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Guidance and Protocols for Wildlife Surveys for Emergency Response

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Abstract

Environment and Climate Change Canada's Canadian Wildlife Service (ECCC-CWS) is responsible for the management and conservation of Wildlife under its jurisdiction. The *Guidance and protocols for Wildlife surveys for emergency response* outlines the rationale, objectives, and protocols to conduct surveys to gather information on Wildlife and their habitats that have been, or have the potential to be, impacted by Pollution or Non-Pollution Incidents. This document supports the standardization of the planning process according to ECCC-CWS's recommendations. The purpose of this document is to guide governments, Indigenous organizations, industry, Response Organizations, and other stakeholders in the design and implementation of surveys that consider all aspects of planning throughout the full life cycle of an incident with regards to Wildlife specific to ECCC-CWS's mandate.

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List of Acronyms

CWHC	Canadian Wildlife Health Co-operative
CWS	Canadian Wildlife Service
ECCC	Environment and Climate Change Canada
ECCC-CWS	Environment and Climate Change Canada's Canadian Wildlife Service
ICS	Incident Command System
RP	Responsible Party
SARA	*Species at Risk Act, 2002*
SCAT	Shoreline Cleanup and Assessment Technique
WRP	Wildlife Response Plan

Definitions

Chain of Custody: A written record for a legal sample documenting the continuity by tracing the possession of the sample from the point of collection through introduction into evidence.

CWS Co-ordinator: A person who leads and implements regional Wildlife emergency preparedness and response on behalf of ECCC-CWS and represents ECCC-CWS's policies and interests when liaising and integrating with other federal and provincial/territorial government departments, Indigenous governments and Indigenous organizations, and stakeholders involved in the response during Wildlife Emergencies. CWS Co-ordinators may also fulfill some of the on-site roles of responder.

CWS Responder: Emergency response personnel that provide on-site support on behalf of ECCC-CWS, as directed by the CWS Co-ordinator, during Wildlife Emergencies.

Environmental Emergency: Any uncontrolled or unexpected incident involving the release (or the likelihood thereof) of a polluting substance into the environment that results or may result in an immediate or long-term harmful effect on the environment, or constitutes or may constitute a danger to human life or health. It may be caused by an industrial activity, natural emergency or by a wilful act.

Incident Command: Responsible for overall management of the incident and consists of the Incident Commander, either single or unified command, and any assigned supporting staff.

Incident Commander: The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and release of resources. The Incident Commander has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.

Lead Agency: The governmental authority that regulates or has legislative authority over the responsible parties' response and is responsible for overseeing the appropriateness of the response.

Migratory Bird: As defined in the *Migratory Birds Convention Act, 1994*, a Migratory Bird referred to in the Convention, and includes the sperm, eggs, embryos, tissue cultures and parts of the bird of species listed under Article 1 of the Convention (Government of Canada 2017).

National Environmental Emergencies Centre (NEEC): Environment and Climate Change Canada's 24/7 focal point for pollution-related emergencies, providing technical/scientific advice, assistance and coordination to the Lead Agency, as well as management of an incident when required.

National Wildlife Area: A protected area created under the *Canada Wildlife Act* that contains nationally significant habitats for plants and animals and that is managed for the purposes of wildlife conservation, research and interpretation.

Non-Pollution Incident: An uncontrolled or unexpected Wildlife injury or mortality event other than a Pollution Incident.

Pollution Incident: The release or deposit of a substance that is harmful to Wildlife into an area or waters that are frequented by Wildlife or into a place from which the harmful substance may enter an area or waters frequented by Wildlife.

Response Organization: Any qualified person or organization that has been certified and designated by the Minister of Transport to carry out emergency response activities (as per the revised *Canada Shipping Act* (2001)). In Canada, there are four Response Organizations as follows: Atlantic Emergency Response Team, Eastern Canada Response Corporation Ltd., Western Canada Marine Response Corporation, and Point Tupper Marine Services Ltd.

Responsible Party: Any person or organization who might be responsible for the source or cause of an environmental emergency and/or a Wildlife Emergency.

SARA-listed Species: A wildlife species listed on the List of Wildlife Species at Risk set out in Schedule 1 of the *Species at Risk Act* (SARA).

Species at Risk: As defined in the *Species at Risk Act* (S.C. 2002, c.29), means an Extirpated, Endangered or Threatened species, or a species of Special Concern.

Unified Command: An application of the Incident Command System, used when there is more than one agency with incident jurisdiction or when incidents cross political jurisdictions. Agencies work together through the designated members of the Unified Command to establish a common set of objectives and strategies and a single Incident Action Plan.

Wildlife: In this document, "Wildlife" is used to refer to the terms Migratory Birds as defined under the *Migratory Birds Convention Act,* and listed Species at Risk as those terms are defined under the *Species at Risk Act* for species falling within the jurisdiction of the Minister of Environment and Climate Change (with the exception of individuals of SARA-listed Species that are located on lands administered by Parks Canada). This term also refers to all wild species occurring in the National Wildlife Areas set out on Schedule I of the *Wildlife Area Regulations* (C.R.C., c. 1609).

Wildlife Emergency: A Pollution or Non-Pollution Incident that results or may result in an immediate and/or long-term harmful effect on the life or health of Wildlife and/or their habitat.

Wildlife Response Organization: Organizations that provide expertise, capabilities and trained personnel to undertake one or several aspects of response, including planning, implementation and reporting of activities related to Wildlife Emergencies. Wildlife Response Organizations (or representatives thereof) are authorized under applicable federal, provincial, and/or territorial legislation to capture, transport, clean, rehabilitate, euthanize, and release Wildlife.

Wildlife Response Plan: A document that outlines the initial and ongoing Wildlife-related strategies that are needed to support any Wildlife response objectives that may occur at the onset of a Pollution or Non-Pollution Incident.

1.0 Introduction

Environment and Climate Change Canada's Canadian Wildlife Service (ECCC-CWS) oversees and/or leads Wildlife Emergency response activities in association with Environment and Climate Change Canada (ECCC)'s responsibilities under the *Migratory Birds Convention Act, 1994*, and its regulations (*Migratory Birds Regulations* and *Migratory Bird Sanctuary Regulations*), the *Species at Risk Act, 2002* (SARA), the *Canada Wildlife Act, 1985*, and the *Wildlife Area Regulations*. Through these pieces of legislation, ECCC-CWS is responsible for management and conservation of all Migratory Birds and Species at Risk under its jurisdiction (hereafter "Wildlife") and how they are managed during a Pollution or Non-Pollution Incident. The *Canada Wildlife Act* and *Wildlife Area Regulations* broaden the responsibility of ECCC-CWS to include habitats and all wild species within designated National Wildlife Areas. Refer to the *Guidelines for Wildlife Response Plans* (ECCC-CWS, 2022a) for further details on species under ECCC jurisdiction.

During an incident affecting Wildlife, ECCC-CWS has the responsibility for regulating activities that involve the handling or disturbing of Wildlife under its jurisdiction, providing scientific advice on populations, and setting Wildlife emergency response standards, guidelines, and priorities for the Lead Agency and Responsible Party (RP) during an emergency response.

This document provides technical guidance and protocols to guide how ECCC-CWS recommends surveys be conducted during Pollution or Non-Pollution Incidents. Where this document refers to birds, it should be assumed that guidance is specific to Migratory Birds under ECCC's jurisdiction, and additional guidance should be sought from other federal, provincial, territorial and Indigenous governments or agencies for non-Migratory Birds, where applicable. Although ECCC-CWS's definition of Wildlife includes Species at Risk other than birds (e.g., mammals, amphibians), the survey methods of this document focus solely on birds (including those listed under SARA). However, in the case of carcass collection, all Wildlife species are considered. This document sets the standards to be used by ECCC-CWS personnel but serves also as a guidance for other agencies and the RP involved in an emergency response. During major or complex incidents, the planning and implementation of these surveys should be put in context with the development of a Wildlife Response Plan (WRP) as described in the *Guidelines for Wildlife Response Plans* (ECCC-CWS 2022a). While this document emphasizes approaches for response in marine environments, the concepts and some of the techniques may be applicable to emergency response in freshwater and terrestrial environments. The aim of this document is to ensure consistency in national approaches for surveys, data collection during an emergency response, and the nature and detail of information required to assess damage incurred on Wildlife populations. These methods may be applicable to pre-spill surveys for preparedness planning in high-risk areas or sensitive habitats, but details are not covered in this document.

1.1 Objectives of Wildlife Surveys

When ECCC-CWS receives a notification of an incident involving Wildlife, the first priority is to gather existing information on what Wildlife species are potentially at risk of being affected in the area and to compile available information regarding affected species (e.g., query of existing databases, reports of location of affected species, list of species; see Figure 1). Information collected during surveys will serve to:

- identify and quantify Wildlife species and their habitats known or potentially at risk of being affected by the incident
- help direct appropriate response strategies and actions to minimize further damage to Wildlife or their habitat (i.e., deterring non-affected individuals from impacted areas)
- facilitate the removal of affected individuals **if** this will minimize further damage or support appropriate response strategies (e.g., for the treatment of contaminated Wildlife)
- conduct post-incident damage assessments on populations and their habitat (Figure 1)

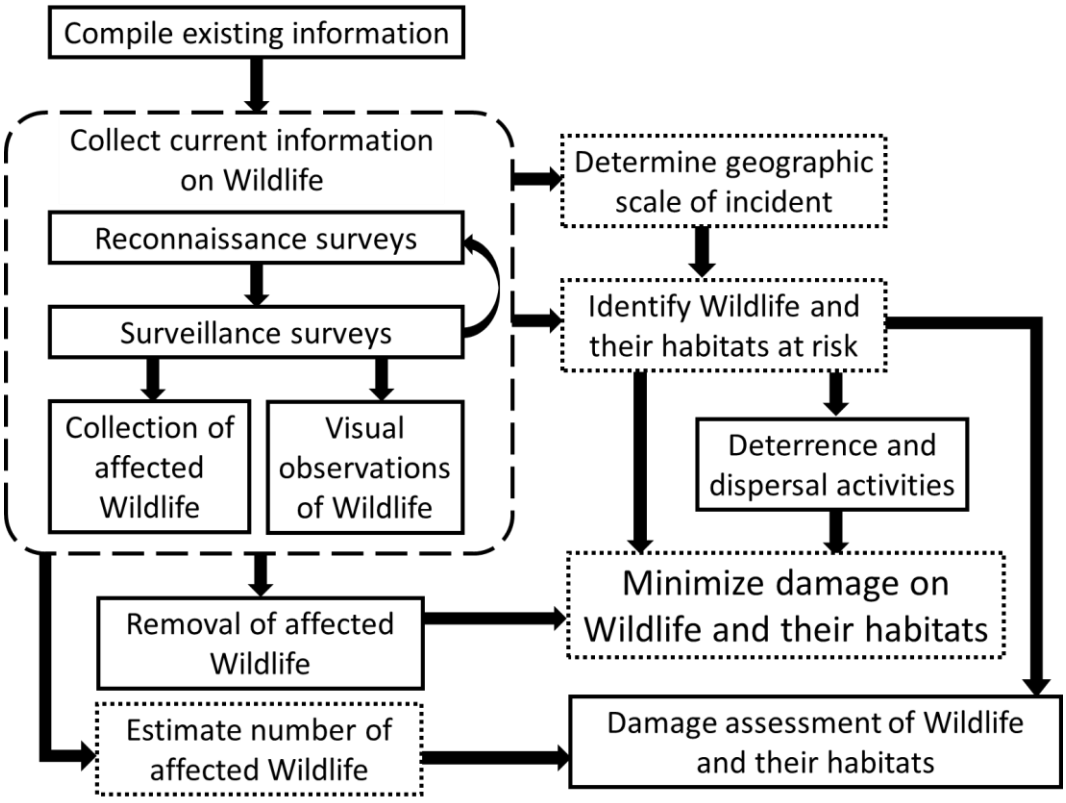

Figure 1: Intent of Wildlife surveys (dashed outline) and other key activities (black outline) that generate information (dotted outline) that help minimize further damage from a Pollution or Non-Pollution Incident on Wildlife populations and their habitat and support a Wildlife damage assessment.

1.2 General Guidelines on Conducting Surveys and Managing Data

1.2.1 Wildlife Response Plans

Depending on the scope and extent of a Wildlife Emergency, WRPs may be developed and should include details of surveys to be conducted. The scope of surveys can change as an incident progresses. Strategic WRPs may be developed in advance of potential incidents for activities that have risks of impacts to Wildlife. Such strategic WRPs should contain details of theoretical survey design as well as practical details for initiating and implementing surveys (e.g., survey protocols, observer qualifications, number of vessels or aircraft, checklist of activities, reporting mechanisms).

Once an incident occurs, incident-specific WRP should be developed (or modified from the existing WRP) to more clearly outline the actual survey design within the scope and parameters of the incident (e.g., volume and extent of oil spill, results of reconnaissance surveys, spill trajectory modelling). While ECCC-CWS does not have the authority to assign, recognize, or approve specific WRPs, it may provide advice to the Lead Agency and the RP regarding the direction and content of a WRP, based on available science and expertise. A WRP receives formal approvals within an Incident Command Post through sign-off by the Incident Command and RP. For more details on developing WRP, see the *Guidelines for Wildlife Response Plans* (ECCC-CWS, 2022a).

1.2.2 General Considerations for Survey Design

Surveys should be designed so that the data collected are representative of the impacted area and can effectively monitor changes in conditions as a result of the incident as well as to document damages that have been sustained to Wildlife and to prevent further damages from occurring. The approach used will be incident-specific and will depend on numerous factors, such as incident conditions, species affected, type of landscape (e.g., marine, aquatic), location within landscape (e.g., inshore, offshore), survey objectives, and available resources (Table 1). An adaptive approach may be necessary during an emergency response to account for unforeseen changes in the incident response. Ideally, the survey platform (e.g., vessel, aircraft) used to conduct bird surveys is dedicated to surveys throughout the response, as this will allow observers to implement a survey design appropriate to the survey objectives. For responses that are managed using the Incident Command System (ICS), or other incident management structure, all surveys should be implemented within the approval, safety, and reporting requirements of the ICS structure and the incident-specific Health and Safety Plan.

Table 1. Summary of survey types and potential applicability across ecosystem types ("Y" and "N" mean recommended and not recommended, respectively). "Large" and "Small" lakes or rivers are not defined, but the distinction is with respect to applicability of a complete census (Figure 2, D) versus a sampling design (Figure 2, E; Section 3.1).

Survey Type	Document Section for Description	Appendix # for Protocol	Ecosystem Type				
			Open water	Near-shore	Large lakes or rivers	Small lakes or rivers	Wetlands
Reconnaissance Surveys							
Aerial	2.1	I[1]	Y	Y	Y	Y	Y
Ground	2.2	I[1]	N	Y	Y	Y	Y
Boat	2.3	I[1]	Y	Y	Y	Y	Y
Surveillance Surveys							
Vessel	3.2.2	II	Y	Y	Y[2]	Y	N
Stationary Platform or Coastal	3.2.3	III	Y	Y	Y[3]	Y	Y
Aerial – Large Nearshore Flocks	3.3.2	IV	N	Y	Y	Y	N
Aerial – Small Nearshore Flocks	3.3.3	IV	N	Y	Y	Y	Y
Aerial – Open Water	3.3.4	IV	Y	N	Y	N	N
Beached Wildlife Survey	3.4.2	V	N	Y	Y[3]	Y	Y
Carcass Collection	3.4.3	VI	Y	Y	Y	Y	Y

Survey Type	Document Section for Description	Appendix # for Protocol	Ecosystem Type				
			Open water	Near-shore	Large lakes or rivers	Small lakes or rivers	Wetlands
Auxiliary Data Collection							
Degree of Oiling	4.1	X	Y	Y	Y	Y	Y
Behaviour	4.2	X	Y	Y	Y	Y	Y
Indicator Species	4.3	[4]	Y	Y	Y	Y	Y
Drift Blocks	4.4	[4]	Y	N	Y	N	N
Oil on Water	4.5	X	Y	Y	Y	Y	Y

[1] If time allows it and if personnel is properly trained, standardized protocol from surveillance surveys can be used.
[2] For rivers, suitable in slow-moving waters.
[3] Conducted from the shore.
[4] Beyond the scope of this document.

1.2.3 Implementing Surveys

During an emergency response involving Wildlife, surveys can be implemented in the following two phases (see Table 2):

1. Reconnaissance surveys, which focus on visual observations of birds
2. Surveillance surveys, including:
    - visual observations, which focus on birds
    - collection of affected Wildlife, which applies more broadly to ECCC-CWS's definition of Wildlife

Initial reconnaissance surveys take place in a timely manner on a larger geographic scale to assess the outer geographic limits of the event and to obtain current information on the distribution and relative abundance of birds within the general area. During this reconnaissance phase, information is collected to determine the spatial extent of the incident, species affected, impacted habitats, areas of special concern (e.g., colonial nesting areas, National Wildlife Areas, Migratory Bird Sanctuaries), and whether mitigation is appropriate to prevent birds from entering the impacted area (i.e., deterrence and dispersal of birds from the area). This preliminary reconnaissance survey determines the most suitable approach for the more systematic phase of the response, which consists in surveillance surveys.

During the surveillance phase, surveys target the impacted area using an appropriate design (see Section 3.1) to quantify the number/density of affected birds through visual observations and/or collection of affected Wildlife. Visual surveys of birds and collection of affected Wildlife may occur in tandem, depending on the scale of the event, the species affected, and other variables such as weather conditions during the response. Repeated surveys will also monitor the ongoing impacts of the incident on Wildlife populations.

One or both survey approaches may be considered and will depend on a wide variety of factors but should be primarily based on the objectives of the survey phase (see Table 2).

Table 2: Key objectives of visual bird (including those listed under SARA) surveys and Wildlife collection conducted during an emergency response. B

Survey Phase	Survey Type	Key Objectives
Reconnaissance	Visual observation	• Determine geographic scale of incident as related to birds • Identify bird species and habitats that have already been impacted • Estimate distribution and relative abundance of birds with potential to be impacted • Evaluate key habitats of importance to birds with potential to be impacted • Inform development of appropriate response strategies • Inform mitigation activities to minimize further damage to birds • Determine suitability of various survey methods (e.g., shore, boat, and/or aerial surveys) for subsequent

Survey Phase	Survey Type	Key Objectives
		surveillance or monitoring for the duration of the incident • Inform Incident Command on the initial status of known or potential impacts on birds
Surveillance	Visual observations	• Monitor and refine the identification of bird species, abundance, distribution, density and habitats in the impacted area • Monitor and identify areas where birds would be potentially at risk from further impacts • Monitor and estimate number of dead and moribund birds affected by incident • Identify areas where affected birds can be collected • Inform other response activities such as habitat protection and birds deterrence and dispersal • Inform Incident Command on the ongoing status of known or potential impacts on birds
	Collection of affected Wildlife[a]	• Collect dead or moribund Wildlife to: ○ refine the geographic scale of the incident ○ determine the cause of death if the source is unknown ○ minimize damage and exposure to unaffected Wildlife (secondary exposure) ○ minimize potential for harm or exposure by the public (e.g., local hunters and individuals supporting aspects of the response) ○ support appropriate response strategies for the treatment of affected Wildlife ○ obtain specimens/samples for legal enforcement activities or reporting requirements and inform damage assessment ○ inform Incident Command on the ongoing status of known or potential impacts on birds

[a] Includes any species under ECCC-CWS's definition of Wildlife in this document but could be extended to include species under other jurisdictions.

1.2.4 Observer Requirements

To ensure high accuracy and reliability of data collected during an emergency response, observers conducting bird surveys must be able to identify species that are seasonally present in the area of the incident, in varying plumages and weather conditions. Observers must be trained and experienced in the relevant survey protocols. Depending on the type of survey, formal training will be required by classroom and/or through field experience. Experienced observers, especially those familiar with local or regional species, are essential for data reliability, particularly with respect to data used in damage assessments. Those conducting surveys need to be aware of any safety certification and training requirements to access certain survey platforms, which may be made available during an emergency response (e.g., underwater egress training may be required for

aerial surveys performed over water). It is outside the scope of this document to outline training and experience standards that are applicable to all Wildlife Emergencies. Industry and Response Organizations should therefore consult with regional CWS Co-ordinators for guidance on relevant standards. Wildlife Response Organizations may also have trained and experienced staff capable of undertaking different aspects of Wildlife surveillance. Observers, or Response Organizations contracting observers, should be familiar with local, regional, agency-specific, and/or industry-specific safety standards and training that may also be required. Personnel participating in surveys must also meet the incident-specific health and safety requirements.

1.2.5 Data Collection and Management

During an emergency response, data quality and management is of paramount importance. Standardized data sheets (paper or electronic) prompt observers to record all required information, which are included in established protocols. Following each survey, data must be entered into a database to facilitate quick and accurate reporting and guide decision making during the response (see Section 5.0 for more details). Data need to be communicated with appropriate section(s) within the ICS structure. ECCC-CWS may oversee data management and quality control of Wildlife surveys conducted by the RP, Response Organizations, and/or other groups and provide guidance to ensure that an adequate expertise is involved in the process. Standardized data entry and transfer to regulatory agencies is essential to ensure data quality. Experienced personnel must develop Quality Assurance/Quality Control within the ICS structure. Contracting professional organisations should be considered. Following each incident, all data collected over the course of Wildlife response activities are consolidated and may form the basis of the damage assessment on populations.

Standardized protocols have been developed for the purpose of conducting bird surveys during an emergency response in Canada. The protocols herein are sufficiently generic to be applied to a broad range of incidents but still facilitate consistent data collection for Wildlife impacted by Pollution or Non-Pollution Incidents. This document includes protocols on how to:

- conduct reconnaissance surveys of birds (Section 2.0)
- conduct surveillance surveys of:
    - birds through visual observations from:
        - vessels (Section 3.2.2)
        - stationary platforms or coastal surveys (Section 3.2.3)
        - aerial surveys (Section 3.3)
    - Wildlife through collection of dead or moribund individuals (Section 3.4)

The approaches described here are appropriate to apply in marine and coastal environments and may also be applicable to aquatic or terrestrial habitats. Future documents, or subsequent versions of this document, may be developed to include additional approaches and methods for other landscapes (e.g., terrestrial, freshwater, riverine, intertidal, and wetlands) and to address species-specific needs (e.g., Species at Risk or species with localized distribution).

