dolphin raises its head vertically out of the water so that its eyes are clear of the surface.

Lobtailing When a whale or dolphin slaps the water surface with its flukes, sometimes repeatedly

Blow When cetacean expels air from its lungs as it surfaces. Visible as cloud of warm, moist air.

Bow Riding When toothed whales or dolphins place themselves immediately ahead of vessel or large whale to experience assisted locomotion provided by the pressure wave.

Feeding Act of gathering food; maybe through e.g., skim or plunge feeding,

Dead A dead marine mammal is observed. Note condition of animal.

Resting When marine mammals are not swimming but are more or less motionless on the surface, in a horizontal position

Porpoising When marine mammals and seals make low, arcing leaps as they travel rapidly near the surface

Breaching Whales or dolphins leaping or jumping clear of the water and "slamming" its body on the surface.

Unknown No behaviour is observed. Applicable if just a sign is observed and not the marine mammal itself, such as ripples on the water surface left by a marine mammal.

Other If none of the behaviour options fit or you simply want to add more behavioural details, describe with a written "comment" in the space provided. For example, this may include a description of diving or feeding behaviour.

Physical Description

Add written description of physical attributes of marine mammal(s) seen. Include descriptions of the size and shape of a **Dorsal Fin**, **Head**, **Blow**, **Body, Beak and also the Colour(s) or Pattern** present on a marine mammal. This should also include any abnormal scarring or the presence of entangled debris (e.g., fishing gear). A sketch of the sighting may also be included in the space provided.

"Incidental" Marine Mammal Sighting Form

* Please circle options in *italics* as appropriate * Please PRINT

Vessel:
Observer:
Observer Location:

Date: _____ (Day) _____ (Month) _____ (Year)
Local Time: [24-h clock]

Vessel Information

Ship Speed (kt): *Not applicable*
Ship's Activity:
Ship Heading (compass pts.): *Not applicable*
Latitude (Deg., Decimal Min):
Longitude (Deg., Decimal Min):

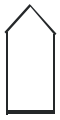
Environmental Conditions

Beaufort Wind Force:
Water Depth (m):
Wind Direction (compass pts.):
Water Temp. (°C):
Visibility (km):

Sightings

Species:
Initial Distance from Vessel (m):
I.D. Reliability: *Positive / Probably / Maybe*
Closest Approach Distance (m):
Number of Individuals: _____ best estimate
_____ minimum _____ maximum

Position & Travel Relative to Ship: [draw arrow]



or
Variable Travel Directions

Behaviour: [circle appropriate code(s)]

Swim Fast	*Swim Medium*	*Swim Slow*	*Flipper Slapping*
Dive	*Dive showing Flukes*	*Spyhopping*	*Lobtailing*
Blow	*Bow Ride*	*Feeding*	*Dead*
Resting	*Porpoising*	*Breaching*	*Unknown*

Other [describe]:

Physical Description of Animal(s): [describe and/or draw]

[indicate size/shape of dorsal fin, head, blow, body, beak and distinctive scars or colour patterns]

* Please return all data sheets to _____. Address_____.

Procedures for Periodic Watches

Observer Qualifications

Observers who conduct these surveys should, as a minimum, have received a standard training course recommended in Chapter 2 of this report. It would be beneficial if observers had field experience as well.

Observation Schedule

Three observational periods, each 20 min in duration (total of 60 min for the day) should be conducted during daylight hours; one watch in the morning, one midday, and one late afternoon. The exact timing of these watches should be dependent on visibility conditions. If for example, foggy conditions prevent a watch during the morning, then two watches could be conducted back-to-back at midday or late in the afternoon. An observer should strive to collect 60 min of data each day.

Submission of Data Sheets

All completed data sheets should be returned to the captain or first mate who will later submit the forms to the appropriate regulatory authority. The observer should be responsible for key punching data sheets into a data entry program like Microsoft Excel. These files should be sent (via email or on a disk) to the appropriate regulatory authority (i.e., DFO or CNSOPB or CNOPB).

Data Coding Instructions

Please complete each section of the "Periodic Watch Marine Mammal Observation Form". This form is intended for trained observers aboard a ship or fixed-installaton who conduct dedicated watches (recommend three 20-min watches per day) for marine mammals on a daily basis. If there is more than one marine mammal sighting during a watch, use an additional form for every marine mammal sighting. If additional forms are used during a watch fill out the Date and all information under the Sightings section. Also, make sure the "Page __ of __ for the Watch" is completed.

The following is a list of each of the types of data that observers will be recording on the paper datasheets during each watch (see Periodic Watch data sheet at the end of the Data Coding Instructions). Each of the following **boldface and underlined** category names is the label on the paper datasheets, which denote the type of data to be entered. The text following describes how observers will record the data for that category. [*Data sheets should be modified to indicate the appropriate organization and the corresponding address where data sheets should be sent*.]

General Information

PAGE __ OF __ FOR THE WATCH If only one form is used for a watch (i.e., either no or only one marine mammal sighting), fill in "Page 1 of 1 for the Watch". If two marine mammal sightings are made during a watch, the first page would be "Page 1 of 2 for the Watch" and the second page would be "Page 2 of 2 for the Watch"; same format for additional sightings.

VESSEL The name of the ship or platform where observations are conducted.

OBSERVER The name of the individual who sighted the marine mammal.

OBSERVER LOCATION The location of the person who made the sighting, e.g., bridge

DATE Do not use a number for the month and use four-digit number for the year; write it out. Example: 28 June 2004, not 28/06/04.

Start Watch Conditions

This information should be recorded at the beginning of each marine mammal watch. It is not necessary to fill this section out for additional forms used for more than one sighting during a watch.

LOCAL TIME Hour/Minutes indicated using the 24 hour military clock. Example: 7:30 AM = 0730; 7:30 PM = 1930.

LATITUDE Record in degrees (e.g., 43) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 43° 38.81').

LONGITUDE Record in degrees (e.g., 58) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 58° 35.26').

BEAUFORT WIND FORCE Based on the Beaufort Scale for wind force, (see Appendix D).

WIND DIRECTION In compass points. If wind from 45 deg., code as NE.

VISIBILITY This is an estimate of the greatest distance from the vessel (in km) at which the observer thinks it is possible to see the sea surface. The maximum value is 10. Use this when the visibility is 10 km or greater. Use decimal values for distances less than 1 km. For example, 100 m = 0.1 km. (1 km = 0.54 nmi).

WATER DEPTH Depth of the water in meters. (1 m = 3.28 ft).

WATER TEMPERATURE If available, provide the water temperature in degrees Celsius.

SHIP SPEED Speed in water in knots. If ship or platform is stationary, circle the "*not applicable*" option.

SHIP HEADING Ship's heading provided in compass points. If headed 45 deg., code as NE. If ship or platform is stationary, circle the "*not applicable*" option.

SHIP'S ACTIVITY Be specific as possible. Some possible options include: transiting, drilling, laying pipe, receiving oil, laying out streamers, retrieving streamers, shooting seismic, ramping up airgun array, anchored, helicopter visit, etc.

End Watch Conditions

This information should be recorded at the end of each marine mammal watch. It is not necessary to fill this section out for additional forms used for more than one sighting during a watch, i.e., End Watch Conditions should be filled out on first Form used during the watch.