2.0 Reconnaissance Survey Methods during an Emergency Response

Reconnaissance surveys take place in a timely manner on a larger geographic scale and serve as a method to assess the spatial extent of the incident and to obtain current information on impacted habitats, areas of special concern (e.g., colonial nesting areas) and the abundance and distribution of birds within the general area (see Table 2). Reconnaissance surveys will be used to inform on the most appropriate methods for subsequent surveillance surveys, and whether mitigation to deter birds from entering the impacted area is appropriate. Reconnaissance surveys are not systematic and their goal is to conduct informal surveys as a means to rapidly assess the distribution of impacted, or potentially impacted birds and habitats for a prompt response (objectives are described in Table 2). A general protocol for aerial, ground, and vessel reconnaissance bird surveys during an emergency response can be found in Appendix I. More exhaustive systematic surveys are conducted during the surveillance phase and suggested standardized protocols are described in Section 3.0. If time allows and if personnel is properly qualified, those standardized surveillance survey protocols can also be used in reconnaissance surveys.

2.1 Aerial Surveys

An aerial survey should be conducted as soon as possible after the incident first occurs and on a sufficiently large geographic scale to assess the outer limits of the incident. Aerial surveys are the most efficient means to quickly assess the extent of large incidents. The survey should make it possible to estimate:

- the number of birds likely to be contaminated
- the species affected (especially Species at Risk and highly vulnerable species)
- their location with respect to the incident (i.e., pollutants)
- habitats that are or may be affected
- habitats to which the birds may be diverted or attracted to

The deployment of the personnel and equipment needed to implement further surveys will vary depending on the extent of known and potential impacts. A high abundance of individuals or species considered to be vulnerable may indicate a high probability of finding impacted birds in the days following the incident. If, in the hours following the incident, it seems possible that the pollutants could reach a large aggregation of birds or key habitats preferred by birds, a deterrence and dispersal strategy must be developed and implemented as soon as possible.

2.2 Ground Surveys

Ground surveys must also be carried out as soon as possible after the incident. The main objective of ground surveys is to assess the number of impacted, or potentially impacted, birds. Ground surveys should also identify birds' preferred habitats that are likely to be impacted, as well as where

deployment of preventive deterrence and dispersal efforts would be most effective. Specifically, ground observers must be able to provide:

- the number of birds that are or may have been impacted, based on their specific behaviour (excessive preening, inability to fly, etc.)
- the exact location of impacted birds, to determine where efforts should be concentrated if a decision is made to rehabilitate them
- the number of birds in the impacted area, by species, to supplement the estimates from the aerial surveys
- the location of the birds' preferred habitats

Surveys should be carried out on foot, or if applicable by truck or an all-terrain vehicle, along the entire shore by a two-person team. Alternatively, motorboats may be used for surveys. Surveys could be carried out, if necessary, in collaboration with the deterrence and dispersal teams. The extent of the impacted area to cover will be determined by the other surveys (aerial surveys, carcass collection, Shoreline Cleanup and Assessment Technique (SCAT), etc.). Binoculars, a spotting scope, detailed 1:50,000 scale maps and GPS devices are required. Unmanned aerial vehicles, where permitted for use, may also allow for surveillance of inaccessible areas. Ground surveys for reconnaissance purposes may be ad hoc in nature but should record information on locations searched and may also collect carcasses as per Section 3.4.

2.3 Vessel Surveys

Vessel-based reconnaissance surveys may also be carried out to complement other surveys. The objectives of the survey are similar to those of aerial and ground surveys. Depending on the conditions, motorboats may be used to assess the situation if no aircraft are available or if the impacted area cannot be accessed from the shore. Survey vessels need to be appropriate for the conditions of the ecosystem (e.g., deep draft, stable boats for offshore areas, shallow draft boats equipped with mud motors for estuaries). Vessel-based surveys for reconnaissance purposes may be ad hoc in nature, but should record information on locations searched (preferably with routes tracked by GPS), and may also follow general principles from the standardized protocol established for bird surveys from vessels (Section 3.2.2).

3.0 Surveillance Survey Methods during an Emergency Response

3.1 Survey Designs

Many Wildlife survey designs exist in the literature. However, the purpose of this document is not to review all possible types of survey approaches, but rather to provide recommendations on the most effective ones in the context of environmental emergencies. For a more complete list of bird surveys endorsed by ECCC-CWS, consult the *Guidance regarding data needed to support assessment of project effects on birds* (ECCC-CWS, in review).

Principles for robust design of Wildlife surveys, particularly using distance sampling methodology, are detailed in Buckland et al. (2001, 2015). These principles, along with relevant experience to emergency response, form the basis for guidance in this document, though alternative approaches may be relevant for specific species and/or circumstances. To adequately quantify the abundance and distribution of birds potentially at risk during an incident, and to estimate the number of dead and moribund birds affected, surveys must be designed so that the data collected are representative of the area and can effectively document the impact. The approach used to collect the data will vary greatly from response to response as it will depend on several factors, such as mortality source, species affected, type of landscape, weather conditions, time to respond, and available resources. The survey approach may also change as the response unfolds. To the extent feasible, the platform used to conduct the surveys should be dedicated to this task during an emergency response, as this will allow observers to design a path to suit the objectives of the survey and to have control of changing the course of the predetermined path if required. The survey design should be determined prior to the survey. In cases where a survey platform is available, but its designated purpose is other than Wildlife surveys (e.g., oil surveillance flight), Wildlife observers may be obligated to conduct reconnaissance surveys. In this case, limitations of a bird survey should be clearly identified (e.g., inappropriate flight altitude), but, when possible, surveys should be adapted to meet the objectives and robust statistical analyses must be used to cope with potentially biased data.

Using existing data, information from reconnaissance surveys, and other sources of information available during an incident (e.g., locations of impacted birds, oil spill tracker buoys, oil spill trajectory modelling, weather forecasts), surveys should be designed to overlap with impacted areas and adjacent un-impacted areas. For small incidents, a complete survey should be conducted since it will give a complete assessment of the resources at risk. For larger incidents, it might not be possible to survey the entire area. In this case, a sub-sampling approach may be more appropriate (e.g., transect and plots). In many cases, surveys should be repeated over multiple days to assess the temporal changes and patterns.

Various survey designs (Figure 2) may be applicable for spills of different sizes, habitat types (see Table 1), target species, and/or available resources (e.g., aircraft vs. vessels). Survey designs will differ greatly depending on whether spills occur in open water (Figure 2, A-C) or nearshore (Figure 2, D-F). Surveillance during spills should consider these various designs, or combinations of these designs, then select from appropriate methods outlined in Table 1.

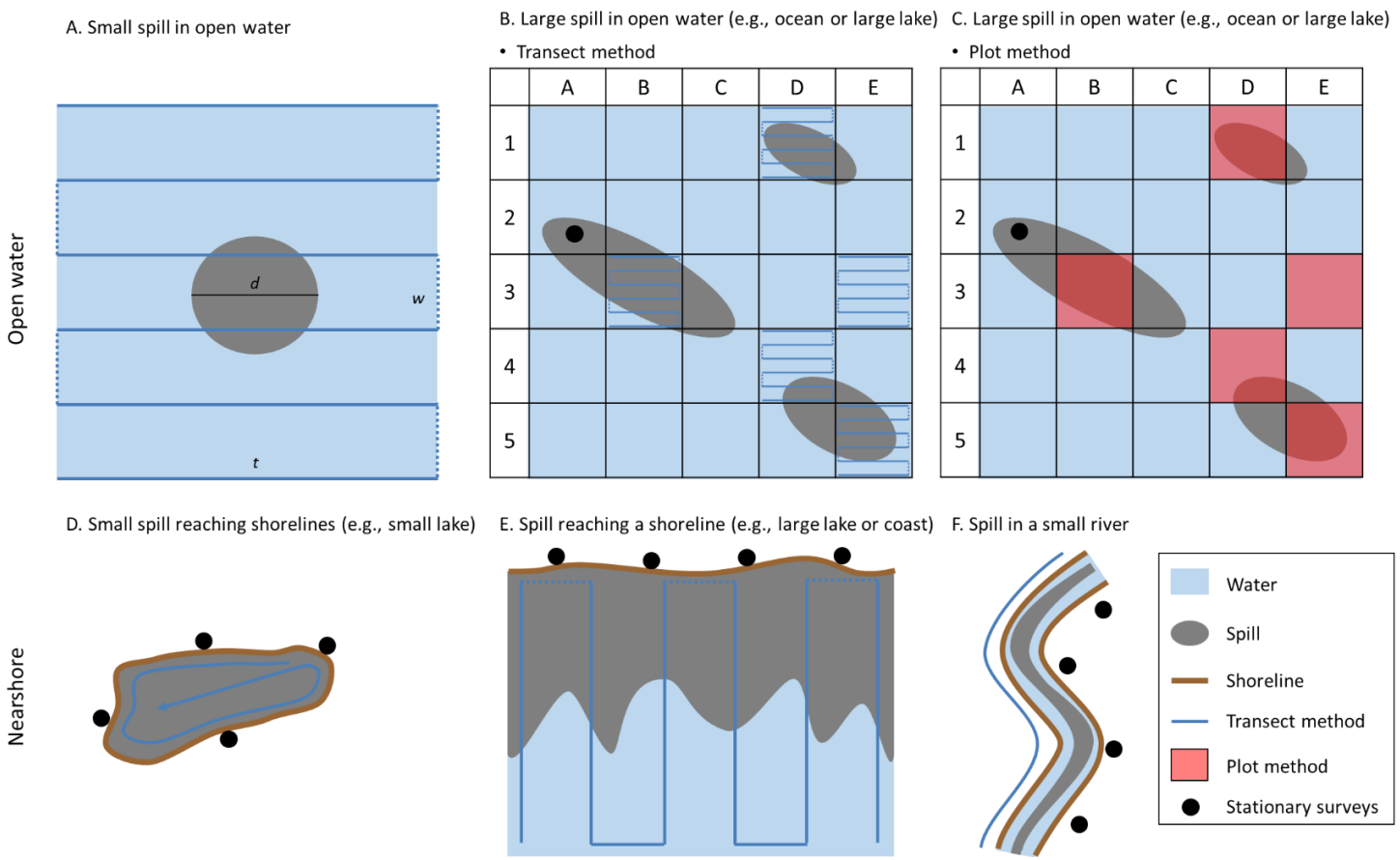

Figure 2: Conceptual survey designs to estimate bird abundance and density in water (light blue areas) during a spill (grey areas) occurring in open water (A-C) and near shores (D-F). Small spill in open water (A), where d is the diameter of the core impacted area, w is the distance between transects (blue dotted lines – not surveyed), and t is the transect (blue solid lines – surveyed) length. Large spill in open water for a dispersed or spreading oil spill where the area is divided into a grid pattern where blocks can be surveyed by series of transects (B) or plots that are entirely surveyed (C) to collect representative samples of bird density and/or mortality. Surveys from stationary platforms (black dots) can be conducted if such structures occur in the area (e.g., offshore oil drilling platform). Spills reaching shorelines of small (D) or large (E) water bodies or rivers (F). Stationary surveys can be conducted in a systematic manner along the shores to complement other types of surveys. Examples are meant as a guide only; the exact pattern for survey transects will depend on the unique circumstances of each incident and the available resources and conditions at the time of the incident.

3.1.1 Survey Designs in Open Water

For relatively small incidents (e.g., contained or limited dispersal of oil), a conceptual survey design should include surveys that extend beyond the extent of the impacted area (Figure 2, A). This will ensure that Wildlife potentially impacted by the incident are accurately estimated and dead or moribund individuals that may have drifted beyond the impacted area are identified. Non-impacted areas should also be surveyed to compare bird densities with impacted conditions. Grid transect length (*t*) and distance between transects (*w*) will be dependent on the shape and diameter (*d*) of the impacted area and should be determined at the time of an incident to meet survey objectives. To maximize efficiency or resource use, the spacing between lines should be such that transects are independent and sufficiently spaced to avoid counting the same individuals twice (Buckland et al. 2001). To assess inter-transect variability, a sufficient number of transects should be surveyed, and the total number of transects should be proportional to the scope of the incident. Sample size is an important consideration: if under-sampled, the density estimate and precision are poor; if oversampled, survey resources could have been used more efficiently elsewhere. If possible, a statistical power analysis should be conducted prior to the survey to determine the appropriate number of lines.

For larger incidents in open water where impacts are dispersed or spreading, survey design may include a subsampling approach with multiple transects (Figure 2, B) or plots (Figure 2, C) to collect representative data over the impacted and non-impacted areas. The transect approach can take the form of a line transect or a strip transect. In line transects, detection probability decreases with distance from the observing platform and not all animals need to be detected. In strip transects all animals within the strip of width *w* are assumed to be detected. All of these methods aim to collect representative samples over the area, but the distinction is that line transects aim to collect density estimates along survey lines using distance sampling, whereas strip transects and plots aim to census all individuals within a given area. The preferred approach is usually dictated by the mode of survey (i.e., vessel vs. aerial), target species (e.g., large aggregated vs. smaller dispersed birds), and size of plots. A gridded approach can facilitate planning, execution, and display/mapping of survey effort. Grid cells to be surveyed can then be prioritized daily with respect to changing parameters of the incident (e.g., observed oil, occurrence of impacted Wildlife, weather, and available resources), giving priority to areas of greatest impact.

The distance sampling methodology for counting birds along transects is outlined in Section 3.2.2 for vessel surveys and Section 3.3.4 for aerial surveys (see also Figure II-1 in Appendix II). The transect length and distance between transects (Figure 2, B) will depend on the grid-cell size, which may vary with the scale of the incident and the number and types of vessels available. A design with parallel, equally spaced transects with a random start is ideal as it provides a uniform coverage, but if platform use is limited and the cost is high, sawtooth or zigzag designs can be employed (Thomas et al. 2010). Generally, a larger number of shorter transects is preferred than fewer longer transects, as the former yields more precise estimates of the encounter rate variance (Thomas et al., 2010). Where there are known density gradients within the study region, stratification can be used to reduce variance within strata (Buckland et al. 2001). In an environmental emergency, this means that surveys should be conducted in impacted and non-impacted areas. If surveys are opportunistic rather than pre-planned, distance sampling methodology is still recommended so that bird density can be estimated even if the route was not designed for the purpose of abundance estimation. For distance sampling designs, software such as Distance (for Window or the R package – http://distancesampling.org/) can be employed to examine the coverage properties of candidate survey designs prior to their implementation.

An alternative to distance sampling is the plot method if predetermined areas can be thoroughly censused (e.g., complete counts of target individuals and species). In this case, bird density can be estimated by accounting for all birds in the area surveyed (Figure 2, C) and extrapolating to areas that were not surveyed. The plot methods for aerial surveys may be most applicable to birds occurring in flocks (e.g., Sections 3.3.2 and 3.3.3).

3.1.2 Survey Designs Near and On Shores

In incidents where marine coastlines, lakes, and riverine shoreline systems are impacted (Figure 2, D-F), a mixed survey can be conducted combining ground surveys with vessel and/or aerial surveys. Incidents occurring in a small enclosed area (e.g., small lake, ponds) can be entirely surveyed by boat or by aircraft to provide a complete count of bird occurrences (Figure 2, D). On the other hand, incidents occurring in larger nearshore areas (e.g., coastal waters, large lakes) can be surveyed using transects. It is recommended that transects be placed in relation to any known gradients in bird density such that each transect has both low-density and high-density portions to minimize variance in distance sampling (Thomas et al. 2010). As bird density can be associated to distance from shoreline, it is recommended that transects run perpendicular to the shoreline to account for these gradients (Figure 2, E). However, if resources are limited, zigzag designs can be implemented. A stratified design is suggested to include both impacted and un-impacted areas and/or cover various habitats. If target species are large flocking birds (e.g., certain waterfowl species) a coastal census that runs parallel to shore or known habitats may be preferred (see also Section 3.3.2)

Incidents in rivers can be surveyed following the contours of the waterbody (Figure 2, F). In slow-moving rivers, a vessel survey can be considered. In the case of large rivers, survey designs for open water can be used.

The stationary survey described in Section 3.2.3 was originally designed for platforms in open water (e.g., oil drilling platforms). However, the protocol can be adapted to other scenarios where the survey is conducted in a systematic manner along the shore. For stationary surveys conducted from a shoreline, survey locations should be evenly spaced and have an adequate view of the nearshore environment. Stationary surveys should also consider sufficient survey coverage for habitat features that may support higher aggregations of birds and/or may support higher oil retention based on shoreline type. Stationary surveys can complement other types of surveys, including vessel or aerial-based surveys and/or carcass collections and beached Wildlife surveys. Stationary surveys can also use fixed-width sampling or the general principles of distance sampling.

3.1.3 Data Treatment

After conducting appropriate surveys to meet the objectives of the response plan, data must be analysed to properly inform Incident Command, assess the situation of the incident, and take appropriate decisions on response actions. This use of survey data for Incident Command decisions making requires frequent summaries of data and mapping of surveys and Wildlife observations in relation to the evolving incident. Statistical analyses and modelling methods, that will follow the time-sensitive response needs, will depend on the type of survey, spatial coverage, repeated measurements, technical specifications, number of observers, etc. and must be carefully considered before conducting surveys to ensure that data analysis requirements and assumptions are met. For more information on survey designs, statistical analyses and modelling, consult ECCC-CWS (in review).

Data analysis and visualisation should take the form of maps, figures, and tables and be incorporated in survey reports and archived properly (Section 5.0). Maps should show the extent of the incident at the time of the survey, any important geographical features, critical habitats, as well as the area covered by the survey. Predictive modelling of data should produce distribution and density maps of targeted species. In surveys based on distance sampling, densities and abundance can be estimated using the software Distance (for Window or the R package – http://distancesampling.org/). For other types of surveys, consult ECCC-CWS (in review). Analyses may be conducted for single species (e.g., species at risk), species groups (e.g., alcids), or for the overall avian community. Sites that support high densities or diversity of Wildlife species must be identified. Figures and tables should present the list of all species and number of individuals observed. Model outputs to determine density or abundance estimates should be presented with precision estimates. Data analysis is critical, as it will form the basis of the information required to conduct subsequent surveys, measure impacts, and assess damages incurred on Wildlife populations.

3.2 Conducting Bird Surveys from Vessels, Stationary Platforms, and Coastal Locations

The purpose of this section is to provide technical guidance on survey protocols to estimate bird densities in water during an emergency response from both moving vessels and stationary platforms, as well as from coastal locations (i.e., coastal surveys). The protocols are modified from Gjerdrum et al. (2012) but are consistent with those used across regions (Pacific, Arctic, Gulf, and Atlantic) to ensure collection of comparable data. In this document, “vessel” refers to vehicles used in water, including ships and boats (moving at speeds >4 knots) and the corresponding protocol is the one for “moving platforms” described in Gjerdrum et al. (2012). The term “stationary platform” refers to any infrastructure that is located in water such as immobile (or moving at speed <4 knots) vessels and oil-drilling platforms. The corresponding protocol is the one for “stationary platforms” described in Gjerdrum et al. (2012). Coastal surveys are conducted from a fixed viewpoint that is located on the shore such as wharfs, bays, headlands, islands, etc. The corresponding protocol is also the one for “stationary platforms” from Gjerdrum et al. (2012) but has been modified slightly to include variable scan angles. This section provides guidance and describes the general methods used to conduct surveys. A series of appendices provide protocols where data field are described in detail, example surveys, and blank data sheets (Appendix II-III), data field coding details (Appendix VII), and distance estimation equations (Appendix VIII).

3.2.1 General Requirements for Bird Observers

To ensure the highest quality of data is collected, observers should have the following:

- Ability to rapidly identify regional bird species (to the lowest taxonomic level possible) in all sex, age, and seasonal plumages, in various lighting conditions, reduced visibilities, and in difficult sea conditions
- Ability to accurately record data on data sheets or electronically in accordance with this protocol, including information on vessel, weather conditions, and birds
- Experience travelling in boats, exposure to inclement weather, and an ability to work in rough sea conditions without getting seasick
- Experience implementing appropriate protocols

3.2.2 Guidance for Surveys from Vessels in Open Water

The general principles for surveys from vessels in open water use distance sampling to estimate bird density and follow the standardized protocol established for bird surveys from vessels (Appendix II, adapted from Gjerdrum et al. 2012). In summary, the observer conducts observations from a vessel that travels at a constant speed following transect lines. Bird observations are recorded and classified into perpendicular distance bins up to a maximum distance of 300 m in a series of 5-minutes observation periods. The observer must record the species (to the lowest taxonomic level), number of individuals, whether birds are in transect or not, if they are flying or on the surface of water, and the distance bin. If applicable and when possible, additional information is recorded such as association and behaviour codes, flight direction, age, plumage, and sex. The absence of observations during observation periods is also recorded. All birds observed on the surface of the water within the 300-m transect are counted continuously throughout the 5-minutes observation period, while birds in flight are counted at regular intervals (every ~300m) to prevent overestimating the density of flying birds (called “snapshots”). Flying birds detected between snapshots are recorded as not in transect. It is important to note that all birds that are oiled or demonstrating signs of oiling (in the case of an oil spill) or in distress (in the case of other Pollution Incidents or Non-Pollution Incidents) are recorded whether they are in transect or not.

In addition to bird observation information, observation period information is also important. This includes: visibility, weather conditions, glare, sea state, wave height, wind speed and direction, ice type, and temperature.

3.2.3 Guidance for Stationary Platform and Coastal Surveys

Stationary platform and coastal surveys are similar to those conducted from moving vessels in that they also use distance sampling to estimate bird density. This survey type follows the standardized protocol established for bird surveys from stationary platforms (Appendix III, adapted from Gjerdrum et al. 2012). In summary, the observer conducts surveys as close as possible to the edge of the platform or the shore and scans a 180° arc, giving priority to birds within a 300-m semi-circle. On coastlines, the vantage point can differ from the 180° arc. In such cases, the scanning angle of the survey area is recorded to estimate the scan area and calculate densities. The area is visually swept only once per scan, from one side to the other, and all birds on the water and in flight are systematically recorded at that time. The survey is complete when all birds within the arc are recorded. Longer scan periods (e.g., 5 or 10 minutes) may be done in addition to the initial scan to provide more information on bird species composition and relative abundance, but the information should be collected separately. In the case of coastal surveys, a systematic design should be followed to cover the extent of the incident. Lehoux and Cossette (1993) estimated that a single team can systematically cover up to 15 km of shoreline per day. If a systematic survey of the shoreline is not possible, observation points may be established at the most accessible sites, following protocols in this document (Appendix III) or similar protocols for shoreline segments (Birds Canada 2020b).

3.3 Conducting Aerial Bird Surveys

The purpose of this section is to provide technical guidance on survey protocols to estimate bird abundance and distribution during an emergency response from aerial survey platforms. The protocols should be used consistently across regions to ensure collection of comparable data. This section describes the general methods used to conduct aerial surveys.

Initial reconnaissance surveys obtain current information on the relative abundance and distribution of birds within the broader area of the incident (Section 2.0). During the surveillance phase, surveys target the impacted area to quantify the number and density of affected birds through visual observations. Repeated surveys will also monitor the ongoing impact of the incident on bird populations as well as identify any changes in the abundance and distribution of birds in the area.

Prior to initiating an aerial survey, it is necessary to confirm the objectives specific to the survey being undertaken. If the intent of the survey is to determine the abundance and distribution of birds potentially at risk as a result of a Pollution Incident or mass mortality event, then the survey should be designed such that extrapolated densities can be used to estimate numbers present in the area of interest. To accurately assess the number of oiled birds distributed singly or in small groups along the coastline, some measure of detection probability is warranted.

This section provides guidance on survey designs and describes the general methods used to conduct surveys. A series of appendices provide protocols where data field are described in detail and blank data sheets for each type of aerial survey (Appendix IV), data field coding details (Appendix VII), and distance estimation equations (Appendix VIII).

3.3.1 General Requirements for Bird Observers

To ensure the highest quality of data is collected, observers should have the following skill set:

- Ability to rapidly identify birds (to the lowest taxonomic level possible) in all sex, age, and seasonal plumages, in various lighting conditions, and in suboptimal conditions of visibility and sea state
- Ability to accurately record data on data sheets or electronically in accordance with this protocol, including information on weather conditions and birds
- Experience travelling in aircrafts and an ability to work in unstable flight conditions without getting airsick

3.3.2 Guidance for Aerial Surveys of Large Nearshore Flocks

This type of survey addresses two primary objectives: 1) to document and photograph large flock distributions and 2) to identify areas with potentially affected birds for further investigation. This type of survey is best suited for large flocks of birds near the coast. For example, this survey can be used on large groups of sea ducks during molting, migration or wintering periods or mixed flock aggregations associated with spawning events. Initial survey flights should be delivered at high altitudes and moderate speeds. Secondary surveys, or additional passes over flocks, may require lower altitudes and/or slower speeds to facilitate species/guild identification and detection of oiled birds (see also Sections 3.3.3 and 3.3.4). Photos are taken for subsequent count and a direct estimation is also made during the flight. Surveys should be conducted using a rotary-wing aircraft with floats, single-engine fixed-wing aircraft with floats, or twin-engine fixed-wing aircraft to minimize risk to the survey crew when flying over open water.

3.3.3 Guidance for Aerial Surveys of Small Nearshore Flocks

This survey is to assess the prevalence of individuals or small flocks of birds, to assess oiling incidents, and to further investigate and refine areas of interest identified during the initial reconnaissance survey. This type of survey is best suited for small flocks of birds near the coast. For example, this survey can be used on small groups of dabbling ducks at any time of the year and multiple nearshore environments. Surveys should be conducted at low altitudes and speeds using a rotary-wing aircraft with floats, single-engine fixed-wing aircraft with floats, or twin-engine fixed-wing aircraft to minimize risk to the survey crew when flying over open water. If applicable, data can be

collected using the independent double-observer methods outlined in the protocol to allow reconciliation and consensus of observations.

3.3.4 Guidance for Aerial Surveys in Open Water

This type of survey uses the general principle of distance sampling to estimate bird density and is very similar in terms of methodology to the standardized protocol established for surveys from vessels (adapted from Gjerdrum et al. 2012). The protocol for aerial surveys is described in detail in Appendix IV. In summary, the observer conducts surveys from an aircraft that travels at a constant speed following predetermined transects. This survey attempts to assess the prevalence of oiled birds and is flown at lower altitudes and speeds than the other aerial surveys. Surveys should be conducted using a twin-engine fixed- or rotary-wing aircraft to minimize risk to the survey crew when flying over open water. This type of survey is best suited for individual or small flocks of birds in open water. For example, this survey can be used on pelagic species (e.g., alcids, petrels). It can also be used to provide an approximate estimate of the extent of oiled birds. The advantage of this survey is that it can be used as a reconnaissance survey when the flight plan has been designed for the purpose of another response activity. As with vessels, distance bands are used to estimate distance from the transect line.

3.4 Collecting Wildlife during an Emergency Response

When a harmful substance, such as oil, is released into a waterbody, or in the case of non-oil related mortalities (e.g., disease), many Wildlife species that are affected in the water end up drowning and sinking in the water and will never be recovered. However, some affected Wildlife will reposition themselves along shorelines in order to minimize heat loss (caused by being in direct contact with cold water) or avoid predation. Other Wildlife species may die in the water and then wash ashore.

During an environmental emergency event involving Wildlife, ECCC-CWS may advise on or assist with the collection of live or dead Wildlife (or samples) to evaluate the incident's impact on Wildlife populations and sensitive Wildlife habitats. Pollution Incidents in the marine or terrestrial environment can cause widespread mortality to Wildlife. However, non-oil related mass mortalities involving Wildlife are also common in Canada along coastlines, lakes, rivers, and shorelines, caused by both natural (e.g., starvation due to severe weather and disease outbreaks) and human-related events (e.g., poisoning, collisions due to light attraction, and flaring), and occasionally trigger a formal emergency response.

The intent of this section is to provide technical guidance to properly trained and authorized personnel who will be conducting Wildlife collection surveys during an emergency response that may be related to either a Pollution or Non-Pollution Incident. Key objectives of these surveys are outlined in Table 1 and include: 1) determining the geographic scale of the incident, 2) collecting dead or moribund Wildlife to determine the cause of death if the source is unknown, minimize damage to unaffected Wildlife by removing affected Wildlife from the environment, support appropriate response strategies for the treatment of affected Wildlife, and obtain specimens/samples for enforcement activities, and 3) provide data to inform damage assessments estimating the numbers of Wildlife impacted by the incident.

These procedures/protocols are meant to be tailored to the specific needs of each incident and/or landscape and to be used within the broader context of established contingency plans, standard operating procedures, and within the ICS structure.

3.4.1 Health and Safety Considerations

Responder health and safety are of primary importance in any Wildlife response effort. The earliest phases of a response are generally the most hazardous to human health and safety. Thus, safe practices during surveys and the field collection of Wildlife must be a priority and Wildlife response efforts should not be initiated unless personnel can conduct activities safely. Furthermore, for safety reasons, the public may need to be excluded from areas where response operations are being conducted. To reduce potential hazards encountered during a Wildlife mortality event, personnel employed by Response Organizations or other agencies should abide by their own established health and safety protocols and standard operating procedures in addition to those that have been established by the incident-specific health and safety plans developed under ICS managed responses. For more details on occupational health and safety in the context of Wildlife collection during an emergency response, consult the document entitled *Guidelines for the Capture, Transport, Cleaning, and Rehabilitation of Oiled Wildlife* (ECCC-CWS, 2022b).

3.4.2 Conducting Beached Wildlife Surveys

Data collected from regularly surveyed beaches provides information on Wildlife species that are affected by exposure to pollution and mass mortalities due to entanglement with fishing gear, weather-related stranding, and disease. By systematically monitoring dead Wildlife (oiled and unoiled) on beaches, changes in mortality that may be associated with a particular Pollution Incident can be detected.

The aim of this section is to describe visual beached Wildlife surveys of carcasses along shorelines that can be conducted regularly to determine trends in mortalities over the course of an incident. This survey accounts for effort and can help determine species and areas that are more likely to be affected as well as where live impacted Wildlife may be captured and treated. For purpose of damage assessment, additional details on beached bird survey work plans, including estimates of carcass persistence and detection probability, can be found in U.S. Fish & Wildlife Service (2010; 2012) and other peer-reviewed literature (see Section 4.4).

The protocol included in this document is commonly known as a “Beached Bird Survey” and is based on the document *Adopt-a-beach – Newfoundland and Labrador Beached Bird Survey Program: Surveyor’s guide* (which was adapted from Chardine and Pelly (1994)). The protocol described here has been developed for the Atlantic Region, but specific protocols for the Quebec and Pacific Regions are available (Birds Canada, 2019; 2020a). Other protocols can be found for specific incidents (U.S. Fish & Wildlife Service, 2010; 2012). The Atlantic protocol has been modified to include any Wildlife, any type of shoreline, and to conduct the surveys at a higher frequency in order to be more applicable in the context of an environmental emergency (the protocol and datasheet can be found in Appendix V). In summary, each beach should be surveyed by walking one way along the wrack or flotsam line (i.e., the line of stranded seaweed and debris or high water mark) closest to the water, scanning on each side, and returning along the next wrack line higher up on the beach. Note also that fresh carcasses may be found close to the water line; older carcasses may be found at the extreme high tide. If a beach is particularly deep, several sweeps may be required. Alternatively, a zig-zag search pattern (between mid-beach and the high tide mark) may be the most efficient survey method. The area above the extreme high tide mark should always be thoroughly examined, especially if the incident involves waterfowl, as live oiled

birds may seek shelter in nearby vegetation or predators/scavengers may drag the birds above the high tide mark. Beach surveys should include nearshore emergent vegetation (e.g., reed beds and marsh areas) where affected Wildlife may have taken refuge. SCAT operations (ECCC, 2018) can also prove a valuable resource for identifying areas requiring further search effort. Carcass persistence rate and detection probability experiments may be implemented to provide a better mortality estimate (U.S. Fish & Wildlife Service 2010; 2012).

3.4.3 Collecting Wildlife during a Pollution Incident

An emergency response is a joint effort from various government departments and organizations. In support of the Lead Agency, ECCC-CWS may assist with or coordinate the collection of dead and live oiled Wildlife on accessible beaches, shorelines, or nearshore areas through systematic surveys. The primary objectives of Wildlife collection surveys following a Pollution Incident can be found in Table 1.

ECCC-CWS will recommend to all agencies involved in a response the need to 1) monitor Wildlife impacts through Wildlife collection surveys, 2) ensure that no undocumented Wildlife are removed from beaches or shorelines, and 3) ensure that everyone collecting Wildlife has valid authorization and training to do so under the *Migratory Birds Convention Act*, *Migratory Birds Regulations*, *Migratory Bird Sanctuary Regulations*, SARA, *Canada Wildlife Act*, and *Wildlife Area Regulations* (see Appendix IX for contact information of ECCC-CWS regional permits offices). A complete list of regulatory requirements including applicable legislation, permits, and authorisations are available in the *Guidelines for Wildlife Response Plans* (ECCC-CWS, 2022a). Protocols should be distributed to responders prior to conducting Wildlife collection surveys. The following material provides example protocols for collecting and documenting dead, live oiled, and non-oiled Wildlife.

3.4.3.1 Guidance for Collecting Wildlife during a Pollution Incident

Wildlife collection surveys during an emergency response should also be conducted using a two-tiered approach, similar to that used for visual bird surveys. This entails an initial collection phase and follow-up phase. For complete information on the capture, handling, and transport of Wildlife, carcass collection, and record keeping, consult the document entitled *Guidelines for the Capture, Transport, Cleaning, and Rehabilitation of Oiled Wildlife* (ECCC-CWS, 2022b). The following summarize that document on how to collect affected Wildlife during each phase:

- **Initial collection phase:** During the initial phase of the response, responders quickly scan and collect dead Wildlife on beaches and shorelines where affected Wildlife have been sighted and where stranded Wildlife have been found through beached Wildlife surveys (see Section 3.4.2) or reports from SCAT surveys. This approach is useful to quickly assess the geographic extent and distribution of oiled Wildlife.
- **Follow-up phase:** Once the extent of the impacted area has been identified, follow-up Wildlife collection surveys should be more comprehensive (i.e., visiting other accessible beaches and shorelines in the area and searching the entire stretch of a beach). These collection surveys would be most efficient if conducted as part of the beached Wildlife survey and SCAT operations.

For both the initial collection phase and follow-up phase, the following should be considered:

- If feasible, do not use contaminated nets to capture live Wildlife to avoid cross-contamination of samples and oil exposure of non-oiled Wildlife

- Carcasses and live oiled Wildlife may need to be retrieved using a boat if the shoreline cannot be safely accessed or safe wading operations are not feasible
- Wildlife collection surveys should be repeated daily as long as is deemed necessary to effectively document the impacts of the incident
- Banded or otherwise marked Wildlife should be kept separate from other carcasses; in the case of birds, information should be provided to ECCC-CWS personnel to ensure prompt and accurate reporting to the Bird Banding Office
- At the end of each day, or more frequently if possible, data on collected Wildlife must be transmitted into ICS through the identified representative (see Section 5.0 for survey reporting). The CWS Co-ordinator should also be informed via the Incident Command or appropriate channel of communication. It is essential to document all surveys conducted including those resulting in zero capture or collection.
- Incident-specific documentation may include, but not be limited to:
    - carcass collection protocols (e.g., Appendix VI)
    - chain of custody forms
    - beach/shoreline survey data sheets (Section 3.4.2; Appendix V)
    - electronic database maintaining records of surveys and results (see also Section 3.4.3.4 below)

3.4.3.2 Standardized Tools for the Field

Wildlife collection kits and protocols should be standardized to ensure that 1) Wildlife are collected in a safe and consistent manner that adheres to chain of custody requirements, 2) when called upon, samples are collected and stored appropriately for laboratory analysis and evidence, and 3) responders are readily equipped to respond efficiently to an incident with a range of potential required survey materials. Inventory for these kits is found in Appendix VI.

3.4.3.3 The Fate of Collected Live Oiled Wildlife

During a pollution response, ECCC-CWS provides guidance as to appropriate response strategies for the treatment of live oil-affected Wildlife. Where possible, these strategies should be outlined in WRPs developed for the incident. If a Wildlife treatment facility with valid operating permits is in place, all live affected Wildlife must be transported to the facility for documentation, assessment, and treatment. For information on how to safely transport oiled Wildlife to a treatment facility, consult the document entitled *Guidelines for the Capture, Transport, Cleaning, and Rehabilitation of Oiled Wildlife* (ECCC-CWS, 2022b). If no Wildlife treatment facility is in place or the facility cannot accept additional Wildlife because of capacity, then ECCC-CWS personnel should be contacted for advice and/or procedures, as outlined in the WRP for the incident.

3.4.3.4 Post-Field Assessments

Upon return from the field, dead Wildlife are brought into a laboratory or suitable space to allow more detailed examination of all Wildlife collected. At a minimum, the following information must be collected:

- Date and location of where Wildlife were found
- Degree of oiling
- Species or lowest level of taxonomic classification
- Data associated with any Wildlife bands or other markers

Additional information on individual Wildlife may be collected for scientific purposes; see Appendix VI for an example data sheet. This information is vital as it will form the basis of what is communicated to the CWS Co-ordinator and subsequently to the Incident Command, if in place, as part of the monitoring and deterrence and dispersal (sometimes referred to as "hazing") efforts. Following the incident, all data collected on recovered oiled Wildlife are to be compiled into a database along with information received from all other oiled Wildlife sightings (from the public and responders). This database, along with other relevant information, such as bird abundance and distribution in the vicinity of the impacted area (using information from monitoring and previously existing data), drift block information (if available), and information pertaining to the distribution and persistence of the oil slick, forms the basis for the prevention of further damage to Wildlife and their habitats and the assessment of the incident's impact on Wildlife populations and their habitats. Information must be reported to relevant agencies and the response operations (e.g., Incident Command) in a timely fashion.

Oiled carcasses are to be treated as hazardous waste and therefore require proper disposal. Procedures for disposing of contaminated carcasses will be outlined in the incident-specific Waste Management Plan and referenced in the WRP, or will otherwise be addressed by the Wildlife treatment facility (if an Incident Command has not been established). Provincial representatives or the Environmental Protection Operations Directorate (EPOD) may need to be contacted to inquire about disposal options in the region.

3.4.4 Recovering Wildlife During a Non-Pollution Incident

In Non-Pollution Incidents involving Wildlife (e.g., starvation and disease), all cases are treated similarly because of the time required to determine a diagnosis from the time the mortality is reported. ECCC-CWS's directions to responders, other agencies, and the RP are based on information provided by agencies with expertise in human health issues, including the Public Health Agency of Canada.

Searching for Wildlife during an uncontrolled or unexpected mass mortality event should follow the same procedures as outlined in the previous section. However, unless the cause of death during the collection phase is known, it should be assumed that Wildlife may have a zoonotic (infectious) disease, and for this reason, the investigation would generally be led by Provincial and Territorial departments and/or the Canadian Wildlife Health Co-operative (CWHC). As such, it is imperative that Wildlife are collected in a manner that protects human health while enabling a complete post-mortem examination to determine the cause of death. When available and if applicable, for necropsy and/or sampling, freshest carcasses should be preferentially collected over older carcasses. The following collection guidelines were developed with input from experts from the CWHC, Provincial and Territorial departments:

1. While wearing disposable rubber gloves, place dead Wildlife in individual plastic bags (if feasible) and tie shut. Partial remains of Wildlife carcasses should also be collected and placed in a separate bag. Totes, coolers, bags, and drums may be used as collection points for incidents involving large numbers of Wildlife.
2. Record the date and location where Wildlife were found and contact information of the individual making the collection by either:
    - writing directly on the bag with a permanent marker
    - attaching a label to the bag with the above-mentioned information
3. Place the labelled bag into a second plastic bag (i.e., double-bag) and tie shut.

4. After removing and disposing of gloves, thoroughly wash hands for 20 seconds with disinfecting soap, and any other items that may have been contaminated while handling the Wildlife.
5. During storage and shipping, store bag(s) in a cool area (e.g., outdoors during winter months or in a cooler with ice packs) that is sheltered from scavenging Wildlife. Freeze Wildlife if they are to be retained for more than several days. In the event of mass Wildlife casualties, it may be necessary to consolidate collections in drums or totes.
6. Contact the CWHC or a provincial/territorial veterinarian to arrange for the collection of dead Wildlife, or to consult on issues such as carcass disposal.

It is important to note that detailed protocols on handling and collecting potentially diseased Wildlife may already exist for a region (e.g., for birds: *Protocole de collecte des oiseaux sauvages morts ou moribonds dans le cadre de la surveillance intégrée du virus de l'influenza aviaire au Québec* (in French only), developed by provincial veterinarians in the Québec region; MAPAQ et MRNF 2007). Prior to collecting Wildlife, it is critical to contact CWHC or the provincial/territorial veterinarian acting as the regional representative leading the investigation to ensure that region-specific protocols are being followed if these are already in place.

4.0 Auxiliary Data Collection

Critical information on impacted Wildlife can be gathered by observers during surveys, but time is often a limiting factor during an incident. This section describes additional data that may be collected during incidents, depending on the objectives of the Wildlife surveillance operations. Whenever possible and if resources allow, observers should collect as much relevant information as possible such as degree of oiling, altered behaviours, and oil on water while they are conducting their main surveys. In addition, indicator species (e.g., ubiquitous bird with plumage color contrasting with oil color) can be selected to determine the detection rate of oiled birds.

4.1 Degree of Oiling

Birds can be checked for visible oil on the plumage as described in Ralph et al. (2010). Observers estimate the overall degree of oiling and the percentage of oiling. If time allows, this is done for each body part (neck, head, breast, belly, back, and side). The degree of oiling should be assessed according to the following system where a bird with soiled or discolored plumage is recorded as "light" oiling, while a thick, solid covering of oil would be recorded as "heavy":

- ***L*** = light
- ***M*** = moderate
- ***H*** = heavy
- ***P*** = possible oil covering the body (use when oiling is suspected, but the observer is unsure)

The percentage of oiling covering the body is then reported. For each individual or group of birds detected during the survey, the observers also record the time, latitude/longitude, species, number of individuals in the flock, number of individuals from the flock checked for oil, behaviour, and presence of oil on water. A data sheet example is found in Appendix X.

4.2 Behaviour

Behaviours demonstrated by oiled birds can include excessive preening, bathing, problems with diving, inability to take flight, loss of buoyancy, or a general sick appearance and are recorded as possible indicators of oiling as described in Ralph et al. (2010). When possible, sick or dead birds should be picked up and the pickup location recorded on the survey data form with GPS coordinates. Behaviour that may reflect the effects of oiling is recorded, including: excessive preening (***PR***), excessive bathing (***BA***), buoyancy loss (***BU***), quick diving (submerging shallowly and resurfacing quicker than a normal dive) (***DI***), looking sick and unwell (***SI***), normal behaviour (***NO***). If there are any other behaviours noted, record "***OT***" and describe in the comments. If the bird is sitting in or amongst oil, it is recorded in the comments. Data sheets are found in Appendix X.