LOCAL TIME Hour/Minutes indicated using the 24 hour military clock. Example: 7:30 AM = 0730; 7:30 PM = 1930.

LATITUDE Record in degrees (e.g., 43) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 43° 38.81'). If ship or platform has not moved during the watch, circle the "Same as Start" option.

LONGITUDE Record in degrees (e.g., 58) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 58° 35.26'). If ship or platform has not moved during the watch, circle the "Same as Start" option.

BEAUFORT WIND FORCE Based on the Beaufort Scale for wind force, (see Appendix D). If conditions have not changed during the watch, circle the "Same as Start" option.

WIND DIRECTION In compass points. If wind from 45 deg., code as NE. If conditions have not changed during the watch, circle the "Same as Start" option.

VISIBILITY This is an estimate of the greatest distance from the vessel (in km) at which the observer thinks it is possible to see the sea surface. The maximum value is 10. Use this when the visibility is 10 km or greater. Use decimal values for distances less than 1 km. For example, 100 m = 0.1 km. (1 km = 0.54 nmi). If conditions have not changed during the watch, circle the "Same as Start" option.

WATER DEPTH Depth of the water in meters. (1 m = 3.28 ft). If water depth has not changed during the watch, circle the "Same as Start" option.

WATER TEMPERATURE If available, provide the water temperature in degrees Celsius. If water temperature has not changed during the watch, circle the "Same as Start" option.

SHIP SPEED Speed in water in knots. If ship or platform is stationary, circle the "*not applicable*" option.

SHIP HEADING Ship's heading provided in compass points. If headed 45 deg., code as NE. If ship heading has not changed during the watch, circle the "*not applicable*" option.

SHIP'S ACTIVITY Be specific as possible. Some possible options include: transiting, drilling, laying pipe, receiving oil, laying out streamers, retrieving streamers, shooting seismic, ramping up airgun array, anchored, helicopter visit, etc. If ship activity has not changed during the watch, circle the "*not applicable*" option.

Sightings

SPECIES Identify marine mammals as far as possible – if you cannot identify to species level then use more general names like: unidentified baleen whale, unidentified seal, unidentified toothed whale, dolphin species, etc. Please remember that an incorrect identification to species level is worse than a correct generalization. The marine mammals that occur in Atlantic Canadian waters are listed below.

Seals

Ringed Seal	Bearded Seal	Harp Seal
Grey Seal	Harbour Seal	Hooded Seal
Unidentified Seal		

Baleen Whales

Blue Whale	Minke Whale	Humpback Whale
Fin Whale	Right Whale	Sei Whale
Unidentified Baleen Whale	Unidentified Whale	

Large Toothed Whales [2]

Sperm Whale	Long-Finned Pilot Whale	Beluga	Narwhal
Killer Whale	Northern Bottlenose Whale	Sowerby's Beaked Whale	
Pygmy Sperm Whale	Unidentified Toothed Whale	Unidentified Whale	

Dolphins

Atlantic White-side Dolphin	Bottlenose Dolphin	Risso's Dolphin
Common Dolphin (short-beaked)	Striped Dolphin	White-beaked Dolphin
Atlantic Spotted Dolphin	Unidentified Dolphin	

Porpoises

Harbour Porpoise

[2] The long-finned pilot and killer whales belong to the dolphin cetacean family.

IDENTIFICATION RELIABILITY This is an assessment of how certain you are that the marine mammal has been correctly identified. Circle the appropriate code: *Positive*, *Probably*, or *Maybe*.

LOCAL TIME Hour/Minutes indicated using the 24 hour military clock. Example: 7:30 AM = 0730; 7:30 PM = 1930.

NUMBER OF INDIVIDUALS There are three data fields: (1) a 'best estimate' of the number of individuals of that species seen. If it is difficult to count the number of individuals in a group, then an estimate of the (2) 'minimum' and (3) 'maximum' numbers can be provided. Minimum group size is the greatest number of animals you see at the surface all at once. Maximum group size could be the estimate from the number of surfacings over a five or ten-second period. This period would be long enough to allow a group travelling animals to surface, but not so long that the same MM is counted more than once.

INITIAL DISTANCE FROM VESSEL Distance in metres the marine mammal(s) was first sighted. For a "loosely formed" group of mammals, use the closest individual to the vessel for the distance estimate.

CLOSEST APPROACH DISTANCE The closest distance in metres the marine mammal(s) came to the vessel. For a "loosely formed" group of mammals, use the closest individual to the vessel for the distance estimate.

DURATION OBSERVED IN THE AREA Time you spent observing the marine mammal in minutes.

LATITUDE Record in degrees (e.g., 43) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 43° 38.81') location MM sighted. If ship or platform has not moved during the watch, circle the "Same as Start" option.

LONGITUDE Record in degrees (e.g., 58) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 58° 35.26') location MM sighted. If ship or platform has not moved during the watch, circle the "Same as Start" option.

POSITION AND TRAVEL RELATIVE TO THE SHIP Draw an arrow on the diagram showing where the marine mammal was initially sighted and where it was moving relative to the ship. If the animal(s) frequently changes its direction of travel, circle the option "*Variable Travel Directions*".

BEHAVIOUR Circle one or more appropriate behaviour codes. If no suitable codes are available, add brief description of behaviour. The behaviour options are described below.

Swim Fast This refers to a marine mammal swimming at a fast pace at the surface.

Swim Medium This refers to a marine mammal swimming at a medium-pace at the surface.

Swim Slow This refers to a marine mammals swimming slowly at the surface.

Flipper Slapping When large whales slap their foreflippers against the surface of the water.

Dive A marine mammal dives beneath the surface, no flukes observed.

Dive Showing Flukes A marine mammal dives beneath the surface and flukes are seen.

Spyhopping When a whale or dolphin raises its head vertically out of the water so that its eyes are clear of the surface.

Lobtailing When a whale or dolphin slaps the water surface with its flukes, sometimes repeatedly

Blow When cetacean expels air from its lungs as it surfaces. Visible as cloud of warm, moist air.

Bow Riding When toothed whales or dolphins place themselves immediately ahead of vessel or large whale to experience assisted locomotion provided by the pressure wave.

Feeding Act of gathering food; maybe through e.g., skim or plunge feeding,

Dead A dead marine mammal is observed. Note condition of animal.

Resting When marine mammals are not swimming but are more or less motionless on the surface, in a horizontal position

Porpoising When marine mammals and seals make low, arcing leaps as they travel rapidly near the surface

Breaching Whales or dolphins leaping or jumping clear of the water and "slamming" its body on the surface.

Unknown No behaviour is observed. Applicable if just a sign is observed and not the marine mammal itself, such as ripples on the water surface left by a marine mammal.

Other If none of the behaviour options fit or you simply want to add more behavioural details, describe with a written "comment" in the space provided. For example, this may include a description of diving or feeding behaviour.

Physical Description

Add written description of physical attributes of marine mammal(s) seen. Include descriptions of the size and shape of a **Dorsal Fin**, **Head**, **Blow**, **Body, Beak and also the Colour(s) or Pattern** present on a marine mammal. This should also include any abnormal scarring or the presence of entangled debris (e.g., fishing gear). A sketch of the sighting may also be included in the space provided.

"Periodic Watch" Marine Mammal Observation Form Page of for the watch

* Please circle option(s) in *italics* as appropriate * Please PRINT

Vessel: _____

Observer: _____ **Date:** _____ _____ _____
Day Month Year

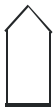
Observer Location:

Start Watch		End Watch	
Local Time [24-h clock]:		**Local Time [24-h clock]:**	
Latitude (Deg., Decimal Min):		**Latitude (Deg., Decimal Min):**	*Same as Start*
Longitude (Deg., Decimal Min):		**Longitude (Deg., Decimal Min):**	*Same as Start*
Beaufort Wind Force:		**Beaufort Wind Force:**	*Same as Start*
Wind Direction (compass pts.):		**Wind Direction (compass pts.):**	*Same as Start*
Visibility (km):		**Visibility (km):**	*Same as Start*
Water Depth (m):		**Water Depth (m):**	*Same as Start*
Water Temp. (°C):		**Water Temp. (°C):**	*Same as Start*
Ship Speed (kt):	*Not applicable*	**Ship Speed (kt):**	*Same as Start*
Ship Heading (compass pts.):	*Not applicable*	**Ship Heading (compass pts.):**	*Same as Start*
Ship's Activity:		**Ship's Activity:**	*Same as Start*

Sightings (use additional copies of this form for each additional marine mammal sighting during a watch)

Species:		**Initial Distance from Vessel (m):**	
I.D. Reliability: *Positive / Probably / Maybe*		**Closest Approach Distance (m):**	
Local Time [24-h clock]:		**Duration Observed in Area (min):**	
Total Number of Individuals:	best estimate	**Latitude (Deg., Decimal Min):**	*Same as Start*
	minimum	**Longitude (Deg., Decimal Min):**	*Same as Start*
	maximum		

Position & Travel Relative to Ship: [draw arrow]



or
Variable Travel Directions

Behaviour: [circle appropriate code(s)]

Swim Fast	*Swim Medium*	*Swim Slow*	*Flipper Slapping*
Dive	*Dive showing Flukes*	*Spyhopping*	*Lobtailing*
Blow	*Bow Ride*	*Feeding*	*Dead*
Resting	*Porpoising*	*Breaching*	*Unknown*

Other [describe]:

Physical Description of Animal(s): [describe and/or draw]

[indicate size/shape of dorsal fin, head, blow, body, beak and distinctive scars or colour patterns]

* Please return all data sheets to _____. Address_____.

Procedures for Monitoring Watches from Seismic Ships

Observer Qualifications

Observers who conduct these surveys should, as a minimum, have received a standard training course recommended in Chapter 2 of this report. For sensitive MM areas and areas where there are few data available for MM, it is recommended that trained biologists conduct observations and implement mitigation measures.

Observation Schedule

The seismic vessel will likely be operating 24 hours per day, and there should be two observers—and they are expected to adopt a "daylight" observing schedule. It is recommended that an observer watch systematically for marine mammals for at least 30 minutes before the airguns start up (during daylight). At least one observer should be required to watch systematically during all hours when the guns are operating during daylight. During periods of reduced visibility (i.e., high sea states and fog) during daylight, MMOs should continue to watch for marine mammals if the vessel is acquiring seismic data.

MMOs should not watch for continuous periods greater than 4 hours. With two observers available, total observation time per day should not exceed 8 hours. The observers can work out an observation schedule that best suits their needs.

Data Coding Instructions for MMOs

The following is a list of each of the types of data that MMOs will be recording on the paper datasheets during each watch (see data sheet at the end of the Data Coding Instructions). The entries from these sheets should be transcribed into a digital database on a computer on the seismic vessel each day. Each of the following **boldface and underlined** category names is the label at the top of the column on the paper datasheets, which denote the type of data to be entered. The text following describes how MMOs will record the data for that category.

VESSEL The name of the ship observations are conducted from.

YEAR Use four digit value.

LICENSE # Obtain this number from the ship or seismic crew. In Newfoundland and Nova Scotia, this is a four-digit Exploration License number, e.g., EL2410.

ARRAY DEPTH This is the depth of the airgun array below the water's surface (not the depth of the sea).

PAGE # Number datasheet pages consecutively from the beginning of the field season.

General Information

DATE Use a number for the month. Example: June = 06.

SEISMIC LINE # Obtain this number from the ship or seismic crew. When the vessel is between lines (i.e., turning) code as "999".

WS or WE **WATCH START** (WS) is the start of an observation session. **WATCH END** (WE) is the end of an observation session. A watch may last for many consecutive hours, and include observations by two observers over several shifts. A WATCH START is **NOT** the start of an individual person's shift, but the beginning of a continuous observation session. A WATCH END signifies that there will be a break in the observations (e.g., MMOs will not be watching for marine mammals for an interval). This can happen when the seismic vessel has to stop shooting due to bad weather, there are problems with the airguns, or when darkness encroaches. Note that when a MMO starts his or her watch when a daylight period begins, they should indicate in the COMMENTS when seismic operations began during the night or how long the airguns have been inactive.

OBSERVER Use 2-letter initials to identify yourself and your partner, if applicable. Example, GM for Gary Miller. The OBSERVER #2 field will be used when there are 2 MMOs observing simultaneously. When one of the MMOs goes "off watch" it is important to record the time as this represents a change in observation effort.

TIME Hour/Minutes/Seconds indicated using the 24 hour military clock. Example: 7:30 AM = 0730; 7:30 PM = 1930. Use either the time on the navigator's computer monitor, or synchronize the digital watch (on the clipboard) with the navigator's clock. Record these as local time.

VESSEL POSITION/HEADING The vessel's position is usually shown on the bridge computer monitor or GPS, and this is the positional data that MMOs will record in the position columns. **LATITUDE** is noted in degrees (e.g., 43) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 43° 38.81'). **LONGITUDE** is also noted in degrees (e.g., 58) and minutes (ranges from 0 to 60. Record to 2 decimal points, example, 58° 35.26'). When a marine mammal is sighted it is more important to observe the mammal than record all positional data - therefore note the time immediately and watch the animal. Ship's **HEADING** provided in compass points. If headed 45 deg., code as NE.

The only time when recording VESSEL POSITION/HEADING is **not** a priority, is when a marine mammal is sighted. It is more important then to implement mitigation measures if necessary and to observe the marine mammal's behaviour, than to watch the navigator's monitor to copy down the vessel's position. Get the vessel's position as soon as you can after sighting a marine mammal. If the animal dives or moves out of the safety zone, then write down the vessel's position, with a note in the comments column as to how long it has been since the initial sighting and the recording of vessel position (it is possible to later back-calculate where the animal was actually seen).

In general, record VESSEL POSITION/HEADING, SEISMIC ACTIVITY, and ENVIRONMENTAL CONDITIONS **for every record** (i.e., every line of the datasheets). Also, **always** record VESSEL POSITION, SEISMIC ACTIVITY, and ENVIRONMENTAL CONDITIONS (1) **every 30 minutes** (**on the hour and half hour**), and (2) **at the start and end of each seismic line**. If an hour or half hour period corresponds closely

to a start or end of line (e.g., within 5 minutes), then it is not necessary to record these data for the hour or half hour interval.

Record any **change** in SEISMIC ACTIVITY or ENVIRONMENTAL CONDITIONS, such as when the airguns are shut down or there is a change in sea state.