4.3 Indicator Species

When the incident involves oil, detecting contaminated birds is difficult especially for aquatic birds with dark plumage that remain on the water and far from shore. In those conditions, detecting oiled birds can be virtually impossible, even with a spotting scope. It is therefore recommended that a probable rate of bird contamination be established using indicator species (e.g., gulls). Indicator species should represent the following characteristics:

- Widespread distribution across the area under assessment
- Plumage color contrasting with oil color
- Representative habitat use shared by species with dark plumage (e.g., gulls as a surrogate for cormorants)
- Year-round presence in some regions
- Propensity to gather on dry land (especially when they are contaminated), thus making them easier to observe

The percentage of oiling determined for indicator species only provides an indication of the contamination percentage for the other species in the impacted area. This assessment may over- or underestimate actual rates of contamination for different groups of birds, depending on several factors of the incident, including habitat associations and time of year (Lehoux and Bordage 1999). To provide an indication of the contamination risk for birds and the types of problems that the response team will face, a systematic count of all indicator species present in the ground survey area should be performed to obtain the percentage of contaminated birds and the degree of oiling (see Section 4.1). The assessment of indicator species should be done concurrently with other surveys (e.g., surveys from stationary platforms).

4.4 Drift Blocks

Drift blocks are often used as a proxy for oiled and dead marine birds and may play an important role in spill response and experiments for post-incident damage assessment. Spill response and WRPs should consider use of drift blocks during and/or following an incident where carcass collections are likely to form a basis for the damage assessment.

For incidents occurring near coastlines, beached bird surveys have historically been an important part of damage assessments to determine the extent of marine bird mortalities during oil spill events

(Flint et al. 1999, Castege et al. 2007) as well as chronic oil pollution (Wiese and Robertson 2004). Such estimates, however, benefit from carcass or drift block experiments that determine the sinking rates (Wiese 2003), drift rates (Wiese and Jones 2001), and, ultimately, the proportion of impacted birds that are likely to be deposited and found on shorelines (Hlady and Burger 1993, Castege et al. 2007, Martin et al. 2019). The proportion of impacted birds that are deposited on shore is typically a function of predominant winds and/or sea surface currents, and, therefore, drift block experiments will need to carefully consider: a) where oil was released and how it spread, b) where birds were likely to become impacted, and c) which shorelines (if any) would receive carcasses. In some experimental cases, deposition sites for carcasses may be hundreds of kilometers from the original spill location when oil drifts over large areas (Castege et al. 2007). Thus, carefully planned surveys must consider situation-specific circumstances including oil trajectories, predominant or actual weather at the time of the incident, and seasonal concentrations of birds.

In the open ocean, drift block/carcass deployments are less likely to come ashore (Martin et al. 2019), thus alternate methods for mortality assessment during oil spills may be necessary. Nonetheless, Fifield et al. (2017) demonstrated that drift blocks drift like carcasses, are detectable from supply vessels, and could therefore be useful to track potential drift patterns of oiled birds. Drift blocks deployed with satellite transmitters are also a useful way to monitor potential carcass distribution in remote locations or over prolonged periods (Fifield et al. 2017). Although there are limitations with the use of drift blocks for damage assessment in the offshore, they may still provide a tool for monitoring the dispersal of impacted birds as long as there is a means for re-sighting locations (e.g., field observations, satellite tracking) over an appropriate timeframe and area.

4.5 Oil on Water

During any survey, observations of oil along the transects can also be recorded. There are numerous approaches for recording oil on water and shorelines, which may differ among agencies and/or jurisdictions. Familiarity with these systems and ability to accurately quantify oil in the environment is a skill that requires training and experience. In Canada, this is most often conducted by Canadian Coast Guard, ECCC's National Environmental Emergencies Centre (NEEC), and oil spill Response Organizations. Nonetheless, a brief description here provides context for Wildlife surveys where observers may also record occurrence of oil.

Factors to consider and record when encountering oil include:

- latitude and longitude where oil is first encountered and where it is no longer present
- percentage of the water's surface with oil
- character of the oil (e.g., sheens, tar balls, thick mousse, oily foam, and slicks)
- thickness of the oil
- section width

Among these factors, oil thickness may be the most difficult to determine with accuracy and requires training and experience. Commonly used oil thickness ratings in Canada are summarized in Table 3 for oil on the water surface. Oil thickness on the water surface is particularly relevant for birds because different thickness poses different risks to birds. While surface oil of 10 µm thickness is thought to be a lethal dose for birds that come in contact with it (French-McCay 2009), oil sheens of 0.1 µm and 3 µm thickness (TAR codes C to F, Table 3) have been shown to alter feather microstructure in seabirds (O'hara and Morandin 2010). The exact thickness of oil that will cause

mortality of birds is difficult to ascertain; a lethal dose may depend on the amount of oil that birds swim through and accumulate on feathers (Morandin and O'hara 2016) and effects may be exacerbated in colder temperatures (Tuarze et al. 2019).

Thickness of oil deposited on shorelines is described by ECCC's SCAT manual (ECCC, 2018) and summarized in Table 4. The impacts of shoreline-deposited oil on birds are less well known.

Table 3. Marine oil spill thickness appearance rating (TAR) codes used and developed in Canada by Canadian Coast Guard and ECCC.

Category	Appearance	Full description	Thickness (µm)	Thickness (mm)	Quantity (L/km^2)
A	Barely visible	Barely visible under most favourable light condition. Films reflect more light than does water, and looks brighter. May need adjacent bare water for comparison.	0.04	0.00004	40
B	Silver sheen	Visible as a silvery sheen on water surface. A pearly or metallic luster is usually apparent.	0.075	0.000075	75
C	First colour trace	First trace of colour may be observed. First colour seen as a warm tone, more bronze than yellow. As film thickens, deep violet or purple appears: these colours begin the first part of rainbow bands.	0.15	0.00015	150
D	Bright colours	Bright bands of colour. The set of bands are in the sequence bronze, purple, blue green, in order of increasing thickness. These colours are pure and intense. As the thickness increases, the set of bands are slightly less intense and have a modified colour sequence: yellow, magenta (reddish violet), blue, green. They are quite pure.	0.3	0.0003	300
E	Dull colours	Colours begin to turn dull. There is a reduction in the number and purity of colours. Colours are a rich, terra cotta (brick red) and turquoise	1	0.001	1000

Category	Appearance	Full description	Thickness (µm)	Thickness (mm)	Quantity (L/km^2)
		(rather bright blue-green). As thickness increases, these colours are progressively duller or less pure looking. These sets of bands may also contain a trace of white or pale yellow. With increased thickness, any colour present is merely a tint in the light and dark alternating bands. The contrast between light and dark bands remains strong but weakens as thickness increases.			
F	Dark colours	Colours are much darker. It is apparent that interference effects are weak and they will quickly disappear as thickness increases.	3	0.003	3000
G	Yellowish brown	Original TAR Code is extended to include oil thicknesses included in the CCG Oil Spill Response Guide	10	0.01	10,000
H	Light brown or black		100	0.1	100,000
I	Thick dark brown or black		1000	1	1,000,000
J	Heavy oil near the source		10,000	10	10,000,000

Table 4. Surface oil thickness on shorelines described by the average or dominant oil thickness within the segment or zone. Table adapted from ECCC (2018).

Code	Category	Description
TO	Thick Oil	Generally consists of fresh oil or mousse accumulations >1 cm thick
CV	Cover	>0.1 cm to 1 cm thick
CT	Coat	>0.01 cm and ≤0.1 cm thick. Can be scratched off with fingernail on coarse sediments or bedrock
ST	Stain	≤0.01 cm thick. Cannot be scratched off easily from coarse sediments or bedrock
FL	Film	Transparent or translucent film or sheen

5.0 Survey Reporting and Data Archiving

5.1 Survey Reporting

Timely, concise and accurate reporting is essential to ensuring effective response during emergencies. Brief reports should be written after the completion of each survey to ensure that pertinent information is transmitted to relevant agencies and the response operations (e.g., Incident Command). Timely reporting ensures that information from bird surveys and Wildlife collection can inform response actions for subsequent operational periods. More comprehensive reports, including data analysis, may follow in subsequent days, weeks, or months, as needed, to provide overview of incident response and/or impacts (i.e., damage assessment).

Incidents should develop reporting needs and standards early in a response. These could include templates for individual survey reports and/or daily summaries.

Individual survey reports – Reports should be brief (1-5 pages), depending on the scope of the survey, to allow for timely communication to the response operation. Relevant details for individual surveys include the following:

1. Aircraft/vessel and personnel
2. Purpose of survey
3. Methods (with the following sub-headings)
    - Data collection methods
    - Survey design (description or maps of surveys)
    - Data analysis and modelling
4. Results
    - Flight/vessel path, duration, distance, observation conditions/weather
    - Species counts, bird distribution, oiled bird observations
    - Supporting maps
5. Recommendations
    - Describe how surveys results can inform response activities. This may include recommendations for deterrence and dispersal, priority areas for ground surveys, priorities for pollution containment/cleanup, and survey priorities for subsequent days.

Daily Wildlife summary reports – For large and/or on-going incidents, daily reports may be required to summarize most recent activities and cumulative efforts. Report length may vary (1 to 15 pages, excluding appendices) depending on the scope of the incident and response. Relevant factors for reporting surveys during a Wildlife Emergency include the following:

1. Introduction/summary
    - Purpose of surveys
    - Overview of Wildlife response activities

2. Summary of Wildlife observations
    - Current day and cumulative total(s) of
        i. survey effort (number of vessels/aircraft/teams)
        ii. Wildlife observed (by species and/or species groups)
        iii. Wildlife abundance, distribution and densities
    - Maps of completed surveys
3. Impacted Wildlife
    - Current day and cumulative total(s) of observed and/or collected impacted Wildlife
4. Summary of other activities related to the response (as appropriate)
    - New reconnaissance surveys for Wildlife or pollution
    - Updated oil spill trajectory models
    - Rehabilitation facilities and progress
5. Planned surveys for subsequent days
    - Maps of completed and planned surveys, presented in context of other operational activities (observed or modeled pollution, resources in the field)
6. Appendices
    - Raw data
    - Weather forecasts
    - Activity schedules

5.2 Data Archiving

In addition to reporting, record-keeping and data archiving is essential to preserve the results of the surveys that may form a record of the response and be used for purposes of damage assessment. Needs and standards for data archiving should be developed in Wildlife Response Plans and/or early in the response. Factors for consideration include the following:

- Needs of relevant agencies
- Use of existing, applicable databases, where available
- Developing standardized templates, spreadsheets, and databases
- Developing standardized file naming conventions and unique identifiers for collected Wildlife
- Archive of relevant spatial data, including:
    - flight/vessel track lines and stationary platform survey locations
    - waypoints of observed birds
    - polygons of pollution extent
- Developing systems for efficient data entry and transfer
- Data analysis, models, maps and other interpreted products

6.0 Custodian

The custodian for the *Guidance and Protocols for Wildlife Surveys for Emergency Response* and any amendments thereto is the:

Director General, Regional Operations Directorate
ECCC-CWS
ECCC

The approval of future updates is vested to the Director General, Regional Operations Directorate, ECCC-CWS.

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Appendix I: Protocol for Aerial, Ground, and Vessel Reconnaissance Surveys During an Emergency Response

Personnel. A pilot or boat driver, a primary observer, and a data recorder. If a 4th person available, use one data recorder and two observers (one for each side of aircraft/vessel). In the case of coastal surveys, only a primary observer and a data recorder are needed and can drive the truck and/or the ATV. Observations are conducted from a position that provides the best vantage depending on visibility, sun glare, or surrounding activities.

Equipment and equipment settings. Minimal equipment include field note book, pen/pencil, binocular, and GPS. If more equipment is available, observations on species distribution and abundance should be recorded as a digital voice file using either one of two methods: 1) dictated into a voice recorder capable of PC connectivity and time stamping of observation files or 2) using software installed on a laptop computer that can record voice observations and link the file to geo-referenced position information (e.g., PC-Mapper). A GPS should be used to record track information to facilitate mapping survey coverage of the area, or if using PC-Mapper, the tracking option should be on. Other equipment required will vary depending on the equipment being used, but could include GPS-equipped laptops, digital Dictaphones, etc. This will ensure observations can easily be linked to locations derived from a GPS track file.

Recording birds observed.

- Using a hand-held GPS (the recorder will be in charge of this), record the track of the route
- In a field note book, record all birds observed along the route, taking a waypoint and recording the unique identifier for each bird observation
- Print the data sheet below or prepare your note book with the following headers: 1) waypoint, 2) latitude and longitude if readily available and if time allows it, 3) species (or bird group if species not known), 4) count of birds observed, 5) behaviour of birds with a special attention to potentially oiled birds (see codes for association and behaviours in the data sheet), and a comment header to note any relevant information (e.g., are habitats impacted?)
- If taking a waypoint becomes too onerous for the recorder, then only take waypoints for “significant” observations (i.e., large groups of birds, rare species, oil on water, potentially oiled bird)

Metadata. Along with species identification (to the lowest taxonomic level possible) and number of individuals as stated above, information on the company/agency, observer name and position, date, time at start/end, latitude/longitude at start/end, true aircraft/platform speed/direction, altitude, vessel/aircraft type, and any other variable that may affect detectability or may be relevant to the survey should be recorded if time allows it. Where possible, affected bird habitats should also be identified to help guide response operations (deterrence and dispersal, clean-up prioritization).

Birds that are oiled or injured. Record all birds that are oiled or demonstrating signs of oiling (in the case of an oil spill) or in distress (in the case of other Pollution Incidents or Non-Pollution Incidents). Whenever a bird is observed with traces of oil on the body or demonstrating oiled behaviour, it should be clearly recorded. When possible, sick, injured or dead birds should be picked up following appropriated protocols; the pickup location (and GPS coordinates) should be recorded on the data sheet used for bird collection during an emergency response (see Appendix VI). The survey is suspended during the collection and resumed afterwards.

Survey protocol for documenting birds associated with a breeding colony. Surveys can also be used to document active breeding colonies without disturbing breeding birds, as follows:

- While slowly circumnavigating the island at a reasonable distance from the island, record the number of individuals of each species present on the cliffs, rocky ledges, and/or the level interior of the island
- Include birds that may fly away in response to the approaching aircraft/boat/personnel

Record the species and number for each island under the same headers as above.

Data analysis/reporting. Upon return from the survey, observations should then be transcribed and entered into a spreadsheet or standardized database format (e.g., Microsoft Excel or Access) to facilitate data sharing and archiving. Tracks and observation waypoints should be mapped using mapping software.

Recording Observation Period Information

This section provides detailed information on recording information during each observation period, examples on how survey information is recorded, and corresponding data sheets.

Company/agency: Indicate here the company, agency, or organization that requested the surveys.

Platform/aircraft/location name: Indicate the aircraft or platform name. In the case of surveys conducted from the shore, indicate the name of the area (wharf, bay, point, presqu'ile, etc.) and assigned survey location name. If no such name exists, the coordinates must be used.

Platform/aircraft type: Platform/aircraft type may include offshore supply vessel, fishing boat, research ship, etc.

Observer(s) name(s) and position(s): Indicate the first and last name of the primary observer. If a second observer is assisting with the survey, also indicate the name of the secondary observer. Also indicate their position during the survey.

Date: Date that the observation period occurred. Use format DD-MMM-YYYY (e.g., 12-Apr-2008) to avoid ambiguity.

Time at start / time at end: Record the time (using 24-hour notation) at the start and end of the observation period. Use Universal Time (UTC) to standardize across regions. Note that the conversion from local time (L) to UTC will be influenced by daylight savings time. Circle ***UTC*** or ***L***.

Latitude at start/end / longitude at start/end: Indicate position of platform in either decimal degrees (e.g., 47.5185) or degree decimal minutes (e.g., 47˚ 31.11') depending on which format is available to you.

True aircraft/platform speed (kt) and **True aircraft/platform direction (°):** Record the true platform speed in knots and the true (not magnetic) platform direction in degrees.

Altitude (m): Indicate height of observer's eye above the water in metres.

Notes: Make note of disturbances or relevant activities in the area, especially if there are large vessels or fishing activities nearby, or if your vessel is sounding the fog horn.

Recording Bird Information

Record all information possible for each bird as time allows. As a minimum, a waypoint, the species (which can be unknown), and count must be filled in for each sighting.

Waypoint: record the name of the waypoint taken with the GPS. If time allows it, record the latitude and longitude of the waypoint.

Species: Identify each individual bird seen to species. If this is not possible, identify to genus or family. Record all unknowns, even if they are identified only as "unknown gull" or "unknown bird".

Count: Record the number of birds in each sighting in the count field. Record homogenous flocks on a single line. For example, a group of ten Common Murres close together on the water is recorded in a single row as a flock of ten and not in ten individual rows. If large numbers are present, estimate the number as accurately as possible.

Association and **Behaviour:** Record one or more association and/or behaviour codes with each bird when appropriate (see Appendix VII for association and behaviour codes). Codes #16 "Associated with oil slick", #97 "Oiled birds contaminated with oil", #98 "Sick/unwell weakened individuals not behaving as normal, healthy birds, but without obvious injuries", and/or #99 "Dead" are especially relevant in the context of a Pollution or Non-Pollution Incident. If the observer suspects that a bird is oiled but is uncertain, a comment can be added with the mention "Possible". Record homogenous flocks on a single line. For example, if a group of ten Common Murres close together on the water is observed, but only one is oiled, record nine birds as a flock in a single row and one bird in another row with code 16 under the field **Association** and code 97 under the field **Behaviour**. Add any other useful information under the field **Comments**. Other general behaviours of birds can be recorded (e.g., in transit, feeding, loafing, etc.).

Comments: Space is provided to record other pertinent information such as plumage, unusual behaviours, any useful information with regards to the incident, etc. In case of an oil spill, behaviours such as excessive preening, excessive bathing, loss of buoyancy, problems with diving, inability or difficulty to fly, or a general sick appearance, can be recorded as possible indicators of oiling. Impacted habitats (occurrence and type) can be recorded in this field.

Data sheet for reconnaissance surveys from an aircraft, a vessel or from the ground

Observation Period Information:

Company/agency	
Platform/aircraft/location name	
Platform/aircraft type	
Observer(s) name(s) and position(s)	
Date	D D – M M M – Y Y Y Y
Time at start (UTC or L)	
Time at end (UTC or L)	
Latitude at start / end	/
Longitude at start / end	/
True aircraft/platform speed (kt)	
True aircraft/platform direction (°)	
Altitude (m)	
Notes:	

*Waypoint	Location (lat./long.)	*Species	*Count	Assoc./Behav.[1]	Comments

* Bird Information: ***this field must be completed for each record**

[1] Codes for association (e.g. ***16*** = with oil slick, ***18*** = with obs. platform) and behaviours (e.g. ***97*** = oiled, ***98*** = sick/unwell, ***99*** = dead). If oiling is suspected, write “possible” in the comments.

Appendix II: Protocol for Surveys from Vessels in Open Water

The following methods for conducting bird surveys from a vessel (also called “moving platform”) in open water have been adapted from Gjerdrum et al. (2012).

Minimum requirements. Only conduct surveys when the platform is travelling at a minimum speed of 4 knots (7.4 km/h) and a maximum of 19 knots (35.2 km/h). Dedicated seabird surveys are best done at a speed of around 10 knots. If the platform is travelling less than 4 knots, conduct surveys using the protocol for surveys from stationary platforms from Appendix III.

Observer position. Conduct observations from a position on board the ship that provides the best vantage (typically the bridge or bow of the vessel, and outdoors when feasible), facing the bow of the vessel, on either the port or starboard side depending on visibility, sun glare, or bridge activities.

Metadata and environmental data collection. Along with species identification (to the lowest taxonomic level possible) and number, information on environmental conditions and other metadata should be dictated into a voice recorder at the frequency at which it changes. This includes visibility, weather conditions, glare, sea state, wave height, wind speed and direction, ice type and concentrations, and temperature. In addition, observer name and position, speed, altitude, vessel type, and any other variable that may affect detectability or may be relevant to the survey. Where possible, affected bird habitats should also be identified to help guide response operations (deterrence and dispersal, clean-up prioritization).

Equipment and equipment settings. Observations on species distribution and abundance should be recorded as a digital voice file using either one of two methods: 1) dictated into a voice recorder capable of PC connectivity and time stamping of observation files or 2) using software installed on a laptop computer that can record voice observations and link the file to geo-referenced position information (e.g., PC-Mapper). A GPS should be used to record track information to facilitate mapping survey coverage of the area, or if using PC-Mapper, the tracking option should be on. Other equipment required will vary depending on the equipment being used, but could include GPS-equipped laptops, digital Dictaphones, etc. This will ensure observations can easily be linked to locations derived from a GPS track file.

Data analysis/reporting. Voice recordings should be transcribed and entered into a spreadsheet or standardized database format (e.g., Microsoft Excel or Access) to facilitate data sharing and archiving. Tracks and observation waypoints should be mapped using mapping software.

Transect method. Conduct surveys while looking forward from the vessel, scanning at a 90^{o} angle from either the port or starboard side. Priority is given to birds observed in transect (Figure II-1). Birds outside of the transect are recorded if these observations do not interfere with in-transect observations.

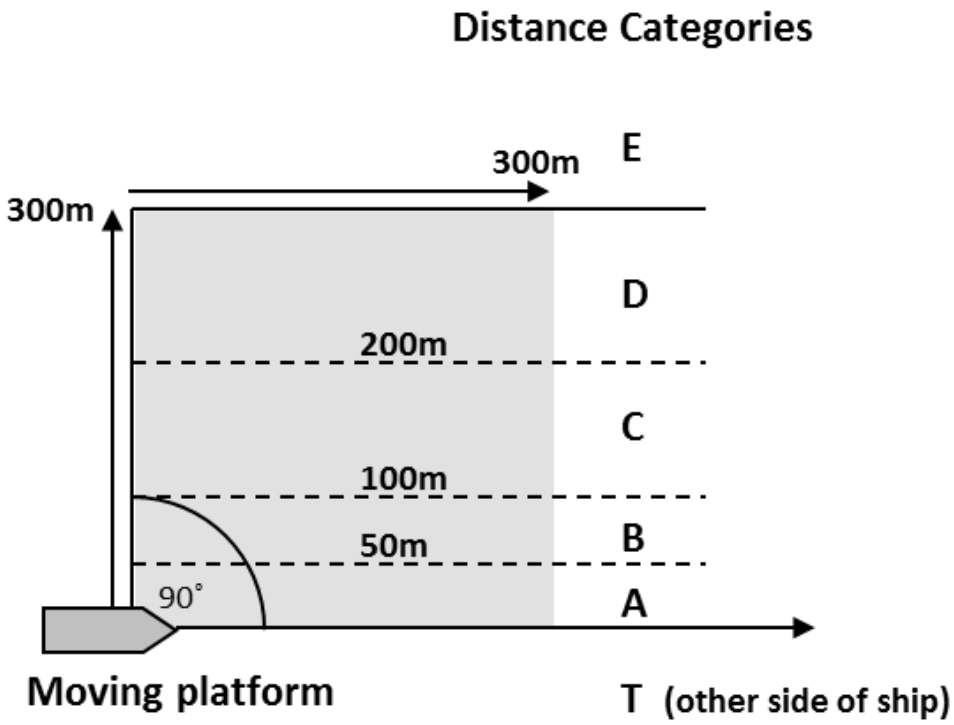


Figure II-1: Illustration of a survey using a 90° scan, covering a 300-m transect from a vessel. The perpendicular distance from the observer to the bird(s) is estimated (distance categories A–D). Birds observed outside the transect (distance categories E and T) are normally also recorded if this does not affect observations within the transect. The shaded area is considered the snapshot box, in which flying birds are considered in transect if observed during a snapshot interval.

Estimating transect width. Observers should practice estimating the width of the transect and perpendicular distance bands (A–D in Figure II-1) prior to beginning observations. This can be accomplished with a distance gauge made from a transparent plastic ruler (see Appendix VIII). This gauge should be kept close at hand to verify transect width and bird distances over the course of the surveys. For more accurate delineation of distance bands, strings can be placed on the window, which considers that bands converge at the vanishing point ahead on the horizon (Bolduc and Desbiens, 2011; see Appendix VIII for a summary).

Five-minute periods. A survey consists of a series of 5-min observation periods, which are exclusively dedicated to detecting birds. Conduct as many consecutive 5-min observation periods as possible, regardless of whether birds are present or not, and try to ensure consistent coverage throughout the day.

Poor visibility. When part of the 300-m transect is not visible due to fog, surveys should still be conducted but the new width of the transect must be recorded. Always record any weather that reduces visibility, such as fog, rain, waves, seawater splashing on bridge windows, heavy precipitation, or snow.

Null observation periods. Record “No birds observed” when no birds were detected during a 5-min period, as this type of information is also important. On the contrary, during the snapshot, if no birds are observed, you do not need to record anything.

Recording birds on the water. All birds observed on the surface of the water are continuously recorded throughout the 5-min period and their perpendicular distance from the observer is estimated (distance categories A–D; Figure II-1). When visibility is good, birds on the water may be seen up ahead of the platform, perhaps as far as 400 or 500 m. Because these individuals may dive or fly away as a result of the approaching vessel, they should be counted as in transect and their perpendicular distance recorded when they are first detected (unless the observation period will end before the ship reaches them, in which case they are recorded in the next period). If a bird appears to have been flushed off the water, count it as a "water" bird and be sure this same bird is not subsequently counted as a flying bird during a "snapshot" (see "recording birds in flight" below for description of snapshot).

Recording birds in flight. During the observation period, more birds will fly through the survey area than were present in that area at a single instant in time. The faster birds fly relative to the ship speed, the greater the number of birds passing through during a 5-min period. If these flying birds are counted continuously as they are encountered, their density will be overestimated. Therefore, flying birds are recorded using a series of instantaneous counts, or "snapshots", at regular intervals throughout the observation period. The time interval between snapshots depends on the speed of the ship and is chosen so that the ship moves roughly 300 m between snapshots (Table II-1).

Table II-1: Intervals at which instantaneous snapshot counts of flying birds should be conducted.

Platform speed (knots)	Platform speed (km/h)	Interval between counts (minutes)
4.0 – 4.4	7.4 – 8.1	2.5
4.5 – 5.4	8.2 – 10	2.0
5.5 – 8.4	10 – 15.5	1.5
8.5 – 12.4	15.5 – 23	1.0
12.5 – 19.0	23 – 35	0.5

At the time of the snapshot, all flying birds within 300 m of the observer are counted (Figure II-1 — shaded area is considered the snapshot box) and their perpendicular distance estimated at the time of the snapshot (distance categories A–D). Flying birds are then ignored until the start of the next snapshot. In this way, the entire survey transect is covered by a series of instantaneous snapshots. During each snapshot, flying birds are recorded as in transect only if they are within the snapshot box. All other flying birds that are sighted outside the snapshot box or between snapshot intervals are recorded as not in transect. If no birds are observed during the snapshot, you do not need to record anything.

It is strongly recommended that a countdown timer is used to indicate snapshot intervals. If travelling at a speed of 10 knots, for example, the timer will be set to "beep" every minute, indicating that a count of flying birds is required.

Lines of flying birds. Some species (e.g., alcids, gannets, and waterfowl) may fly in long lines across the survey area. At the time of the snapshot, count the number of birds in the flock and estimate the distance to the centre of the flock. All birds are recorded as in transect if the centre of the flock is within the 300-m snapshot box. If the centre of the group is beyond 300 m, they are recorded as outside the transect, despite some individuals being in the transect.

Birds that are oiled or injured. Whenever a bird is observed with traces of oil on the body or demonstrating oiled behaviour, it should be clearly recorded. In this case, the codes for associations and behaviours #16 “Associated with oil slick”, #97 “Oiled birds contaminated with oil”, #98 “Sick/unwell weakened individuals not behaving as normal, healthy birds, but without obvious injuries”, and/or #99 “Dead”, should be recorded (see Codes for associations and behaviours; Appendix VII). All mentions of oiled birds, whether inside or outside of the transect, need to be recorded. If the observer suspects that a bird is oiled but is uncertain, a comment can be added with the mention “Possible”. When possible, sick, injured or dead birds should be picked up following the protocol and the pickup location should be recorded on the data sheet used to collect information on birds collected during an emergency response with GPS coordinates (see Appendix VI). The survey is suspended during the collection and resumed afterwards.

Birds that follow the ship. After recording a flying bird, subsequently ignore it if you think it is following the ship. Do not record the same bird on subsequent snapshots, even if it leaves and then re-enters the survey area. When dozens or more birds are following the vessel, it will be impossible to determine which individuals you have already recorded and those that have recently joined the ship. In this case, estimate the number of birds following the ship at regular intervals (i.e., once an hour) and note their association as ship followers. Ignore the ship followers at intervals between counts. If you can determine that there are new individuals joining the flock, these are recorded as you would for any flying bird. For some species (e.g., waterfowl), birds can be flushed forward even using the snapshot method, which increases the risk of counting the same group of birds twice. Some awareness of observers of the size and demographics of flocks (i.e., number of males, females, and juveniles) can help prevent double counting.

Recording Observation Period Information

This section provides detailed information on recording information during each observation period for vessels, examples on how survey information is recorded, and corresponding data sheets.

Company/agency: Indicate here the company, agency, or organization that requested the surveys.

Platform name and type: Indicate the platform name. Platform type may include offshore supply vessel, fishing boat, and research ship.

Observer(s): Indicate the first and last name of the primary observer. If a second observer is assisting with the survey, also indicate the name of the secondary observer.

Date: Date that the observation period occurred. Use format DD-MMM-YYYY (e.g., 12-Apr-2008) to avoid ambiguity.

Time at start / time at end: Record the time (using 24-hour notation) at the start and end of the observation period. Use Universal Time (UTC) to standardize across regions. Note that the conversion from local time (L) to UTC will be influenced by daylight savings time. Circle ***UTC*** or ***L***.

Latitude at start/end / longitude at start/end: Indicate position of platform in either decimal degrees (e.g., 47.5185) or degree decimal minutes (e.g., 47˚ 31.11') depending on which format is available to you.

Platform activity: Platform activity may influence observations and should therefore be noted. Activity could include steaming, skimming, on stand-by, etc.

True platform speed (kt) and **True platform direction (°):** Record the platform speed in knots and the true (not magnetic) platform direction in degrees. If the platform speed or direction changes significantly during an observation period, terminate the observation period and record the time and position of termination. Start a new observation period, recording the new speed and/or direction.

Observation side: Circle whether you are surveying from ***starboard*** or ***port*** side.

Height of eye (m): Indicate height of observer's eye above the water in metres. This measurement is important to calculate distance categories and may need to be measured with a measuring tape or rope.

Outdoors or indoors: Circle ***Out*** when conducting observations from a position outdoors and ***In*** for indoor observations.

Snapshot used?: Indicate if snapshot method is being used for birds in flight by circling ***Yes*** or ***No***. Under normal circumstances, snapshots should always be used for birds in flight.

Visibility (km): Estimate visibility in kilometers by determining the greatest distance at which an observer can distinguish objects, ideally black, against the horizon sky with the unaided eye. Visibility will be considerably less during foggy conditions.

Weather conditions code: Record the general weather conditions at the time of the survey using codes in Appendix VII. Record the most prominent conditions within the survey area.

Glare conditions code: Light reflecting off the surface of the water can often influence bird detection. Record the glare conditions at the time of the survey using codes in Appendix VII.

Sea state code: Sea state codes give an approximate description of current conditions on the surface of the water. Use codes from Appendix VII.

Wave height (m): Estimate wave height in meters from the highest point of a wave (peak) to the lowest point (trough).

True wind speed (kt) or Beaufort code: Indicate wind speed in knots. If observations are from a vessel, be sure to record the true wind speed, as this takes into account the apparent wind generated from the forward momentum of the vessel. If relative wind speed is the only measurement available, indicate that you are recording relative wind speed so that appropriate adjustments can be made later. If no measurements are available, estimate wind speed using Beaufort codes from Appendix VII.

True wind direction (°): If observations are from a vessel, be sure to record the true wind direction in degrees, as this takes into account the apparent wind generated from the forward momentum of the vessel. If relative wind direction is the only measurement available, indicate that you are recording relative wind direction so that appropriate adjustments can be made later. Use ***ND*** (No Direction) if the wind direction is variable or too light to indicate any particular direction.

Ice type and concentration codes: If ice is present during the survey, indicate the type and concentration using codes from Appendix VII. Indicate in the notes section whether the ice is present within or beyond the transect limits.

Temperature (°C): Record outdoor temperature in degree Celsius.

Notes: Make note of disturbances or relevant activities in the area, especially if there are large vessels or fishing activities nearby, or if your vessel is sounding the foghorn.

Recording Bird Information

Record all information possible for each bird as time allows. As a minimum, the species (which can be unknown), count, fly or water, and in transect fields must be filled in for each sighting. Note that some fields are only appropriate for certain species. For example, age and sex will only be recorded for species where this can be determined (e.g., ageing gulls or sexing waterfowl).

Give priority to birds that are in transect because these are the only ones that are used in density estimates. Birds recorded outside the transect are not used in density estimates, but they do give important information on distribution, species occurrence, timing of occurrence, and behaviour, and every effort should be made to record them if time permits.

Record all birds that are oiled or demonstrating signs of oiling (in the case of an oil spill) or in distress (in the case of other Pollution Incidents or Non-Pollution Incidents) whether they are in transect or not.

Species: Identify each individual bird seen to species. If this is not possible, identify to genus or family. Record all unknowns, even if they are identified only as “unknown gull” or “unknown bird”.

Count: Record the number of birds in each sighting in the count field. Record homogenous flocks on a single line. For example, a group of ten Common Murres close together on the water is recorded in a single row as a flock of ten and not in ten individual rows. If large numbers are present, estimate the number as accurately as possible.

In transect?: Indicate whether the bird observed is in (***Y***) or out (***N***) of the transect. Give priority to birds that are in the transect; record birds seen outside of the survey area if activity levels permit. **Birds on water** are considered in transect when they are within the 300-m perpendicular distance from the observer (Figure II-1). When visibility is good, birds on the water may be seen up ahead of the platform (perhaps as far as 400 or 500 m), but still within the 300-m transect. Because these individuals may dive or fly away as a result of the approaching vessel, they should be counted as in transect and their perpendicular distance recorded when they are first detected (unless the observation period will end before the ship reaches them, in which case they are recorded in the next period). **Flying birds** are only considered in transect when they are flying within the snapshot box (Figure II-1) at the time of a snapshot.

Distance: Record the distance to each bird or flock. This information is used to assess detectability and account for missed birds. For all birds, estimate the perpendicular distance between the bird(s) and the observer (Figure II-1). Distance categories are as follows: ***A*** = 0-50 m, ***B*** = 51-100 m, ***C*** = 101-200 m, ***D*** = 201-300 m, and ***E*** = > 300 m. Record flocks of birds as a single unit by recording the distance to the centre of the flock. For example, if a group is straddling the 300-m boundary with the flock centre located in ***D*** (with some individuals inside and some individuals outside the transect) record the entire flock as being in ***D*****.** If the flock centre is outside the transect, record the entire flock as distance class ***E***. It is very important to record distance to birds within the 300-m strip, but if this is not possible (i.e., too busy), you may use ***3*** = within 300 m but no distance recorded. Distance ***T*** is used to indicate that the bird or flock was observed on the opposite side of the vessel (vessels only).

Fly or water?: Indicate whether the bird observed is in flight or on the water and whether it is feeding. Occasionally you will have a songbird that lands on the ship. These birds can be recorded in the notes section as on the ship. When surveying close to land (including islands), birds sitting on land may be recorded in the notes as on land.

Association and **Behaviour:** Record one or more association and/or behaviour codes with each bird when appropriate (see Appendix VII for association and behaviour codes). Codes #16 "Associated with oil slick", #97 "Oiled birds contaminated with oil", #98 "Sick/unwell weakened individuals not behaving as normal, healthy birds, but without obvious injuries", and/or #99 "Dead" are especially relevant in the context of a Pollution or Non-Pollution Incident. If the observer suspects that a bird is oiled but is uncertain, a comment can be added with the mention "Possible". Record homogenous flocks on a single line. For example, if a group of ten Common Murres close together on the water is observed, but only one is oiled, record nine birds as a flock in a single row and one bird in another row with code 16 under the field **Association** and code 97 under the field **Behaviour**. Add any other useful information under the field **Comments**.

Flight direction: Indicate true direction (***N***, ***NE***, ***E***, ***SE***, ***S***, ***SW***, ***W***, ***or NW)*** birds in flight are heading if they are not associated with the platform. If birds are not flying in any particular direction, record as ***ND***.

Age: Age is based on plumage, where ***J***(uvenile) = first coat of true feathers acquired before leaving the nest and ***I***(mmature) = the first fall or winter plumage that replaces the juvenile plumage and may continue in a series that includes first-spring plumage, but is not the complete ***A***(dult) plumage.

Plumage: Adult plumage can be further categorized as ***B***(reeding) = spring and summer plumage and ***NB*** (non-breeding) = fall and winter plumage. ***M*** is used to indicate a bird with flight feather moult.

Sex: Sex can be determined for some individuals (i.e., waterfowl). Indicate whether the bird observed is ***M***(ale), ***F***(emale), or ***U***(nknown).

Comments: Space is provided to record other pertinent information such as plumage, unusual behaviours, any useful information with regards to the incident, etc. In case of an oil spill, behaviours such as excessive preening, excessive bathing, loss of buoyancy, problems with diving, inability or difficulty to fly, or a general sick appearance, can be recorded as possible indicators of oiling.

Recording heterogeneous groups of birds. Sometimes flocks of birds will contain multiple species or age classes and will require multiple rows on the data sheet (i.e., a flock containing both Great and Sooty Shearwaters or a flock of kittiwakes containing both adults and immatures or a flock containing contaminated and clean birds). Subsets of the group that share the same morphological and behavioural characteristics are recorded in the same row (i.e., all adult kittiwakes in breeding plumage flying in the same direction). Other individuals from the group that have different characteristics (i.e., juveniles) are recorded in subsequent rows. Draw an arc on the data sheet linking all rows from the group to indicate that they were observed together.

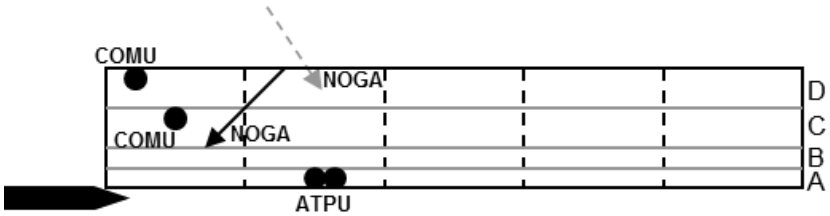
Example of a 5-minute survey from a vessel

Hydrocarbons have been released approximately 150 km offshore from a ship that has come loose from its tow line and is now sinking. Seabird surveys are required to get an estimate of mortality. It is 12 July 2014 and our position at 08:00 (the beginning of our first 5-min survey) is 48.26 degrees

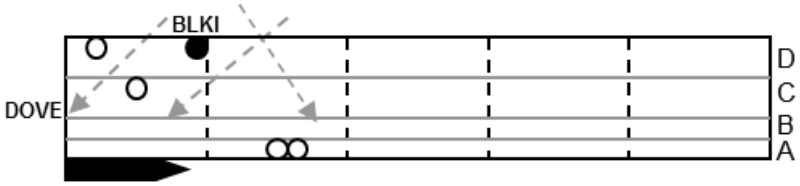
latitude and -50.95 degrees longitude. The ship we are on is travelling east at 10 knots; based on the speed of the vessel, we will conduct a snapshot for flying birds every minute (see Figure II-1), or 5 times during the survey. Flying birds detected between snapshots are recorded as not in transect. It is a clear day, no clouds, 5 knot northwest winds, with half metre swells.

In the diagrams that follow, birds on the water are represented by circles (full circles are in transect, open circles are outside transect) and flying birds by arrows (birds are at the position of the arrowhead; solid lines are in transect, dashed lines are outside transect). The dashed vertical line represents the 300-m distance ahead of the observer, providing an outline of the area in which flying birds are considered in transect. The survey begins with a snapshot of flying birds.

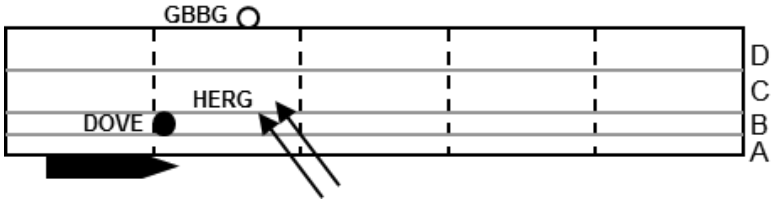
a. We begin the observation period at 08:00 with a count of the flying birds as well as those birds we see on the water. We see 2 separate adult Northern Gannets (NOGA) flying, although we only count one as in transect (at distance C), as the other is more than 300 m in front of the vessel. We also see 2 Common Murres (COMU) on the water to the port side of the vessel, at distances C and D. These are recorded as in transect. We see 2 Atlantic Puffins (ATPU) together on the water, more than 300 m in front of the vessel (distance A). We will also count these as in transect, although we will be careful not to count them again as we get closer.



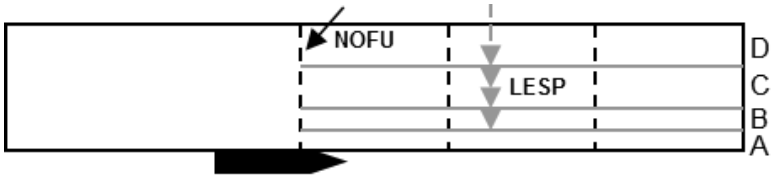
b. We are about 30 s into the 5-min observation period, in between snapshot counts. We have already counted the 2 murres and 2 puffins on the water (shown in the figure as open circles), but an adult Black-legged Kittiwake (BLKI) has appeared on the water at distance D, and we add this to our list of birds in transect. Despite the appearance of a flying Dovekie (DOVE) at distance C, we do not count it as in transect because we are between snapshots. We add the Dovekie to our list but indicate that it is not in transect.



c. At minute 1, we take another snapshot count of flying birds. A flock of Herring Gulls (HERG) is observed travelling NW. The centre of the flock is at distance B. We also see 1 Dovekie (DOVE) on the water at distance B and 1 Great Black-backed Gull (GBBG) outside the 300-m transect (distance E). With the exception of the gull outside the 300-m transect, these new birds are in transect.

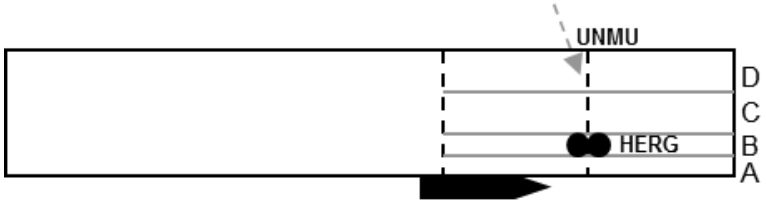


d. At minute 2, we perform another snapshot and count 1 flying Northern Fulmar (NOFU) in transect at distance D travelling SW. We record the flock of 4 Leach's Storm-Petrels (LESP) flying south ahead of the vessel, but do <u>not</u> count them as in transect, as they are beyond 300-m in front of us (i.e., not in the snapshot box). We see no new birds on the water over the next minute.



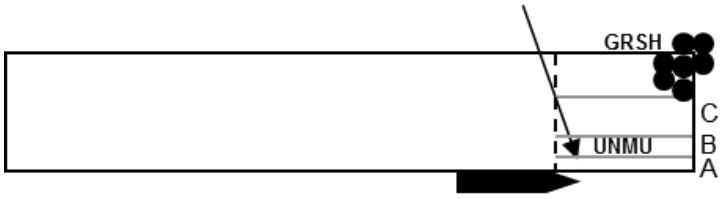
e. At minute 3, we conduct another snapshot. No new birds are observed, so nothing new is written on our data sheet.

f. At 3:42 into our survey, a murre of unknown species (UNMU) is observed flying but we <u>do not</u> count it as in transect because <u>we are between snapshots</u>. We will record it as <u>not</u> in transect. We record the 2 Herring Gulls (HERG) feeding up ahead on the water, both in transect at distance B. Since one is a juvenile and one is an adult, we enter them on the data sheet in 2 rows, linking the 2 with a line in the left margin.