Seismic Activity

ACTIVITY These codes allow the MMO to record the type of activity being conducted by the seismic vessel.

RU (Ramp-up) (**remember to code "# GUNS" as 88**). This is the process whereby, after the array of airguns has been shut down, the array is gradually "ramped up" (soft start) slowly over a period of time by firing one airgun first and then adding additional airguns in sequence until the full array is firing. The MMO should receive notice from the seismic crew about when ramp-up began. The MMO probably will not be able to tell when the ramp-up is complete and the full array is firing. The MMO should be notified by the seismic crew when the ramp-up is complete. After ramp-up, the MMO changes "# GUNS" from 88 (during ramp-up) to however many airguns are firing.

LS (Line Shooting) Used when shooting on a production line (versus shooting between lines or seismic testing - see below).

BL (Between Line shooting) Used when some or all airguns continue to fire between the end of one production line and the start of the next.

ST (Seismic Testing) Test-firing the airguns. The firing pattern tends to be irregular and sporadic. For example, there may be several seconds between individual shots, or several shots in succession followed by silence for several seconds.

SZ Airguns shut down because a designated marine mammal species is within the **S**afety **Z**one. There should never be two SZ in sequence; use OT (with appropriate comments) after a SZ for prolonged shutdowns.

SD Airguns shut down for repairs, or between lines (if airguns not firing between lines). Write in a comment after this code to explain why the airguns have been shut down. There should never be two SD in sequence; use OT after a SD for prolonged shut downs.

OT (Other) Use this code for all other seismic activities. For example, when in transit from port to the start of a seismic line. Write in a comment after this code to describe what the "Other" activity is.

 # GUNS The number of airguns in the array that are firing.

88 the "# GUNS" code when ramping up (indicates a changing array size).

99 "# GUNS" unknown. Indicate, if possible, in a following comment", approximately how many guns were firing, e.g., 2-4, 5-8, etc.

ARRAY VOLUME This is the total volume of the airguns firing in the array (usually does not change during production seismic). However, if an airgun is rendered inoperative the array volume will change. The gunners should notify the on-duty MMO(s) what the array volume is. Write **99** if the array volume is unknown.

Environmental Conditions

BEAU. WIND FORCE Based on the Beaufort Scale for wind force, the MMO records the description that best matches the conditions of the sea around the vessel (see Appendix D). If in doubt, check with the Captain or Mate on duty as they also record this information as part of their watch logs.

VISIBILITY This is an estimate of the greatest distance from the source vessel (in kilometers) at which the MMO thinks it is possible to see the sea surface. As the level of light changes at sunset and sunrise, change the "Visibility – # km" to show the greatest distance at which you feel you could see the water's surface clearly. The maximum value is 10. Use this when the visibility is 10 km or greater. Use decimal values for distances less than 1 km. For example, 250 m = 0.25 km; 50 m = 0.05 km. (In case you have to convert a value given by the crew, 1 nautical mile = 1.853 km). When visibility is variable, use the code "99". For example, when going through fog patches where the visibility is changing frequently, code the # km as "99" and follow with a written "comment" where you record the approximate range of visibility, minimum to maximum distances. For example, "patchy fog, visibility 0.05 km to 0.3 km". If in doubt, ask the captain or mate on duty as they must make estimates of visibility for their own hourly watch records.

WATER DEPTH Depth of the water in meters; probably can be acquired from the computer monitor on the ship's bridge.

WATER TEMPERATURE If available, provide the water temperature in degrees Celsius.

In addition to position and seismic status data, for each marine mammal sighting, the following information will be recorded: species, identification reliability, number of individuals seen, behaviour when first sighted, behaviour after initial sighting, heading, bearing, initial distance, and closest approach distance.

Marine Mammal Sightings

SPECIES Identify marine mammals as far as possible – if you cannot identify to species level then use more general classifications like: unidentified baleen whale, unidentified seal, unidentified toothed whale, dolphin species, etc. Please remember that an incorrect identification to species level is worse than a correct generalization. The marine mammals, and their corresponding codes, that occur in Atlantic Canadian waters are listed below.

Seals

RS	Ringed Seal	**BS**	Bearded Seal
GS	Grey Seal	**US**	Unidentified Seal
HBS	Harbour Seal	**HPS**	Harp Seal
HS	Hooded Seal		

Baleen Whales

BW	Blue Whale	**MW**	Minke Whale
FW	Fin Whale	**RW**	Right Whale
SW	Sei Whale	**UBW**	Unidentified Baleen Whale
HW	Humpback Whale	**UW**	Unidentified Whale

Large Toothed Whales [3]

SPW	Sperm Whale	**NBW**	Northern Bottlenose Whale
LFPW	Long-Finned Pilot Whale	**KW**	Killer Whale
WW	White Whale or Beluga	**SBW**	Sowerby's Beaked Whale
NA	Narwhal	**UTW**	Unidentified Toothed Whale
UW	Unidentified Whale		

Dolphins

AWSD	Atlantic White-side Dolphin	**BD**	Bottlenose Dolphin
CD	Common Dolphin (short-beaked)	**SD**	Striped Dolphin
WBD	White-beaked Dolphin	**RD**	Risso's Dolphin
UD	Unidentified Dolphin	**ASD**	Atlantic Spotted Dolphin

Porpoises

HP	Harbour Porpoise

[3] The long-finned pilot and killer whales belong to the dolphin cetacean family.

Always write in a description of every marine mammal observation (a sentence or two), as well as filling in the field codes. Write these comments on the line following and, if necessary, below the coded line (and write a "Y" in the "WITH ABOVE RECORD?" column). For example, "1 grey seal, 1st seen directly ahead of vessel. Seal looked at vessel, then swam hurriedly away towards 3 o'clock for ~20 m with head well out of water, and front dove. Not seen again."

ID RELIAB. (Identification Reliability) This is a MMO's assessment of how certain they are that the marine mammal has been correctly identified. Codes include: **MA**ybe, **PR**obably, and **PO**sitive.

NUMBER The number of individuals of that species seen.

A "Movement" value is assigned to the behaviour type to describe the general direction in which the marine mammal appears to be moving as it performs the behaviour. Animals can be coded as "swimming toward", "swimming away", "swimming parallel", or "fleeing" (a particularly vigorous form of swimming away). Marine mammals that "mill" swim sedately in a limited area with no consistent direction of movement. If it is possible to continue making observations of a marine mammal after the initial sighting, this will be done and recorded in a second line of comments.

MOVEMENT Use these codes to indicate the movement of the marine mammal relative to the seismic vessel. This refers only to movement at the water surface. Do not use these codes to indicate which direction a marine mammal dove in because we do not know if the marine mammal changed direction underwater.

ST Swimming Toward the seismic vessel

SA Swimming Away from the seismic vessel at a relatively "normal" speed. ("Normal" is a subjective estimation. See "Fleeing" below.)

FL Fleeing. When a marine mammal is hurriedly or frantically swimming away from the vessel.

SP Swimming Parallel to the gun vessel. This could be swimming in the same direction as the vessel is travelling, or in the direct opposite direction.

MI Mill. Swimming "leisurely" in a limited area with no consistent direction of movement ("swimming in circles").