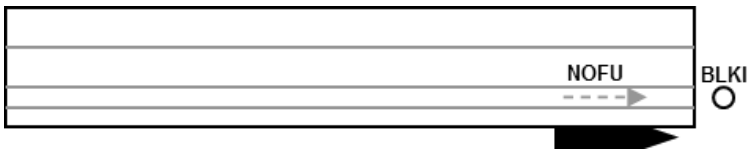


g. At minute 4, our next snapshot takes place, and we see that the unknown murre (UNMU) we saw flying earlier (see frame f) can now be recorded as in transect at distance B, as it is within the snapshot box and observed during the snapshot. If we know for certain that this is the same individual we previously recorded as not in transect, we can cross the previous observation out. If we are not certain that this is the same individual we do not cross anything out.

   There is also a large flock of 200 Great Shearwaters (GRSH) on the water near the edge of the 300-m transect. Since the centre of the flock is within the transect, at distance D, we count all the shearwaters as in transect (if the centre of the flock had been beyond 300 m, we would have recorded them as outside the transect, despite some individuals being in the transect).



h. As we approach the end of the 5-min observation period, we record a Northern Fulmar (NOFU) that is following us (at distance B) but has not been previously recorded. We record it as not in transect since we are not at a snapshot point. We do not record the Black-legged Kittiwake (BLKI) we can see ahead of the vessel because by the time we reach it, the 5-min observation period will be over, and the bird will likely be counted in the next period.



Data sheet for surveys from a vessel

Observation Period Information:

Company/agency		Visibility (km)	
Platform name and type		Weather conditions code	
Observer(s)		Glare conditions code	
Date	D D – M M M – Y Y Y Y	Sea state code	
Time at start (UTC or L)		Wave height (m)	
Time at end (UTC or L)		True wind speed (kt) or Beaufort code	
Latitude at start / end	/	True wind direction (°)	
Longitude at start / end	/	Ice type code	
Platform activity		Ice concentration code	
True platform speed (kt)		Temperature (°C)	
True platform direction (°)			
Observation side	Starboard Port		
Height of eye (m)			
Outdoors or Indoors	Out or In		
Snapshot Used?	Yes or No		
Notes:			

Bird Information: *this field must be completed for each record

*Species	*Count	*In transect?	*Distance[1]	*Fly or water?	Assoc.[2]	Behav.[2]	Flight direc.[3]	Age[4]	Plum.[5]	Sex	Comments

[1] ***A*** = 0–50 m, ***B*** = 51–100 m, ***C*** = 101–200 m, ***D*** = 201–300 m, ***E*** = > 300 m, and ***3*** = within 300 m but no distance recorded.
[2] See Codes for association (e.g. ***16*** = with oil slick, ***18*** = with obs. platform) and behaviours (e.g. ***97*** = oiled, ***98*** sick/unwell, ***99*** = dead). If oiling is suspected, write “possible” in the comments.
[3] Indicate flight direction (***N***, ***NE***, ***E***, ***SE***, ***S***, ***SW***, ***W***, or ***NW***); ***ND*** = no apparent direction.
[4] ***J***(uvenile), ***I***(mmature), or ***A***(dult).
[5] ***B***(reeding), ***NB***(non-breeding), or ***M***(oult)

Appendix III: Protocol for Surveys from Stationary Platforms or Coastal Surveys

Minimum requirements. Use the stationary scan method when the platform is travelling less than 4 knots (7.4 km/h) or is stationary (e.g., offshore oil drilling platform). This survey can be conducted from locations on the shores.

Observer position. Conduct surveys from a position outdoors whenever possible, as close as possible to the edge of the platform or the shore. Observers should scan from the same location each time to increase the comparability among scans.

Metadata and environmental data collection. Along with species identification (to the lowest taxonomic level possible) and number, information on environmental conditions and other metadata should be recorded. This includes visibility, weather conditions, glare, sea state, wave height, wind speed and direction, ice type and concentrations, and temperature. In addition, observer name and any other variable that may affect detectability or may be relevant to the survey. Where possible affected bird habitats should also be identified to help guide response operations (deterrence and dispersal, clean-up prioritization).

Data analysis/reporting. Observations should be transcribed and entered into a spreadsheet or standardized database format (e.g., Microsoft Excel or Access) to facilitate data sharing and archiving. Tracks and observation waypoints should be mapped using mapping software.

Scan method. Conduct surveys by scanning a 180° arc, giving priority to birds within a 300-m semi-circle (Figure III-1). Birds outside the semi-circle are recorded if these observations do not interfere with observations made within the semi-circle. On coastlines, the vantage point can differ from the 180°. In such case, the scanning angle of the survey area needs to be recorded to calculate densities.

The area is visually swept only once per scan, from one side to the other, and all birds on the water and in flight are systematically recorded at that time. Binoculars and spotting scopes can be used to confirm species identification and other details as necessary.

Estimating distance to edge of semi-circle. Observers should practice estimating the 300-m edge of the semi-circle and distance bands (Figure III-1) prior to beginning observations. This is best accomplished with a distance gauge made from a transparent plastic ruler (see Appendix VIII).

Poor visibility. When a portion of the semi-circle is not visible due to fog, the scan should still be conducted but the distance to the edge of the semi-circle must be recorded. Always record any weather that reduces visibility, such as fog, rain, seawater splashing on bridge windows, or snow.

Null observation periods. Record “No birds observed” when no birds were detected during a scan, as this type of information is also important.

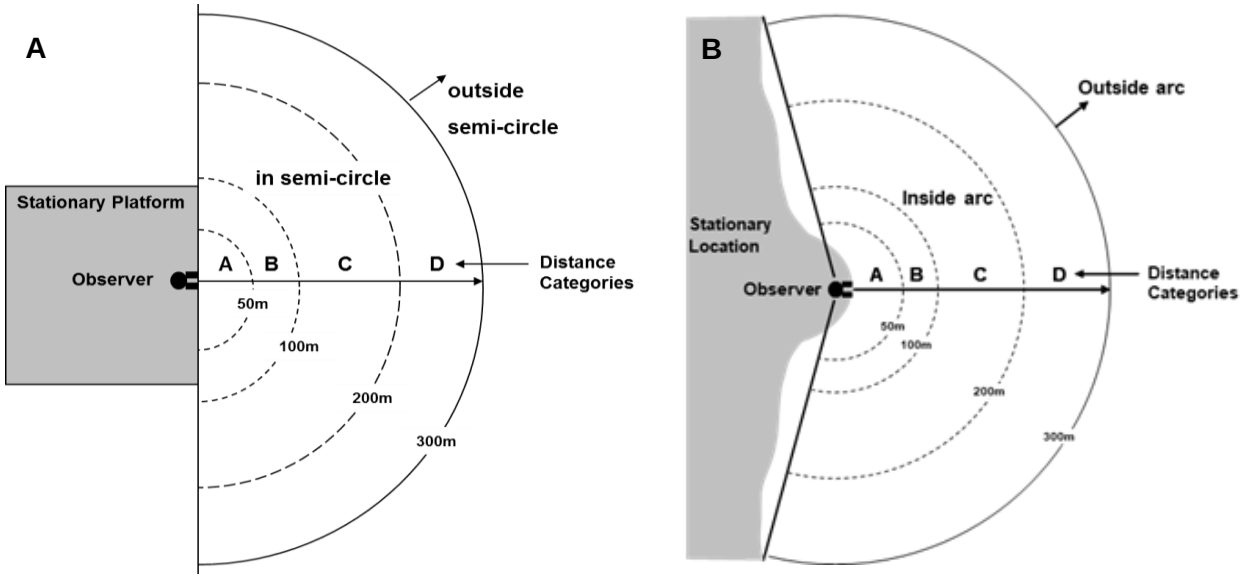


Figure III-1: Illustration of a survey on a stationary platform (e.g., offshore oil drilling platform) using a 180o scan (A) and coastal survey (e.g., along the shoreline) using a variable arc angle scan (B), surveying an area 300 m from an observer.

Recording Observation Period Information

This section provides detailed information on recording information during each observation period from stationary platforms or from coastal surveys, examples on how survey information is recorded, and corresponding data sheets.

Company/agency: Indicate here the company, agency, or organization that requested the surveys.

Platform/location name and type: Indicate the platform name. Platform type may include offshore oil drilling platform. In the case of surveys conducted from the shore, indicate the name of the area (wharf, bay, point, presqu'ile, etc.) and assigned survey location name. If no such name exists, the coordinates must be used.

Observer(s): Indicate the first and last name of the primary observer. If a second observer is assisting with the survey, also indicate the name of the secondary observer.

Date: Date that the observation period occurred. Use format DD-MMM-YYYY (e.g., 12-Apr-2008) to avoid ambiguity.

Time at start: Record the time (using 24-hour notation) at the start of the observation period. Use Universal Time (UTC) to standardize across regions. Note that the conversion from local time (L) to UTC will be influenced by daylight savings time. Circle ***UTC*** or ***L***. Stationary surveys are considered an instantaneous scan of the area and therefore only the start time is required.

Latitude / longitude: Indicate position of platform in either decimal degrees (e.g., 47.5185) or degree decimal minutes (e.g., 47˚ 31.11') depending on which format is available to you.

Platform activity: Platform activity may influence observations and should therefore be noted.

Scan type: Conduct a 180° scan for all stationary surveys. If scan was conducted from the shore or if part of the survey area is obstructed, indicate the scan angle used.

Scan direction: Indicate the true (not magnetic) bearing in degrees (°) when looking straight ahead, at centre of semi-circle.

Scan duration (minutes): Some protocols include an observation period to improve chances of observing birds and capture an accurate count and species composition. If it is the case for the selected protocol, record the scan duration. Duration should be long enough to provide an accurate count, but short enough to avoid double-counting birds that fly through. It is recommended to make 5 to 20-minute counts depending on abundance. Duration will be used as a measure of effort to estimate densities.

Height of eye (m): Indicate height of observer's eye above the water in metres. This measurement is important to calculate distance categories and may need to be measured with a measuring tape or rope.

Outdoors or indoors: Circle ***Out*** when conducting observations from a position outdoors and ***In*** for indoor observations.

Visibility (km): Estimate visibility in kilometers by determining the greatest distance at which an observer can distinguish objects, ideally black, against the horizon sky with the unaided eye. Visibility will be considerably less during foggy conditions.

Weather conditions code: Record the general weather conditions at the time of the survey using codes in Appendix VII. Record the most prominent conditions within the survey area.

Glare conditions code: Light reflecting off the surface of the water can often influence bird detection. Record the glare conditions at the time of the survey using codes in Appendix VII.

Sea state code: Sea state codes give an approximate description of current conditions on the surface of the water. Use codes from Appendix VII.

Wave height (m): Estimate wave height in meters from the highest point of a wave (peak) to the lowest point (trough).

True wind speed (kt) or Beaufort code: Indicate wind speed in knots. If no measurements are available, estimate wind speed using Beaufort codes from Appendix VII.

True wind direction (°): Use ***ND*** (No Direction) if the wind direction is variable or too light to indicate any particular direction.

Ice type and concentration codes: If ice is present during the survey, indicate the type and concentration using codes from Appendix VII. Indicate in the notes section whether the ice is present within or beyond the semi-circle limits.

Temperature (°C): Record outdoor temperature in degree Celsius.

Notes: Make note of disturbances or relevant activities in the area, especially if there are large vessels or fishing activities nearby, or if your vessel is sounding the foghorn.

Recording Bird Information

Record all information possible for each bird as time allows. As a minimum, the species (which can be unknown), count, fly or water, and in semi-circle fields must be filled in for each sighting. Note that some fields are only appropriate for certain species. For example, age and sex will only be recorded for species where this can be determined (e.g., ageing gulls or sexing waterfowl).

Give priority to birds that are in the semi-circle because these are the only ones that are used in density estimates. Birds recorded outside the semi-circle are not used in density estimates, but they do give important information on distribution, species occurrence, timing of occurrence, and behaviour, and every effort should be made to record them if time permits.

Record all birds that are oiled or demonstrating signs of oiling (in the case of an oil spill) or in distress (in the case of other Pollution Incidents or Non-Pollution Incidents) whether they are in semi-circle or not.

Species: Identify each individual bird seen to species. If this is not possible, identify to genus or family. Record all unknowns, even if they are identified only as “unknown gull” or “unknown bird”.

Count: Record the number of birds in each sighting in the count field. Record homogenous flocks on a single line. For example, a group of ten Common Murres close together on the water is recorded in a single row as a flock of ten and not in ten individual rows. If large numbers are present, estimate the number as accurately as possible.

In semi-circle?: Indicate whether the bird observed is in (***Y***) or out (***N***) of the semi-circle. Give priority to birds that are in the semi-circle; record birds seen outside of the survey area if activity levels permit.

Distance: Record the distance to each bird or flock. This information is used to assess detectability and account for missed birds. For all birds, estimate the distance between the bird(s) and the observer (Figure III-1). Distance categories are as follows: ***A*** = 0-50 m, ***B*** = 51-100 m, ***C*** = 101-200 m, ***D*** = 201-300 m, and ***E*** = > 300 m. Record flocks of birds as a single unit by recording the distance to the centre of the flock. For example, if a group is straddling the 300-m boundary with the flock centre located in ***D*** (with some individuals inside and some individuals outside the semi-circle) record the entire flock as being in ***D*****.** If the flock centre is outside the semi-circle, record the entire flock as distance class ***E***. It is very important to record distance to birds within the 300-m strip, but if this is not possible (i.e., too busy), you may use ***3*** = within 300 m but no distance recorded. Distance ***T*** is used to indicate that the bird or flock was observed on the opposite side of the vessel (vessels only).

Fly or water?: Indicate whether the bird observed is in flight or on the water and whether it is feeding. Occasionally you will have a songbird that lands on the platform. These birds can be recorded in the notes section as on the platform. When surveying close to land (including islands), birds sitting on land may be recorded in the notes as on land.

Association and **Behaviour:** Record one or more association and/or behaviour codes with each bird when appropriate (see Appendix VII for association and behaviour codes). Codes #16 "Associated with oil slick", #97 "Oiled birds contaminated with oil", #98 "Sick/unwell weakened individuals not behaving as normal, healthy birds, but without obvious injuries", and/or #99 "Dead" are especially relevant in the context of a Pollution or Non-Pollution Incident. If the observer suspects that a bird is oiled but is uncertain, a comment can be added with the mention "Possible". Record homogenous flocks on a single line. For example, if a group of ten Common Murres close together on the water is observed, but only one is oiled, record nine birds as a flock in a single row and one bird in another row with code 16 under the field **Association** and code 97 under the field **Behaviour**. Add any other useful information under the field **Comments**.

Flight direction: Indicate true direction (***N***, ***NE***, ***E***, ***SE***, ***S***, ***SW***, ***W***, ***or NW)*** birds in flight are heading if they are not associated with the platform. If birds are not flying in any particular direction, record as ***ND***.

Age: Age is based on plumage, where ***J***(uvenile) = first coat of true feathers acquired before leaving the nest and ***I***(mmature) = the first fall or winter plumage that replaces the juvenile plumage and may continue in a series that includes first-spring plumage, but is not the complete ***A***(dult) plumage.

Plumage: Adult plumage can be further categorized as ***B***(reeding) = spring and summer plumage and ***NB*** (non-breeding) = fall and winter plumage. ***M*** is used to indicate a bird with flight feather moult.

Sex: Sex can be determined for some individuals (i.e., waterfowl). Indicate whether the bird observed is ***M***(ale), ***F***(emale), or ***U***(nknown).

Comments: Space is provided to record other pertinent information such as plumage, unusual behaviours, any useful information with regards to the incident, etc. In case of an oil spill, behaviours such as excessive preening, excessive bathing, loss of buoyancy, problems with diving, inability or difficulty to fly, or a general sick appearance, can be recorded as possible indicators of oiling.

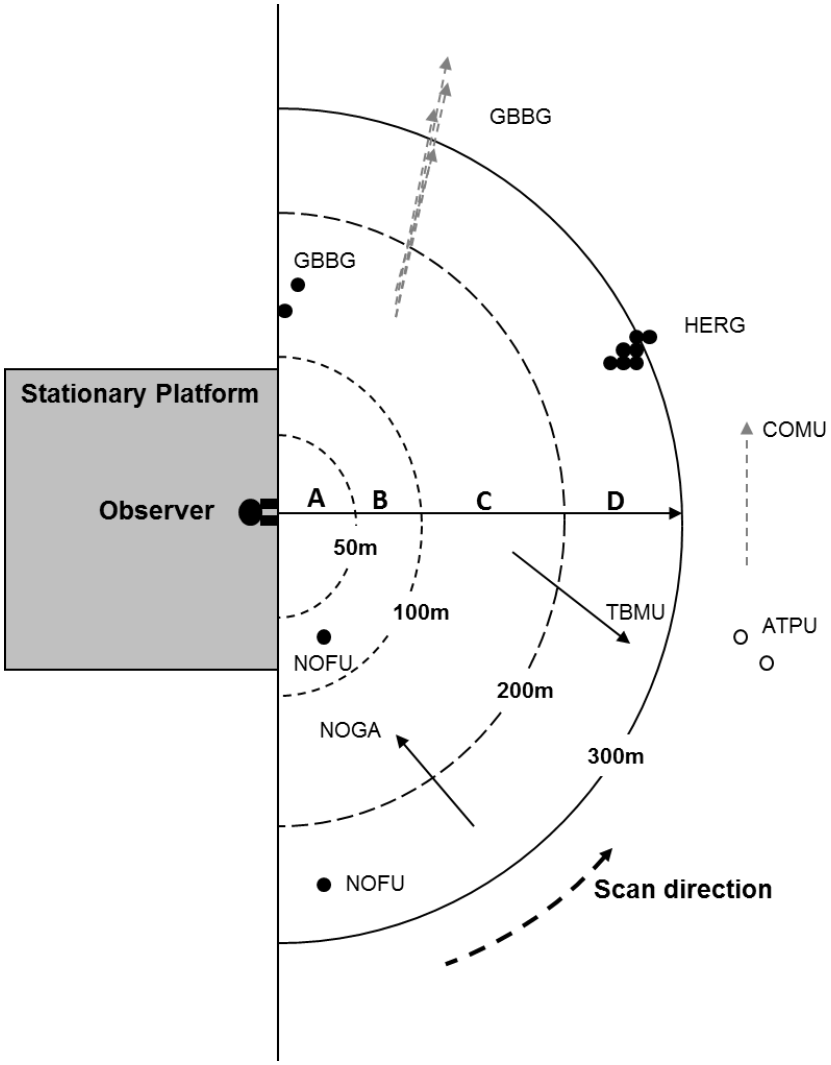
Recording heterogeneous groups of birds. Sometimes flocks of birds will contain multiple species or age classes and will require multiple rows on the data sheet (i.e., a flock containing both Great and Sooty Shearwaters or a flock of kittiwakes containing both adults and immatures or a flock containing contaminated and clean birds). Subsets of the group that share the same morphological and behavioural characteristics are recorded in the same row (i.e., all adult kittiwakes in breeding plumage flying in the same direction). Other individuals from the group that have different characteristics (i.e., juveniles) are recorded in subsequent rows. Draw an arc on the data sheet linking all rows from the group to indicate that they were observed together.

Example survey from a stationary platform

Before we begin the scan, we record the required Scan Information at the top of the data sheet. We are facing east and about to conduct our first survey of the day from an offshore oil platform. We have estimated the distance from where we are standing out to 50, 100, 200, and 300 m using our ruler gauge created with the formula outlined in Appendix VIII. We will now visually scan a 180^{o} arc, counting all birds observed. It is a clear day, no clouds, 5 knot northwest winds, with half metre swells.

The survey begins on the right-hand side of the semi-circle. In the diagram that follows, birds on water are represented by circles (full circles are in semi-circle, open circles are outside semi-circle) and flying birds by arrows (birds are at the position of the arrowhead; solid lines are in semi-circle, dashed lines are outside semi-circle).

Two separate Northern Fulmar (NOFU) sit on the water, one at distance B and another at distance D. We add both of these to the data sheet as in semi-circle, on separate lines.



a. An adult Northern Gannet (NOGA) is flying toward us at distance C and we record it as in semi-circle.
b. We observe a flying Thick-billed Murre (TBMU) travelling southeast, and we record it as in semi-circle at distance D.
c. Two Atlantic Puffins (ATPU) beyond 300 m are sitting on the water. We record them on the data sheet at distance E but note that they are not in the semi-circle.
d. We also see a Common Murre (COMU) flying north beyond 300 m and record it as not in semi-circle at distance E.

e. A flock of 7 Herring Gulls (HERG) is observed at the edge of the 300-m semi-circle. Because the centre of the group is within the semi-circle, at distance D, we count all the gulls as in the semi-circle (if the centre of the group had been beyond 300 m, we would have recorded them as outside the semi-circle at distance E, despite some individuals being in the semi-circle).
f. Four Great Black-backed Gulls (GBBG) are flying north, away from the platform. Since the centre of the flock is outside the semi-circle, these individuals are all recorded as outside the semi-circle at distance E.
g. Two additional Great Black-backed Gulls (GBBG) are sitting in the water feeding at distance C. Because one is an immature and one is an adult, we enter them in 2 data sheet rows, linking the 2 rows with an arc in the left margin.