NO No movement relative to the vessel. The marine mammal stayed in one place.

UN Unknown. Movement relative to the vessel was not observed.

OT Use this code for all other Movement types. Write in a comment after this code to describe what the "Other" Movement is.

If more than one direction of movement is observed, add subsequent movement codes on following lines. For example, if a marine mammal was 1st seen swimming toward the vessel, then stopped

and swam away, put the code "ST" on the 1st line and "SA" on the next line down. Use "WITH ABOVE RECORD? = Y" to indicate which lines are related to the line above it.

Standardized behaviour categories will be recorded. "Behaviour 1" will be the behaviour of the marine mammal when sighted initially, and "Behaviour 2" is the next behaviour observed subsequently.

For behaviour of marine mammals, the MMO will write out a detailed description of what they observe, including the speed, direction of movement relative to the vessel (clock face) if any, any dives, blows, resurfacings, feeding, etc. As soon as possible, record the vessel's position or ask a crew member to write it down for you. Note the time and length of the observation.

BEHAV #1 The first behaviour type observed.

SI (Sink) When a marine mammal sinks straight back down underwater, hind flippers or fluke first, with an upright posture; usually applies to seals, not whales or dolphins.

FD (Front Dive) A head-first dive, as opposed to sinking hind flippers or fluke first back underwater.

TH (Thrash) A particularly "frantic" or "violent" dive; this is a subjective evaluation.

DI (Dive) Use the 3 more specific codes above when possible.

LO (Look) A marine mammal in an upright posture and **not traveling**, with its head out of the water looking at the source vessel; usually applies to seals, not whales or dolphins. (Movement would be coded "NO" for a marine mammal that only looked.)

SF (Swim Fast) This refers to a marine mammal swimming at a fast-pace at the surface.

SM (Swim Medium) This refers to a marine mammal swimming at a medium-pace at the surface.

SS (Swim Slow) This refers to a marine mammal swimming slowly at the surface.

SW (Swim) Use the 3 more specific codes above when possible.

BH (Breach) Whales or dolphins leaping or jumping clear of the water and "slamming" its body on the surface.

LT (Lobtail) When a cetacean slaps the water surface with its flukes, sometimes repeatedly.

SH (Spyhop) When a cetacean raises its head vertically out of the water so that its eyes are clear of the surface.

FS (Flipper Slap) When large cetaceans slap their foreflippers against the surface of the water.

FE (Feeding) Act of gathering food; maybe through e.g., skim or plunge feeding,

FL (Fluking) When cetacean brings its tail out of the water before a dive.

BL (Blow) When cetacean expels air from its lungs as it surfaces. Visible as cloud of warm, moist air.

BR (Bow Riding) When toothed cetaceans place themselves immediately ahead of vessel or large whale to experience assisted locomotion provided by the pressure wave.

PO (Porpoising) When cetaceans and seals make low, arcing leaps as they travel rapidly near the surface

RA (Rafting) When marine mammals are not swimming but are more or less motionless on the surface, in a horizontal position

WR (Wake Riding) Swimming in the waves or turbulence behind a moving vessel.

DE (Dead) A dead marine mammal is observed. Note condition of animal.

OT (Other) Describe with a written "comment" on the line below or in the "Comments" field.

NO (None) When only marine mammal sign is observed and not the marine mammal itself, such as ripples on the water surface left by a seal; OR under Behav. #2 when there is no 2nd behaviour.

UN Unknown

BEHAV #2 The second behaviour type observed, use the same codes as above. These codes describe whether a marine mammal stayed at the surface or dove, and what it did at the surface or how it dove. If more than 2 behaviour types are observed, subsequent behaviour codes can be added on following lines. For example, a seal might dive then resurface farther away. In that case, you would begin a 2nd line of codes for any observations after the seal resurfaced. Use "WITH ABOVE RECORD = Y" to indicate which new lines are connected to those above.

The marine mammal's direction of movement ("Heading") and initial position relative to the vessel ("Bearing") is recorded by reference to the vessel's heading. Directions relative to the vessel are estimated as hours on a clock face; "1 o'clock", for example, was 30 degrees off the vessel's trackline to the right (starboard).

CLOCK FACE These 2 columns (together with the "**INITIAL DISTANCE**" fields) describe the location of the marine mammal relative to the vessel when the marine mammal was first sighted (**WHERE AT**) and, if it was travelling, in what direction relative to the source vessel (**WHERE TO**). These are described as clock face positions. Example: A marine mammal initially sighted directly ahead of the vessel would be listed as "12" under "WHERE AT". If it was swimming away at 90 degrees starboard from the vessel's track, "WHERE TO" would be listed as 3 (swimming towards 3 o'clock on an imaginary clock face). Record in 1/2 hour increments, if necessary (i.e., 15 degree increments).

WHERE AT Position of marine mammal relative to vessel, in clock face coordinates, when it is first sighted. For example:

12 directly in front of the vessel

1230 15 degrees off the vessel's trackline to starboard

6 directly behind the vessel

3 perpendicular to the vessel's trackline to starboard

99 unknown

WHERE TO Direction of movement of marine mammal relative to vessel, in clock face coordinates, when it is first sighted. For example:

12 travelling in the same direction as the vessel

6 travelling in the opposite direction of the vessel

3 travelling to starboard, 90 degrees off the vessel's trackline

9 travelling to port, 90 degrees off the vessel's trackline

88 not travelling. Use also for "milling" behaviour type.

99 unknown

INITIAL DISTANCE The distance at which the marine mammal was initially sighted. This value is recorded as either the number of reticle markings, as seen through the binoculars (from **0.5** to **14** and MMOs can estimate reticle marks to 1/2 reticles, e.g., 12.5), or distance estimated by eye (write the letter "**E**").

CLOSEST DISTANCE The closest (approach) distance in metres the marine mammal(s) came to the vessel. For a "loosely formed" group of mammals, use the closest individual to the vessel for the distance estimate.

If reticle binoculars are used, the reticle markings are the fine lines that are seen within the field of view when looking through the binoculars. The MMO adjusts the position of the binoculars so that the TOP reticle line appears to rest on the horizon, then counts the reticle lines starting at the top and going down to the location of the marine mammal. The very top line (on the horizon) is counted as "zero". The next line down is considered "one". There are only 14 reticle markings so make sure that the reticle entered in the datasheet is only a number from 0.5 to 14. The reticle value is then compared with the reticle conversion chart where the MMO will get the corresponding pre-calculated distance between the marine mammal and the position of the MMO (in meters).

 # RETICLES OR EYEBALL If the initial distance a marine mammal is sighted is estimated with the "naked" eye code as **E**. If reticle binoculars were used code the number of reticles (usually **0.5 to 14**).

 # METERS Approx. distance to the marine mammal in whole meters (e.g., 50), as measured by the reticle binoculars or estimated by eye.

Remember that the meter value is entered in the second distance column only whether or not the MMO estimated the distance or used the reticle binoculars. In the first distance column the MMO enters **how** they obtained that particular number of meters; the MMO either estimated the distance by eye or obtained it using the reticle binoculars. The distance and bearing to the marine mammal is measured from the vessel's bridge. During observations, MMOs will round distance estimates to the **nearest 10 m**; estimates made using the reticle binoculars will be rounded to **the nearest half reticle**. Due to the nature of the optical system in the reticle binoculars, reticle estimates are more precise for marine mammals sighted closer to the vessel.

WITH ABOVE RECORD? This indicates whether or not a line of comment text line should go with the line preceding it. For example, if this line is a comment line that provides more information about the preceding line, or if this line continues an observation of a marine mammal. Write "**Y**" if this line is related to the line above it, and leave this field **blank** if this line is not related to the line above it.

In addition to recording the code values for each line, as described above, MMOs can include a "comment" line to describe what is happening whenever they feel something might need more explanation. For example: "Leaving Halifax Harbour to head out to seismic area"; or "Guns stopped because of a computer problem". **Always** write in a description of every marine mammal observation, as well as coding it. If you need to extend your comments onto the next blank line, write the comments on the line below the coded line and write a "Y" for Yes in the "With Above Record? column. A summary of all data codes is provided in Appendix E.

Data Editing (Common Mistakes to Watch For and Avoid)

You should check your own work at the end of your watch every day to ensure that it is accurate and that written sequences make sense. For example, an MMO couldn't record an operating airgun array volume (such as LS) followed by a RU (ramp-up) - without a shut down (SD or SZ) in between. In addition, make sure all columns are filled in. If the MMO notes a mistake, and remembers what it was supposed to be, he or she must correct it. If an MMO notes a mistake by an MMO on another shift, it must be brought to their attention as soon as possible in order that they can correct the record.

The initial clock face of WHERE AT denotes where on an imaginary clock the marine mammal would be in relation to the vessel. Once that has been determined, then determine where the animal is heading (WHERE TO).

The volume of the operating airgun array and the number of guns operating are **essential** to estimate what sound levels a newly-sighted marine mammal might have been exposed to. If an MMO sighted a marine mammal within or about to enter the safety radius during seismic operations, and then shut the airguns down, the #GUNS column for the sighting would read "0". But prior to this sighting the #GUNS column would read greater than zero.

Vessel: ____________________ Year: ____________________ License # : ______________ Array Depth (m): ________ Page # ___________

Date		Seis. Line #	WS or WE	Observer(s)		Time			Vessel Position/Heading					Seismic Activity			Environ. Conditions				Marine Mammal Sightings												Comments	With above record?
									Latitude		Longitude		Heading														Clock Face		Initial Distance		Closest Distance			
Day	Month			#1	#2	Hr	Min	Sec	Deg	Min	Deg	Min	Comp. Pts.	Activity	# Guns	Array Volume	Beau. Wind Force	Visib. (km)	Water Depth (m)	Water Temp. (°C)	Species	ID Reliab.	Number	Move-ment	Behav #1	Behav #2	Where At	Where To	# Reticles or Eyeball	# Meters	# Reticles or Eyeball	# Meters		

APPENDIX C: Seabird Data Collection Handbook

Moving Vessels: Methods and Data Sheet Instructions

Timing of Bird Surveys

Surveys should be conducted three times per day at widely spaced intervals: early morning, mid day and late afternoon/evening, during full daylight.

Duration of Surveys

Each survey should be 10 min in duration. The number of 10-min surveys can be changed to meet the needs of the scientific authorities. It is recommended that two consecutive 10-min counts be conducted at each of the three survey times during the day for a total of 60 survey minutes. A separate survey data sheet must be used for each 10-min count. Therefore, a total of 60 survey min would require six survey sheets.

Survey Method

There are two methods. The commonly used method will be the Method 1. This is the most straightforward method suitable for observers of average skill level. Method 2 will be reserved for observers with advanced skill levels.

Method 1 (Partial Tasker Method)

180° scan – A 300-m wide band arcing from the bow beam to 90° off each side of the ship. Only birds observed first with the unaided eye are counted. Binoculars can be used to confirm identification of birds first spotted by the unaided eye. Binoculars may also be used for conducting surveys specifically for alcids (murres, puffins, guillemots), waterfowl and loons which are prone to flush or dive too far ahead of an approaching ship to be accurately counted or even observed at all.

Method 2 (Complete Tasker Method)

300-m band strip transect – Each count is 10 min in duration. The transect area is a 300-m wide band from the bow beam to 90° off one side of the ship. Within the 300-m band, all birds on the water are counted but only flying birds observed during snapshot counts are added.

Ideally, all the flying birds along the entire length of the 300 m wide transect band (the distance the vessel travels in 10 min) would be counted with one instantaneous count. However, the distance in which flying birds can be detected is 500 m under good conditions. Therefore, several snapshots are needed to cover the entire distance traveled by the ship in the 10-min period. The number of counts is dependent on the speed of the ship and visibility. If the ship was traveling at 8 knots the ship will cover 2.5 km in 10 min (see Table C-1). If the maximum distance flying birds could be detected was 500 m then five snap-shots counts spaced at two-min intervals would be required. A snapshot count should be close to instantaneous. Flying birds observed between the snap-shots are not counted in the Method 2 rows but would be added to Method 1 totals.

Record information for Method 2 in the same columns ('Species', 'Number', 'On Water', 'Flying' and 'Age') as is used for Method 1. Insert a check mark in the 'On Transect' column for birds within the 300 m transect band. Method 1 and Method 2 can be conducted simultaneously. The check marks identify which birds were in the Method 2 transect band. Automatically all birds recorded with Method 2 will be also recorded on the Method 1.

TABLE C-1. Number of instantaneous counts of flying birds needed per 10-min count (Method 2-Complete Tasker Method).

Ship Speed (knots)	Maximum distance at which all flying birds can be detected	
	300 m	500 m
4	4	2
5	5	3
6	6	4
7	7	4
8	8	5
9	9	6
10	10	6
11	11	7
12	12	7
13	13	8
14	14	9
15	15	9
16	16	10
17	17	10
18	19	11
19	20	12

Note: enter a new line of data for each bird sighting. Use a second sheet if more space is required.

Data Coding Instructions

The following is a list of each of the types of data that observers will be recording on the paper datasheets during each watch (see data sheet at the end of the Data Coding Instructions). Each of the following **boldface and underlined** category names is the label on the paper datasheets, which denote the type of data to be entered. The text following describes how observers will record the data for that category. [*Data sheets should be modified to indicate the appropriate organization and the corresponding address where data sheets should be sent*.]

VESSEL Name of vessel

VESSEL ACTIVITY Insert number indicating actions of vessel steaming from one point to another, seismic exploration and other.

1 – steaming
2 – seismic work
3 – other (describe)

SURVEY METHOD Circle Method 1 or Method 2 or both. Method 2 is often used at the same time as Method 1.

Method 1 – 180° scan off the bow of the vessel.
Method 2 – 300 m transect band with snapshot counts for birds in flight.

OBSERVER Two initials of observer.

OBSERVER POSITION This is the position on the vessel where the observer is observing from and angle of view in survey zone. Fill in appropriate number.

1 – Bow 180° forward
2 – Bow 90° Port (from bow beam of vessel to 90° perpendicular on port side)
3 – Bow 90° Starboard (from bow beam of vessel to 90° perpendicular on starboard side)
4 – other

START TIME Use Coordinated Universal Time (UTC) for all times. Use two digit numbers

Hour – two digit number, e.g. 00,01,02….10,11,12
Minute – two digit number, e.g. 00,01,02….10,11,12
Second – two digit number, e.g. 00,01,02….10,11,12

LATITUDE Latitude of vessel at Start Time. Recorded in degrees and minutes (0-60) and to two decimal points (e.g. 49° 01.43').