Data sheet for surveys from a stationary platform or coastal survey

Scan Information:

Company/agency		Visibility (km)	
Platform/location name and type		Weather conditions code	
Observer(s)		Glare conditions code	
Date	D D – M M M – Y Y Y Y	Sea state code	
Time at start (UTC or L)		Wave height (m)	
Latitude		True wind speed (kt) or Beaufort code	
Longitude		True wind direction (°)	
Platform activity		Ice type code	
Scan type	180º or other (specify:)	Ice concentration code	
Scan direction		Temperature (°C)	
Scan duration (minutes)			
Height of eye (m)			
Outdoors or Indoors	Out or In		
Notes:			

Bird Information: *this field must be completed for each record

*Species	*Count	*In semi-circle?	*Distance[1]	*Fly or water?	Assoc.[2]	Behav.[2]	Flight direc.[3]	Age[4]	Plum.[5]	Sex	Comments

[1] ***A*** = 0–50 m, ***B*** = 51–100 m, ***C*** = 101–200 m, ***D*** = 201–300 m, ***E*** = > 300 m, and ***3*** = within 300 m but no distance recorded.
[2] See Codes for association (e.g. ***16*** = with oil slick, ***18*** = with obs. platform) and behaviours (e.g. ***97*** = oiled, ***98*** sick/unwell, ***99*** = dead). If oiling is suspected, write “possible” in the comments.
[3] Indicate flight direction (***N***, ***NE***, ***E***, ***SE***, ***S***, ***SW***, ***W***, or ***NW***); ***ND*** = no apparent direction.
[4] ***J***(uvenile), ***I***(mmature), or ***A***(dult).
[5] ***B***(reeding), ***NB***(non-breeding), or ***M***(oult).

Appendix IV: Protocols for Aerial Surveys

This appendix presents three protocols for aerial surveys that can be used during an environmental emergency:

1. Large nearshore flocks
2. Small nearshore flocks
3. Open water

The choice of the protocol depends on numerous factors including targeted species, survey design, area size, distance from shore, type of aircraft available, etc.

General Considerations for Aerial Surveys

Survey considerations. To ensure adequate survey coverage, flight track information and waypoints of the most recent bird distributions and “haul out” locations (as in the case of Common Eiders) should be loaded onto a handheld GPS or on a laptop equipped with a GPS-voice recording software (e.g., PC-Mapper for Airborne Inventory) prior to take off. All other relevant modelling and environmental information should be considered prior to designing a route. This includes recent spill trajectory models, bathymetry of the region, ice coverage, water current data, oiled bird reports/coordinates, and any other information that may be deemed important.

Aircraft type. The type of aircraft will depend of the type of survey and the requirements to conduct them. In general, helicopters provide the ability to go low and slow and are suitable for smaller waterbodies or waterbodies with emergent vegetation. Helicopters are also adapted to survey nesting or secretive species. Pop out floats typically provide better visibility than fixed floats. Fixed wing aircraft will provide longer range and are faster, which allows covering larger areas more efficiently. For surveys conducted over water, rotary-wing aircraft with floats, single-engine fixed-wing aircraft with floats, or twin-engine fixed-wing aircraft are used to minimize risk to the crew in case of emergency landing. When surveys are conducted offshore away from the shore, twin-engine fixed- or rotary-wing aircraft are chosen to minimize risk to the crew when flying over open water. In all cases, high-winged aircraft are preferred allowing for unobstructed view from windows.

Metadata and environmental data collection. Along with species identification (to the lowest taxonomic level possible) and number, information on environmental conditions and other metadata should be dictated into a voice recorder at the frequency at which it changes. This includes visibility, weather conditions, glare, sea state, wave height, wind speed and direction, ice type and concentrations, and temperature. In addition, observer name and position, speed, altitude, aircraft type, and any other variable that may affect detectability or may be relevant to the survey. Where possible, affected bird habitats should also be identified to help guide response operations (deterrence and dispersal, clean-up prioritization).

Equipment and equipment settings. Observations on species distribution and abundance should be recorded as a digital voice file using either one of two methods: 1) dictated into a voice recorder capable of PC connectivity and time stamping of observation files or 2) using software installed on a laptop computer that can record voice observations and link the file to geo-referenced position information (e.g., PC-Mapper for airborne inventory). A GPS should be used to record flight track information to facilitate mapping survey coverage of the area, or if using PC-Mapper, the flight tracking option should be on. Other equipment required will vary depending on the equipment being used, but could include GPS-equipped laptops, flight helmets with dual microphones, digital Dictaphones, etc. This will ensure observations can easily be linked to locations derived from a GPS track file. GPS-enabled cameras ensure that photographs taken are linked to locations.

Photos of large aggregations (flocks) of birds should be taken using a digital single-lens reflex (DSLR) camera set to the highest resolution. A 70-300 mm image-stabilized lens with a low to medium ISO setting and a fast shutter speed should be used. The speed should be a minimum of 1/250th s, but preferably ≥ 1/1000th s (or higher, as photographic equipment allows). Images should be shot in JPG format. High resolution videos (i.e., 4K resolution) can also be used.

Flight track information set to a 1-second recording frequency should be collected on the GPS and/or computer. Times should be synced among the camera, GPS, and computer (or voice recorder), and the photographer should take a single photo of the GPS and computer with their set times displayed.

Data analysis/reporting. Voice recordings should be transcribed and entered into a spreadsheet or standardized database format (e.g., Microsoft Excel or Access) to facilitate data sharing and archiving. Photos or videos of large aggregations of birds should be analyzed and individuals should be counted using image editing/counting software. For photo images, the software CountEm could be used to quickly obtain an estimate of the total of individuals using a subset of transect (Cruz et al. 2015). This method is quick and accurate (coefficient of variation 5-10%; J. Lefebvre, ECCC-CWS, pers. comm. 2020). Abundance should be corrected where possible based on these photo counts. Tracks and observation waypoints should be mapped using mapping software.

Data collected using double observer methods should be analyzed using appropriate software and corrected abundances should be reported.

Birds that are oiled or injured. Whenever a bird is observed with traces of oil on the body or demonstrating oiled behaviour, it should be clearly recorded. In this case, the codes for associations and behaviours should be recorded (Codes for associations and behaviours; Appendix VII). All mentions of oiled birds, whether inside or outside of the transect, need to be recorded. If the observer suspects that a bird is oiled but is uncertain, a comment can be added with the mention “Possible”.

Recording Observation Period Information

This section provides detailed information on recording information during each observation period for aerial surveys. See specific protocols and data sheets for each of the three types of aerial surveys below.

Company/agency: Indicate here the company, agency, or organization that requested the surveys.

Aircraft name and type: Indicate the aircraft name and type.

Aircraft team: Indicate the first and last name of the primary aircraft team, their role and their position inside the aircraft.

Date: Date that the observation period occurred. Use format DD-MMM-YYYY (e.g., 12-Apr-2008) to avoid ambiguity.

Time at start / time at end: Record the time (using 24-hour notation) at the start and end of the observation period. Use Universal Time (UTC) to standardize across regions. Note that the conversion from local time (L) to UTC will be influenced by daylight savings time. Circle ***UTC*** or ***L***.

Latitude at start/end / longitude at start/end: Indicate position of aircraft in either decimal degrees (e.g., 47.5185) or degree decimal minutes (e.g., 47˚ 31.11') depending on which format is available to you.

True aircraft speed (kt) and **True aircraft direction (°):** Record the aircraft speed in knots and the true (not magnetic) aircraft direction in degrees. If the aircraft speed or direction changes significantly during an observation period, terminate the observation period and record the time and position of termination. Start a new observation period, recording the new speed and/or direction.

Recorder type (if applicable)**:** Record the type of recorder used for the survey. For instance, a laptop equipped with a GPS-voice recording software (e.g., PC-Mapper for Airborne Inventory) could be used.

Camera model (if applicable): Record camera model (e.g., digital single-lens reflex (DSLR)).

Altitude (m): Indicate altitude in metres. This measurement is important to calculate distance categories.

Visibility (km): Estimate visibility in kilometers by determining the greatest distance at which an observer can distinguish objects, ideally black, against the horizon sky with the unaided eye. Visibility will be considerably less during foggy conditions.

Weather conditions code: Record the general weather conditions at the time of the survey using codes in Appendix VII. Record the most prominent conditions within the survey area.

Glare conditions code: Light reflecting off the surface of the water can often influence bird detection. Record the glare conditions at the time of the survey using codes in Appendix VII.

Sea state code: Sea state codes give an approximate description of current conditions on the surface of the water. Use codes from Appendix VII.

Wave height (m): Estimate wave height in meters from the highest point of a wave (peak) to the lowest point (trough).

True wind speed (kt) or Beaufort code: Record the true wind speed in knots, as this takes into account the apparent wind generated from the forward momentum of the aircraft. If relative

wind speed is the only measurement available, indicate that you are recording relative wind speed so that appropriate adjustments can be made later. If no measurements are available, estimate wind speed using Beaufort codes from Appendix VII.

True wind direction (°): Record the true wind direction in degrees, as this takes into account the apparent wind generated from the forward momentum of the aircraft. If relative wind direction is the only measurement available, indicate that you are recording relative wind direction so that appropriate adjustments can be made later. Use ***ND*** (No Direction) if the wind direction is variable or too light to indicate any particular direction.

Ice type and concentration codes: If ice is present during the survey, indicate the type and concentration using codes from Appendix VII. Indicate in the notes section whether the ice is present within or beyond the transect limits.

Temperature (°C): Record outdoor temperature in degree Celsius.

Notes: Make note of disturbances or relevant activities in the area, especially if there are large vessels or fishing activities nearby.

Recording Bird Information

This section provides detailed information on recording bird information for aerial surveys. See specific protocols and data sheets for each of the three types of aerial surveys below.

Record all information possible for each bird as time allows. As a minimum, the species (which can be unknown) and count (or count estimate) fields must be filled in for each sighting. For aerial surveys in open water fill “Fly or water?” and “In transect?” fields. Note that some fields are only appropriate for certain species and types of surveys. For example, age and sex will only be recorded for species where this can be determined (e.g., ageing gulls or sexing waterfowl). For some types of surveys, altitude prevents from identifying sex, plumage or age.

Recording heterogeneous groups of birds. Sometimes flocks of birds will contain multiple species or age classes and will require multiple rows on the data sheet (i.e., a flock containing both Great and Sooty Shearwaters or a flock of kittiwakes containing both adults and immatures or a flock containing contaminated and clean birds). Subsets of the group that share the same morphological and behavioural characteristics are recorded in the same row (i.e., all adult kittiwakes in breeding plumage flying in the same direction). Other individuals from the group that have different characteristics (i.e., juveniles) are recorded in subsequent rows. Draw an arc on the data sheet linking all rows from the group to indicate that they were observed together.

Record all birds that are oiled or demonstrating signs of oiling (in the case of an oil spill) or in distress (in the case of other Pollution Incidents or Non-Pollution Incidents) whether they are in transect or not.

Flock ref. # (for large and small flock surveys only): Record the flock reference number. Each flock that is photographed gets a unique reference id (the sequence starts with “F1” for flock 1, “F2” for flock 2, etc.) that gets recorded with the visual estimate. Alternatively, the whiteboard photo number can be recorded.

Photo # (for large and small flock surveys only): Record photo numbers that have been taken for each flock.

Species: Identify each individual bird seen to species. If this is not possible, identify to genus or family. Record all unknowns, even if they are identified only as “unknown gull” or “unknown bird”.

Count (or Count estimate): Record the number of birds in each sighting in the count field. If applicable, record homogenous flocks on a single line. For example, a group of ten Common Murres close together on the water is recorded in a single row as a flock of ten and not in ten individual rows. If large numbers are present, estimate the number as accurately as possible.

Age: Age is based on plumage, where ***J***(uvenile) = first coat of true feathers acquired before leaving the nest and ***I***(mmature) = the first fall or winter plumage that replaces the juvenile plumage and may continue in a series that includes first-spring plumage, but is not the complete ***A***(dult) plumage.

Plumage: Adult plumage can be further categorized as ***B***(reeding) = spring and summer plumage and ***NB*** (non-breeding) = fall and winter plumage. ***M*** is used to indicate a bird with flight feather moult.

Sex: Sex can be determined for some individuals (i.e., waterfowl). Indicate whether the bird observed is ***M***(ale) or ***F***(emale).

Fly or water? (for small flocks and open water only): Indicate whether the bird observed is in flight or on the water and whether it is feeding. When surveying close to land (including islands), birds sitting on land may be recorded in the notes as on land.

Association and **Behaviour (for small flocks and open water only):** Record one or more association and/or behaviour codes with each bird when appropriate (see Appendix VII for association and behaviour codes). Codes #16 “Associated with oil slick”, #97 “Oiled birds contaminated with oil”, #98 “Sick/unwell weakened individuals not behaving as normal, healthy birds, but without obvious injuries”, and/or #99 “Dead” are especially relevant in the context of a **Pollution or Non-Pollution Incident**. If the observer suspects that a bird is oiled but is uncertain, a comment can be added with the mention “Possible”. Record homogenous flocks on a single line. For example, if a group of ten Common Murres close together on the water is observed, but only one is oiled, record nine birds as a flock in a single row and one bird in another row with code 16 under the field **Association** and code 97 under the field **Behaviour**. Add any other useful information under the field **Comments**.

Reconciliation (Reconc.; for small nearshore flocks only): Record the reconciliation between the two observers (if applicable): ***1-1*** = seen by the front observer and by the rear observer, ***1-0*** = seen by the front observer and missed by the rear observer, ***0-1*** = missed by the front observer and seen by the rear observer.

In transect? (for open water only): Indicate whether the bird observed is in (***Y***) or out (***N***) of the transect. Give priority to birds that are in the transect; record birds seen outside of the survey area if activity levels permit.

Distance (for open water only): Record the distance to each bird or flock. This information is used to assess detectability and account for missed birds. For all birds, estimate the perpendicular distance between the bird(s) and the observer (Figure IV-1). Distance categories are as follows: ***A*** = 0–50 m and is often ignored because this band is hidden under the aircraft, ***B*** = 51–100 m, ***C*** = 101–200 m, ***D*** = 201–300 m, ***E*** = 300–1000 m, and ***F*** = >1000. Record

flocks of birds as a single unit by recording the distance to the centre of the flock. For example, if a group is straddling the 1000-m boundary with the flock centre located in ***E*** (with some individuals inside and some individuals outside the transect) record the entire flock as being in ***E*****.** If the flock centre is outside the transect, record the entire flock as distance class ***F***. It is very important to record distance to birds within the 1000 m strip, but if this is not possible (i.e., too busy), you may use ***3*** = within 1000 m but no distance recorded. Distance ***T*** is used to indicate that the bird or flock was observed on the opposite side of the aircraft (if only one observer is on board).

Comments: Space is provided to record other pertinent information such as plumage, unusual behaviours, any useful information with regards to the incident, etc. In case of an oil spill, behaviours such as excessive preening, excessive bathing, loss of buoyancy, problems with diving, inability or difficulty to fly, or a general sick appearance, can be recorded as possible indicators of oiling.

1. Protocol for Aerial Surveys of Large Nearshore Flocks

Survey considerations. Initial survey flights should be delivered at higher altitudes (1000-1200 feet [300-365 m]) and moderate speeds (120-150 knots [220-275 km/h]) to address two primary objectives: 1) to document and photograph large flock distributions and 2) to identify areas with potentially affected birds for further investigation. In areas that are heavily hunted, approach at 2500-3000 feet (750-1000 m) and descend on the area, identifying each flock as they flush. Secondary surveys, or additional passes over flocks, may require lower altitudes and/or slower speeds to facilitate species/guild identification and detection of oiled birds.

Aircraft and personnel. Surveys should be conducted using a rotary-wing aircraft with floats, single-engine fixed-wing aircraft with floats, or twin-engine fixed-wing aircraft to minimize risk to the survey crew when flying over open water. Observers are designated certain roles during surveys as either the navigator/photographer, primary data recorder/estimator, or the secondary data recorder (if a third observer is available). The photographer is placed in the seat best suited to obtain a good photographic image of flocks, typically the front of the aircraft next to the pilot, and therefore the photographer tends to also be the navigator. The primary data recorder should be seated on the same side but behind the navigator; the secondary data recorder should be positioned behind the pilot.

Situations. This type of survey is best suited for large flocks of birds near the coast. For example, this survey can be used on large groups of Common Eiders during molting, migration or wintering periods.

Data collection. Taking photographs of flocks allows the correction for observer biases in estimation of flock sizes (e.g., Bordage et al. 1998). If a camera port is available, this should be used to generate images that minimize distortion. To get good images, the flock may have to be circled so that the sun is behind the photographer.

Seated directly behind the photographer/navigator is the primary data recorder, or “estimator”. It is their responsibility to make flock size estimates and document the proportion of males and females where possible. This seating allows good communication between the photographer/navigator and estimator to ensure coordination of photographs and visual

estimates of flocks. This can be a challenge if there are several flocks in succession. To control for this, select one or two flocks to photograph and record their shapes for reconciliation later.

A third observer (the secondary data recorder), if available, will be positioned behind the pilot. This observer scans for flocks on this side of the aircraft, runs the computer, edits the whiteboard (see below), and coordinates the photographer/navigator and estimator making sure the data are recorded. If a third observer is not present on the aircraft, the pilot can be used to scan that side of the aircraft and identify flocks for subsequent enumeration. Computer operating and white board editing would then become the task of the estimator.

Each flock that is photographed gets a unique reference id (the sequence starts with “F1” for flock 1, “F2” for flock 2, etc.) that gets recorded with the visual estimate. A hand-held white board can be employed, with the date and unique flock reference written on it. The white board is photographed sequentially during a survey — at the start of the survey and every time after a new flock and estimate is recorded. The third observer or the estimator is responsible for changing the flock identifier in between photographs/flocks. Notes can also be written on the whiteboard to help sort out the flocks later. For example, if there are two flocks in a row, and there is no time to shoot a new whiteboard image in between, shoot the white board with the second flock id after the flock was photographed and an arrow pointing back to indicate the flock is before the identifier.

Data sheet for aerial surveys of large nearshore flocks

Observation Period Information:

Company/agency		Visibility (km)		
Aircraft name and type		Weather conditions code		
Date (DD-MMM-YYYY)	D D – M M M – Y Y Y Y	Glare conditions code		
Time at start (UTC or L)		Sea state code		
Time at end (UTC or L)		Wave height (m)		
Latitude at start / end	/	True wind speed (kt) or Beaufort code		
Longitude at start / end	/	True wind direction (°)		
True aircraft speed (kt)		Ice type code		
True aircraft direction (°)		Ice concentration code		
Altitude (m or feet)		Temperature (°C)		
Recorder type				
Camera model		Aircraft team	**Front of aircraft**	
Route tracked by GPS?	Yes or No		Name	Name
			Role	Role
			Name	Name
			Role	Role
			Rear of aircraft	
Notes:				

Bird Information: *this field must be completed for each record

Flock ref. #1	Photo #	*Species	*Count estimate	Age2	Plum.3	Sex	Comments

[1] Alternatively, the whiteboard photo number can be recorded.
[2] ***J***(uvenile), ***I***(mmature), or ***A***(dult).
[3] ***B***(reeding), ***NB***(non-breeding), or ***M***(oult).

2. Protocol for Aerial Surveys of Small Nearshore Flocks

Survey considerations. This survey is an attempt to assess the prevalence of individuals or small flocks of birds, to assess oiling incidents, and investigate areas identified in the reconnaissance survey. Flights are conducted at lower altitudes (150-300 feet [45-90 m]) and speeds (<100 knots [185 km/h] if aircraft type allows). In the case of hauled out species like Common Eiders, this will be accomplished by assessing the number of birds that have grouped together on land or ice to avoid hypothermia effects. In the winter there will be some ice rind on the rocks and the islands may be covered in snow. It will be important during surveys to search these areas as well as the intertidal areas.

Aircraft and personnel. Surveys should be conducted using a rotary-wing aircraft with floats, single-engine fixed-wing aircraft with floats, or twin-engine fixed-wing aircraft to minimize risk to the survey crew when flying over open water. The navigator, observer, and photographer positions will be as outlined in protocol for large flocks.

Situations. This type of survey is best suited for small flocks of birds near the coast. For example, this survey can be used on small groups of dabbling ducks at any time of the year and multiple environments near the shoreline.

Data collection. Where applicable, data can be collected using the independent double-observer methods outlined below to assess the probability of detecting birds, though this may not be useful in all situations, depending on the location and distribution of oiled birds (Robertson et al. 2014). If possible, data on the geographical extent of the spill (e.g., sheen) should be documented and geo-referenced (GPS waypoints) by the aerial survey crew. If staff experience permits, data can be collected using independent double-observer methods similar to those outlined in Koneff et al. (2008). In this case, independent observations are recorded by both the front and rear observer on the same side of the aircraft. A visual barrier (e.g., cloth) can be put in place to keep the rear observer from being influenced by the front observer's actions. Communication must be disabled between observers during an observation. Reconciliation of observations is to be initiated by either the rear observer immediately following an observation or by the front observer after enough time has elapsed for the bird(s) to pass out of the field of view of the rear observer. During reconciliation, the two observers discuss whether they both made the same observation. If they observed the same bird or group of birds, the rear observer records that the observations should be reconciled. If there is a discrepancy between the front and rear observer's observations, additional discussion is necessary to determine whether the same group was seen and to form an agreement on the species and number in the group. If no agreement can be formed but it can be determined that the same group of birds was seen, the front observer's observations should be used in the final reconciliation and should be noted by the rear observer. In this way, each observation will be reconciled and given one of three categorizations: 1) seen by the front observer and by the rear observer (data recorded as "1 1"), 2) seen by the front observer and missed by the rear observer ("1 0"), and 3) missed by the front observer and seen by the rear observer ("0 1"). If the density of birds and frequency of observations is too high to allow time for reconciliation, this should be noted by the rear observer and these observations will be excluded from the estimation of detection rates. When large flocks are seen, photos can be taken to get better estimates of numbers and composition.