LONGITUDE Longitude of vessel at Start Time. Recorded in degrees and minutes (0-60) and to two decimal points (e.g. 51° 43.01)

DAY The day of the month expressed as a two digit number (e.g., 05 for 5th day of the month)

MONTH The month of the year expressed as a two digit number (e.g., 05 for May)

YEAR The year expressed as a four digit number (e.g., 2005)

AIR TEMPERATURE The temperature of the air in degrees Celsius. (°C)

WIND SPEED Wind speed on Beaufort scale. Enter a number from the Beaufort Scale corresponding to the wind speed in knots.

Beaufort Wind Force	Wind Speed (Knots)
0	<1
1	1-3
2	4-6
3	7-10
4	11-16
5	17-21
6	22-27
7	28-33
8	34-40
9	41-47
10	48-55
11	56-63

WIND DIRECTION Enter wind direction in degrees on the compass (e.g., 180° = south).

CLOUD COVER The percent of sky covered in cloud at start of survey to the nearest 10%.

SEA STATE Enter a number from the Sea State Scale corresponding to the wave height in metres.

Sea State	Wave Height (m)
0	0
1	0.1
2	0.1-0.5
3	0.5-1.2
4	1.2-2.4
5	2.4-4
6	4-6
7	6-9
8	9-14

VISIBILITY Enter a value from 0-10 indicating the number of km visible from the observers position. If <1 estimate in metres to nearest 100 m (e.g. 0.5 = 500 m). If visibility is clear to the horizon enter 10.

GLARE AMOUNT A measure of the amount of glare in the field of view being surveyed.

NO	No appreciable glare
LI	Little glare, not a hindrance to seeing birds
MO	Moderate glare causing moderate viewing problems in part or all of viewing zone.
SE	Severe glare seriously affecting viewing area.

GLARE POSITION The position of the glare as described on a clock face with the bow/stern axis being 12 o'clock and 6 o'clock respectively.

WATER DEPTH Depth in metres if information is available.

WATER TEMPERATURE Temperature (°C) of water if the information is available.

SPECIES Use the United States Fish and Wildlife Service (USFWS) Bird Banding Laboratory (BBL) four letter code (e.g. Northern Fulmar = NOFU). See list of most common birds in Table C-2. If the name does not appear in the list then write out the full name.

NUMBER The number of a species seen at one time. One line per sighting, i.e. there could be several sightings for one species in a ten minute count period.

ON WATER The number of birds on the water during a particular sighting. Leave blank if not applicable. Example: a simultaneous sighting of three birds, two on the water and one flying would require inserting a '3' under the heading **Number**, '2' under the heading **On Water** and a '1' under the heading **Flying**.

FLYING The number of birds flying during a sighting. Leave blank if none.

TABLE C-2. List of seabirds expected to be sighted in the northwest Atlantic and the four letter codes used by the USFWS Bird Banding Laboratory (BBL). The most regularly encountered seabirds are boldfaced.

Common Name	BBL Code	Common Name	BBL Code	Common Name	BBL Code
Red-throated Loon	RTLO	Common Goldeneye	COGO	**gull sp.**	**GULL**
Common Loon	COLO	Bufflehead	BUFF	Caspian Tern	CATE
loon sp.	LOON	Red-breasted Merganser	RBME	**Common Tern**	**COTE**
Horned Grebe	HOGR	duck sp.	DUCK	**Arctic Tern**	**ARTE**
Red-necked Grebe	RNGR	**Red-necked Phalarope**	**RNPH**	Roseate Tern	ROTE
Northern Fulmar	**NOFU**	**Red Phalarope**	**REPH**	tern sp.	TERN
Cory's Shearwater	**COSH**	**phalarope sp.**	**PHAL**	**Dovekie**	**DOVE**
Greater Shearwater	**GRSH**	shorebird sp.	SHOR	**Common Murre**	**COMU**
Sooty Shearwater	**SOSH**	**Pomarine Jaeger**	**POJA**	**Thick-billed Murre**	**TBMU**
Manx Shearwater	**MASH**	**Parasitic Jaeger**	**PAJA**	**murre sp.**	**MURR**
shearwater sp.	**SHEA**	**Long-tailed Jaeger**	**LTJA**	**Razorbill**	**RAZO**
Wilson's Storm-Petrel	**WISP**	**jaeger sp.**	**JAEG**	**Razorbill/murre sp.**	**RAMU**
Leach's Storm-Petrel	**LHSP**	**Great Skua**	**GRSK**	**Black Guillemot**	**BLGU**
storm-petrel sp.	**STOR**	**South Polar Skua**	**SPSK**	**Atlantic Puffin**	**ATPU**
Northern Gannet	**NOGA**	**skua sp.**	**SKUA**	**alcid sp.**	**ALCI**
Great Cormorant	GRCO	Laughing Gull	LAGU		
Double-crested Cormorant	DCCO	Black-headed Gull	BHGU		
cormorant sp.	CORM	Bonaparte's Gull	BOGU		
Common Eider	COEI	Ring-billed Gull	RBGU		
King Eider	KIEI	**Herring Gull**	**HERG**		
eider sp.	EIDE	**Iceland Gull**	**ICGU**		
Harlequin Duck	HARD	Lesser Black-backed Gull	LBBG		
Long-tailed Duck	LTDU	**Glaucous Gull**	**GLGU**		
Black Scoter	BLSC	**Great Black-backed Gull**	**GBBG**		
Surf Scoter	SUSC	**Black-legged Kittiwake**	**BLKI**		
White-winged Scoter	WWSC	Sabine's Gull	SAGU		
scoter sp.	SCOT	Ivory Gull	IVGU		

FLIGHT DIRECTION Record the direction in *degrees* that a bird is flying when first sighted. Leave blank if not applicable.

Compass Degree (°)	Compass Direction
0	N
45	NE
90	E
135	SE
180	S
225	SW
270	W
315	NW

Exceptions

00 A bird wandering or flight direction indeterminate.

01 A bird flying with vessel, e.g. a gull riding updraft created by vessel, or a bird following vessel that flies within survey area.

02 Kleptoparasitism. A bird chasing another bird in attempt to steal food. Usually jaegers and skuas.

AGE Record age if known. Leave blank if unknown or not sure.

AD	Adult
IM	Immature, or sub adult but not juvenile
JV	Juvenile. Flightless young, e.g. murre chicks swimming at sea with parent in late summer.

<300 M Check mark if < 300 m from vessel.

>300 M Check mark if > 300 m from vessel.

COMMENTS Comment of interest not already recorded in the main table, e.g. juvenile murre with parent, colour morph of jaeger, feeding activity, oiled bird, association with marine mammal and fishing boat in area attracting birds.

Fixed Installations: Methods and Data Sheet Instructions

Timing of Bird Surveys

Surveys should be conducted three times per day at widely spaced intervals: early morning, mid day and late afternoon/evening, during full daylight.

Duration of Surveys

Each survey should be 10 min in duration. The number of 10-min surveys can be changed to meet the needs of the scientific authorities. It is recommended that two consecutive 10-min counts be conducted at each of the three survey times during the day for a total of 60 survey minutes. A separate survey data sheet must be used for each 10-min count. Therefore, a total of 60 survey min would require six survey sheets.

Survey Method

An observation post should be selected from which observations can be conducted daily. An observation view area of at least 180° is required. A wider angle of view is acceptable if it can be duplicated every day. Birds will be recorded as inside or outside 300 m from the fixed-installation. Activity of the bird such as flying or on water and relation to the vessel will be recorded. Some birds, especially gulls are attracted to vessels and may be present throughout the day. There will be space on the data sheet to record this information. Any oiled birds observed will be recorded by species and amount of oiling.

Note: enter a new line of data for each bird sighting. Use a second sheet if more space is required.

Data Coding Instructions

The following is a list of each of the types of data that observers will be recording on the paper datasheets during each watch (see data sheet at the end of the Data Coding Instructions). Each of the following **boldface and underlined** category names is the label on the paper datasheets, which denote the type of data to be entered. The text following describes how observers will record the data for that category. [*Data sheets should be modified to indicate the appropriate organization and the corresponding address where data sheets should be sent.*]

Vessel:_____	Ship Activity:_____	Survey Method: ~~1~~ ~~2~~	Observer:_____ Observer Position:_____ Page:___/___
Day_____ Month_____ Year_____		Weather: Temp (°C)_____ Wind (kt)_____Direction_____ Cloud (%)_____	
Visibility_____ Glare_____ Glare Position_____ Water Depth (m)_____ Water Temp (°C)_____ Sea State_____			
Position(deg/minutes)_____°_____._____' N, _____°_____._____' W		Start Time: Hour_____ Minute_____ Sec._____	

Method 1 (180°)									**Method 2 (Snapshot)**
Species	Number	On Water	Flying	Flying (dir)	Age/sex	< 300 m	> 300 m	Comments	On Transect

* Please return all data sheets to _____. Address_____.

VESSEL Name of vessel

VESSEL ACTIVITY Insert number indicating actions of vessel steaming from one point to another, seismic exploration and other.

1 – steaming
2 – seismic work
3 – other (describe)

VESSEL LOCATION Latitude of vessel at Start Time. Recorded in degrees and minutes (0-60) and to two decimal points (e.g. 49° 01.43').

DATE Day, month and year expressed in two digit numbers, e.g. 05/06/04 = 5 June 2004.

START TIME Use Coordinated Universal Time (UTC) for all times. Use two digit numbers

Hour – two digit number, e.g. 00,01,02….10,11,12
Minute – two digit number, e.g. 00,01,02….10,11,12
Second – two digit number, e.g. 00,01,02….10,11,12

OBSERVER Two initials of observer.

ANGLE OF VIEW The observer's angle of view. Should be minimum of 180°.

WIND SPEED Wind speed on Beaufort scale. Enter a number from the Beaufort Scale corresponding to the wind speed in knots.

Beaufort Wind Force	Wind Speed (Knots)
0	<1
1	1-3
2	4-6
3	7-10
4	11-16
5	17-21
6	22-27
7	28-33
8	34-40
9	41-47
10	48-55
11	56-63

WIND DIRECTION Enter wind direction in degrees on the compass (e.g. 180° = south).

SEA STATE Enter a number from the Sea State Scale corresponding to the wave height in metres.

Sea State	Wave Height (m)
0	0
1	0.1
2	0.1-0.5
3	0.5-1.2
4	1.2-2.4
5	2.4-4
6	4-6
7	6-9
8	9-14

VISIBILITY Enter a value from 0-10 indicating the number of km visible from the observers position. If <1 estimate in metres to nearest 100 m (e.g. 0.5 = 500 m). If visibility is clear to the horizon enter 10.

GLARE AMOUNT A measure of the amount of glare in the field of view being surveyed.

NO No appreciable glare
LI Little glare, not a hindrance to seeing birds
MO Moderate glare causing moderate viewing problems in part or all of viewing zone.
SE Severe glare seriously affecting viewing area.

GLARE POSITION The position of the glare as described on a clock face with the bow/stern axis being 12 o'clock and 6 o'clock respectively.

SPECIES Use the United States Fish and Wildlife Service (USFWS) Bird Banding Laboratory (BBL) (e.g. Northern Fulmar = NOFU). See list of most common birds in Table C-2. If the name does not appear in the list then write out the full name.

NUMBER The number of a species seen at one time. One line per sighting, i.e. there could be several sightings for one species in a ten minute count period.

ON WATER The number of birds on the water during a particular sighting. Leave blank if not applicable. Example: a simultaneous sighting of three birds, two on the water and one flying would require inserting a '3' under the heading **Number**, '2' under the heading **On Water** and a '1' under the heading **Flying**.

FLYING The number of birds flying during a sighting. Leave blank if none.

FLIGHT DIRECTION Record the direction in *degrees* that a bird is flying when first sighted. Leave blank if not applicable.

Compass Degree (°)	Compass Direction
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45	NE
90	E

135	SE
180	S
225	SW
270	W
315	NW

Exceptions

00 A bird wandering or flight direction indeterminate.

01 A bird flying with vessel, e.g. a gull riding updraft created by vessel, or a bird following vessel that flies within survey area.

02 Kleptoparasitism. A bird chasing another bird in attempt to steal food. Usually jaegers and skuas.

AGE Record age if known. Leave blank if unknown or not sure.

AD	Adult
IM	Immature, or sub adult but not juvenile
JV	Juvenile. Flightless young, e.g. murre chicks swimming at sea with parent in late summer.

<300 m Check mark if < 300 m from vessel.

>300 m Check mark if > 300 m from vessel.

COMMENTS Comment of interest not already recorded in the main table, e.g., juvenile murre with parent, colour morph of jaeger, feeding activity, oiled bird, association with marine mammal and fishing boat in area attracting birds.

APPENDIX D: Beaufort Wind Force Scale

Interrelationships of Wind Speed, Beaufort Wind Force, Sea State, and Wave Heights on the Open Sea

Wind Speed		Beaufort Wind Force	World Meteorological Organization Terms	Sea State	Wave Height (m)	Description
Knots	m/s					
<1	<0.5	**0**	Calm	**0**	0	Glassy
1-3	0.5-1.5	**1**	Light air	**0.5**	<0.1	Ripples
4-6	2.1-3.1	**2**	Light breeze	**1**	0-0.1	Small wavelets
7-10	3.6-5.1	**3**	Gentle breeze	**2**	0.1-0.5	Smooth wavelets
11-16	5.7-8.2	**4**	Moderate breeze	**3**	0.5-1.2	Slight; small wavecaps
17-21	8.7-10.8	**5**	Fresh breeze	**4**	1.2-2.4	Moderate waves, some spray
22-27	11.3-13.9	**6**	Strong breeze	**5**	2.4-4	Rough, larger waves
28-33	14.4-17.0	**7**	Near gale	**6**	4-6	Very rough
34-40	17.5-20.6	**8**	Gale	**6**		
41-47	21.1-24.2	**9**	Strong gale	**6**		
48-55	24.7-28.3	**10**	Storm	**7**	6-9	High
56-63	28.8-32.4	**11**	Violent storm	**8**	9-14	Very high

From Richardson et al. (1995).