Data sheet for aerial surveys of small nearshore flocks

Observation Period Information:

Company/agency		Visibility (km)		
Aircraft name and type		Weather conditions code		
Date (DD-MMM-YYYY)	D D – M M M – Y Y Y Y	Glare conditions code		
Time at start (UTC or L)		Sea state code		
Time at end (UTC or L)		Wave height (m)		
Latitude at start / end	/	True wind speed (kt) or Beaufort code		
Longitude at start / end	/	True wind direction (°)		
True aircraft speed (kt)		Ice type code		
True aircraft direction (°)		Ice concentration code		
Altitude (m or feet)		Temperature (°C)		
Recorder type				
Camera model		Aircraft team	**Front of aircraft**	
Route tracked by GPS?	Yes or No		Name	Name
			Role	Role
			Name	Name
			Role	Role
			Rear of aircraft	
Notes:				

Bird Information: *this field must be completed for each record

*Flock ref. #[1]	Photo #	*Species	*Count estimate	*Fly or water?	Age[2]	Plum.[3]	Sex	Assoc.[4]	Behav.[4]	Reconc.[5]	Comments

[1] Alternatively, the whiteboard photo number can be recorded.
[2] ***J***(uvenile), ***I***(mmature), or ***A***(dult).
[3] ***B***(reeding), ***NB***(non-breeding), or ***M***(oult).
[4] See Codes for association (e.g. ***16*** = with oil slick, ***18*** = with obs. platform) and behaviours (e.g. ***97*** = oiled, ***98*** = sick/unwell, ***99*** = dead). If oiling is suspected, write “possible” in the comments.
[5] Reconciliation between the two observers (if applicable): ***1-1*** = seen by the front observer and by the rear observer, ***1-0*** = seen by the front observer and missed by the rear observer, ***0-1*** = missed by the front observer and seen by the rear observer.

3. Protocol for Aerial Surveys in Open Water

This type of survey uses the general principle of distance sampling to estimate bird density and is very similar in terms of methodology to the standardized protocol established for surveys from vessels (modified from Gjerdrum et al. 2012, see also Appendix II).

Survey considerations. This survey is an attempt to assess the prevalence of oiled birds and is flown at lower altitudes (150–200 feet [45–60 m]) and speeds (< 80-100 knots [150-185 km/h] if aircraft type allows).

Aircraft and personnel. Surveys should be conducted using a twin-engine fixed- or rotary-wing aircraft to minimize risk to the survey crew when flying over open water (i.e., long distance from the shore). One observer is placed on each side of the aircraft to conduct two transects.

Situations. This type of survey is best suited for individuals or small flocks of birds in open water. For example, this survey can be used on pelagic species (e.g., alcids, petrels). It can also be used to determine if birds are oiled. The advantage of this survey is that it can be used for opportunistic surveys when the flight plan has been designed for the purpose of another stakeholder involved in the response.

Data collection. Where applicable, data can be collected by two observers. Each observer follows the same protocol as described in the methods for surveys from vessels (Appendix II). Conduct surveys while looking forward from the vessel, scanning at a 90^{o} angle from either the port or starboard side. Priority is given to birds observed in transect (Figure IV-1). Birds outside of the transect are recorded if these observations do not interfere with in-transect observations. Distance bands may be the same as for vessel-based surveys or may be altered to adapt to aircraft type and altitude if desired, e.g., ***A*** = 0–50 m and is often ignored because this band is hidden under the aircraft, ***B*** = 51–100 m, ***C*** = 101–200 m, ***D*** = 201–300 m, ***E*** = 300–1000 m, and ***F*** = >1000. The number of distance bands used, and the guides used for estimating bands (i.e., gradations indicated on the airplane window) need to be adapted with altitude. Density is calculated using the length and the width of the transects.

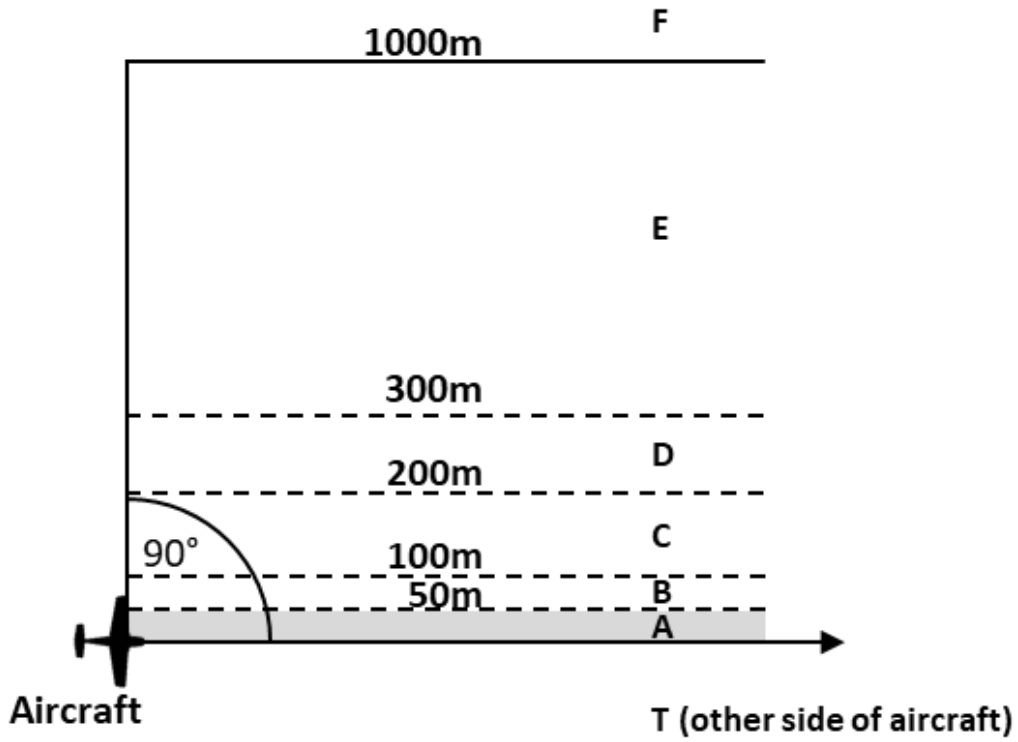


Figure IV-1: Illustration of a survey using a 90° scan, covering a 1000 m transect from the aircraft. The perpendicular distance from the observer to the bird(s) is estimated (distance categories A–E). Birds observed outside the transect (distance categories F and T) are normally also recorded if this does not affect observations within the transect. The shaded area is category (0–50 m) and is often ignored because this band is hidden under the aircraft.

Data sheet for aerial surveys in open water

Observation Period Information:

Company/agency		Visibility (km)		
Aircraft name and type		Weather conditions code		
Date (DD-MMM-YYYY)	D D – M M M – Y Y Y Y	Glare conditions code		
Time at start (UTC or L)		Sea state code		
Time at end (UTC or L)		Wave height (m)		
Latitude at start / end	/	True wind speed (kt) or Beaufort code		
Longitude at start / end	/	True wind direction (°)		
True aircraft speed (kt)		Ice type code		
True aircraft direction (°)		Ice concentration code		
Altitude (m or feet)		Temperature (°C)		
Recorder type				
Camera model		Aircraft team	**Front of aircraft**	
Route tracked by GPS?	Yes or No		Name	Name
			Role	Role
			Name	Name
			Role	Role
			Rear of aircraft	
Notes:				

Bird Information: *this field must be completed for each record

*Species	*Count	*Fly or water?	*In transect?	*Distance[1]	Age[2]	Plum.[3]	Sex	Assoc.[4]	Behav.[4]	Comments

[1] ***A*** = 0–50 m, ***B*** = 51–100 m, ***C*** = 101–200 m, ***D*** = 201–300 m, ***E*** = 300–1000 m, ***F*** = >1000 m.
[2] ***J***(uvenile), ***I***(mmature), or ***A***(dult).
[3] ***B***(reeding), ***NB***(non-breeding), or ***M***(oult).
[4] See Codes for association (e.g. ***16*** = with oil slick, ***18*** = with obs. platform) and behaviours (e.g. ***97*** = oiled, ***98*** = sick/unwell, ***99*** = dead). If oiling is suspected, write “possible” in the comments.

Appendix V: Protocol for Beached Wildlife Surveys during an Environmental Emergency

The following protocol has been modified from the document *Adopt-a-beach – Newfoundland and Labrador Beached Bird Survey Program: Surveyor's guide*, which was adapted from Chardine and Pelly (1994). Specific protocols for the Quebec and Pacific Regions are available.

1. Protocol for Beached Wildlife Surveys

When: Please conduct your survey daily on the same stretch of beach. If in a marine environment, it is best to walk the beach at low tide or as the tide is receding. Sometimes bad weather or personal circumstances do not allow for regular outings. Surveys need to be conducted by trained personnel.

Where: The best beaches are those that are easy to walk, not too steep, composed of sand/gravel or small cobble and that naturally accumulate driftwood and seaweeds. Walk one way along the wrack or flotsam line (i.e., the line of stranded seaweed and debris) closest to the water, scanning on each side, and return along the next wrack line above. Note that fresh carcasses may also be found close to the water line, whereas old carcasses may be found at the extreme high tide. If a beach is particularly deep, several sweeps may be required.

2. Filling out the Datasheets

a. Survey Information

Always complete all boxes relevant to each beach visit (beach name, observer name, and the day, month and year the survey was conducted) even if no Wildlife is found.

b. Carcass information

Species: It is important to try to identify each carcass to its lowest taxonomical level (i.e., species). Beached Wildlife field guides will be especially useful to identify carcasses.

When it is not possible to identify a carcass to species because it is too heavily scavenged or decomposed please provide as much information as you can (e.g., unknown gull (UKGU) or unknown murre (UKMU)). If you have a digital camera, you may want to take a photo of the carcass to confirm the identification with an experienced person at a later date.

Age and sex: In some birds, it is relatively easy to differentiate between immature and adult birds (e.g., gulls) and between males and females (e.g., seaducks). Please refer to the provided beached Wildlife field guide to help you record this information.

Degree of scavenging: Evaluate how much of the body is intact (i.e., not scavenged or missing). Indicate by Yes or No if more than half of the breast is present.

Degree of oiling: Record whether there is oil on the carcass by identifying the appropriate category:

0 No oil
1 Slight oiling – smudges of oil that do not totally penetrate the breast feathers or coat the wings
2 Moderate oiling – oil penetrates to base of feathers or saturates wings; < 25% body affected
3 Heavy oiling – oil penetrates to base of feathers; > 25% of body affected

c. Beach Information

For each survey, please record the relative amount of oil, snow/ice and heavy seaweed using the following codes:

Beach codes for oil:

0 Clean
1 Slightly oiled: few small patches or tar-balls (<1 per 50 m)
2 Moderately oiled: several large patches of oil or many small ones; wrack line speckled with oil
3 Heavily oiled: water line and wrack line extensively covered with oil

Beach codes for snow/ice or seaweed:

0 Covers 5% of beach or less
1 Covers 5-30% of beach
2 Covers 30-60% of beach
3 Covers >60% of beach

d. Recording Live Wildlife in Area

At the bottom of the datasheet, you will find a space to record live Wildlife present in the area (i.e., on the beach or on the water inshore) during your survey. This section is completely optional (unless Wildlife are oiled, see below) as your focus should be on searching for Wildlife carcasses on the beach. Please fill in this section (species and count) only if you are comfortable identifying live Wildlife from a distance. This information gives an idea of what species are found inshore in different areas throughout the year.

Sometimes during an oiling event, oiled birds (especially murres and dovekies) come inshore and stay on the water for some time before being found on the beach. It is sometimes possible to see if these birds are oiled based on their behaviour (e.g., excessive preening) or by seeing the oil on their feathers with a pair of binoculars. If you do see oiled Wildlife on the water, contact the relevant agencies or the chain of command established for the incident (e.g. Incident Command).

Additional space is provided for any notes or other observations you wish to record while conducting your beached Wildlife survey. Please see below for an example of a blank datasheet.

3. Collecting Wildlife Carcasses

It is important to collect carcasses to:

- determine cause of death, if unknown
- minimize damage to unaffected Wildlife (secondary exposure)

- support appropriate response strategies to protect Wildlife
- obtain minimum number of casualties for damage assessment
- obtain specimens/samples for enforcement activities or reporting requirements
- inform Incident Command

It is also important to clear the beach of all carcasses after every survey to ensure that you do not recount the same Wildlife during your next survey. Follow the procedure for carcass collection in Appendix VI.

4. Protocol for Sampling Oiled Wildlife

If you find a Wildlife with fresh oil (thick and shiny) on its feathers, collect the Wildlife following the sheet entitled "*Example of Protocol for Collecting Wildlife during an Oil Spill Response*" provided in Appendix VI. Briefly:

- put on a pair of clean disposable gloves
- tightly wrap the entire Wildlife in aluminum foil
- place the wrapped Wildlife in a clear plastic bag
- double-bag the wrapped Wildlife in an evidence bag
- write on evidence bag the date, location, that Wildlife was found dead, and your name and contact information
- report the oiled Wildlife and relevant information to the relevant agencies or the chain of command established for the incident (e.g. Incident Command)
- place evidence bag in a secure place until retrieved by appropriate enforcement personnel

Anytime you encounter live oiled Wildlife on a beach, contact the relevant agencies or the chain of command established for the incident (e.g. Incident Command). Alternatively, use the established protocol for the incident to collect live oiled Wildlife if the staff has the appropriate trainings and authorisations.

5. Protocol for Sampling Unoiled Wildlife

If you find a fresh whole Wildlife with no evidence of oil on its feathers, it may be useful to collect this Wildlife so that a necropsy can be performed to determine the cause of death. If you are willing, collect the Wildlife as follows:

- Put on a pair of clean disposable gloves
- Place Wildlife in clear plastic bag
- Write on plastic bag the date, location, that Wildlife was found dead, and your name and contact information
- Place in cool area sheltered from predators
- Contact the coordinator of this program (see below) to arrange for pickup

However, if you find an unusual number of fresh unoiled carcasses in a small area (5 or more Wildlife individuals within 100 m) notify the relevant agencies and the response operations (e.g. Incident Command). Use appropriate protocols to handle these Wildlife individuals as they may be diseased.

6. References

Chardine, J.W. and Pelly, G. 1994. Operation Clean Feather: Reducing oil pollution in Newfoundland waters. Canadian Wildlife Service Technical Report Series No. 198. Atlantic Region.

7. Checklist

Here is a checklist to ensure that you have all necessary materials and training for the beached Wildlife survey:

Materials:

- Surveyor Instruction Guide
- Field guide of local beached birds or beached Wildlife
- Permit to pick-up and possess birds and Wildlife
- Disposable gloves and hand sanitizer
- Aluminum foil
- Clear plastic bags
- Pencils, markers, wing ruler
- Binder and datasheets
- Hat identifying your affiliation with the program
- Backpack
- Pair of comfortable walking boots
- Raingear/sun protection/snacks/water
- Digital camera (optional)
- Binoculars (optional)
- Field guide for bird and Wildlife identification (optional)
- Communication device: cellular phone, satellite phone, SPOT
- First Aid Kit

Beached Wildlife survey datasheet:

Time start (UTC or L): _____ Latitude/Longitude at start: _____ _____

Time end (UTC or L): _____ Latitude/Longitude at end: _____ _____

Did you find Wildlife (Yes/No)?

- No, please remember to still submit your results
- Yes, please fill out form and submit your results

Beach	Surveyor(s)	Day	Month	Year

Species	**No.**	**Dead Wildlife on beach**			
		Age (U, J, A)	**Sex (U, M, F)**	**Is > 50% of carcass intact? (Y/N)**	**Oiling code (0, 1, 2, 3)**

Live Wildlife in area

Species	**No.**	**Oil Code**

Beach condition code (0, 1, 2, 3) or % covered

Oil	**Snow/ice**	**Seaweed**

Notes:

Appendix VI: Example of Protocol for Collecting Wildlife during an Oil Spill Response

The following two protocols have been modified from a document developed for Migratory Birds by the Atlantic Region to include Wildlife:

1. Collection of dead Wildlife
2. Collection of live Wildlife

Note that anyone collecting migratory Wildlife must be a nominee on an existing federal salvage permit.

1. Collection of Dead Wildlife

1. Make arrangements to retrieve all dead oiled and unoiled Wildlife with:
    - ECCC-CWS personnel if oiled Wildlife rehabilitation response is not in place, or
    - Wildlife rehabilitator if oiled Wildlife rehabilitation response is in place
2. Every time a beach is swept, select two oiled Wildlife individuals to be retained as possible evidence, preferably from different parts of the beach. For each of these two Wildlife individuals:
    - Individually wrap the Wildlife in aluminum foil
    - Place the wrapped Wildlife in its own evidence bag
    - Completely fill out a chain of custody form
    - Write on the bag (or on data form/label) the collector, date, time, coordinates/location, species (if known at time)
    - Place label, chain of custody form, and bagged Wildlife carcass into a second bag
    - Place evidence bag in a secure place until retrieved by appropriate ECCC personnel
3. To avoid cross-contamination, it is essential that:
    - clean gloves are used prior to handling each Wildlife
    - Wildlife individuals are wrapped in foil as soon as they are found
4. Place each remaining Wildlife found on the beach in its own generic plastic bag, and:
    - write on the bag (or on data form/label) the collector, date, time, coordinates/location, and record that the Wildlife was found dead
    - record on the bag weather the Wildlife was OILED or NOT OILED
    - treat Wildlife parts the same as whole Wildlife
5. If it is not feasible to individually bag all Wildlife found on the beach:
    - put remaining oiled Wildlife in one of more large bags
    - put remaining unoiled Wildlife in separate large bag(s) from oiled Wildlife
    - write on the bag (or on data form/label) the collector, date, time, coordinates/location, and record that Wildlife were found dead
    - record on the bags if they contain OILED or NOT OILED Wildlife
    - keep Wildlife from different beaches in separate bags

Important information:

- Always wear disposable gloves when handling Wildlife
- Keep a vigilant eye out for banded or otherwise marked Wildlife; if collected, keep separate from other carcasses and handover to ECCC-CWS personnel

2. Collection of Live Wildlife

2.1 If oiled Wildlife response is <u>not</u> in place:

1. If you are permitted to humanely euthanize the oiled Wildlife, do so following the standard protocol and:
    - individually wrap two euthanized Wildlife individuals in aluminum foil
    - place the wrapped Wildlife in individual evidence bags
    - completely fill out a chain of custody form
    - write on the bag (or on data form/label) the collector, date, time, coordinates/location, species (if known at time), and record that Wildlife was found alive
    - place evidence bag, label, and chain of custody form in second bag
    - store in secure place until retrieved by appropriate ECCC personnel
2. Record and bag remainder of the euthanized oiled Wildlife as outlined in points 3, 4, and 5 from Section 1 (Collection of Dead Wildlife) above.
3. If you are not permitted to euthanize oiled Wildlife, do not feel comfortable doing so, or have found a Wildlife listed under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or SARA (e.g., Harlequin Duck, Ivory Gull):
    - place oiled Wildlife in a cardboard box
    - label box with the collector, date, time, and location where Wildlife was recovered
    - place in warm, quiet area until handed over to ECCC-CWS personnel for euthanasia or rehabilitation

2.2 If oiled Wildlife response is in place:

1. place the oiled Wildlife in a cardboard box
2. label box with the collector, date, time, and location where Wildlife was recovered
3. place in warm, quiet area until handed over to Wildlife rehabilitator for rehabilitation or euthanasia

Important information when catching and placing live Wildlife in box:

- Handle Wildlife with gloves, preferably disposable ones
- Lid and walls of box must have sufficient holes to allow proper ventilation
- Large Wildlife, only one per box (e.g. murre, seaduck)
- Small Wildlife, may place two per box if only slightly oiled (e.g. dovekie, storm-petrel)

Emergency response kits for collecting Wildlife

Emergency response kits and protocols should be standardized to ensure that 1) Wildlife are collected in a safe manner and information is collected consistently, 2) when called upon, samples are collected and stored appropriately for laboratory analysis and evidence, and 3) responders are readily equipped to respond efficiently to an incident with a range of potential required survey materials. Inventory for these kits should include the following:

- Written authorization(s) to handle Wildlife
- Laminated one-page protocol for collecting Wildlife tailored to the needs of each geographic region (see above)
- Waterproof notebook for documenting the search, or standardized data sheets developed for the incident
- Waterproof writing implements (i.e., permanent markers, pens, and pencils)
- GPS unit
- Camera
- Personal Protective Equipment such as:
    - Disposable examination gloves
    - Proper footwear (e.g., hip-waders, rubber boots, etc.)
    - Masks
- Material for live oiled Wildlife:
    - Nets
    - Cardboard boxes of various sizes or pet caddies lined with sorbent sheets
    - Identification tags, labels, and/or data sheets
    - Cervical dislocator
- Material for dead oiled Wildlife and/or evidence samples:
    - Plastic bags (small and large)
    - Aluminum foil
    - Identification tags, labels, and/or data sheets
    - Coolers for storing and shipping samples
    - Tape (to secure coolers)
    - Evidence bags
    - Hazardous waste / biohazard bags
- Chain of custody forms
- First aid kit

Data sheet for collection of birds

RECOVERY INFORMATION

Specimen No. _____

Species _____ Location of recovery _____

Examined by _____ Date of recovery _____

Date examined _____ Method of recovery _____

Name (and contact) of person who collected bird _____

Condition of bird (tick all appropriate boxes) ☐ Found dead ☐ Found alive ☐ Oiled ☐ Scavenged

Is bird banded or otherwise marked? ☐ Yes ☐ No

If yes, provide information (number, colour, any codes or code colour, body part, etc.): _____

_____

BIOMETRICS (as applicable)

Mass	_____	g	Culmen (total length)	_____	mm	Tarsus bone	_____	mm
Wing	_____	mm	Culmen (midline)	_____	mm	Tarsus total	_____	mm
Gonys	_____	mm	Nostril	_____	mm	E.I.W.	_____	mm
Other	_____		Head length	_____	mm	I.I.W.	_____	mm

Age ☐ First year ☐ Second year ☐ Adult ☐ Unknown

Sex ☐ Male ☐ Female ☐ Unknown

Ovaries ☐ Differentiated ☐ Undifferentiated

Bill process ☐ Rounded ☐ Pointed ☐ Narrow ☐ Wide

Other observations/remarks:

DEGREE OF OILING, SCAVENGING, AND DECOMPOSITION

☐ Clean: no traces of oil

☐ Superficial oiling: smudges of oil that does not completely penetrate the breast feathers or coat the wing

☐ Penetrated oiling: oil penetrates to base of feathers and/or saturates wing

If penetrated oiling, proportion of body affected:

☐ < 10%
☐ 10-25%
☐ 25-50%
☐ 50-75%
☐ 75-100%

Degree of scavenging (dead Wildlife):

☐ None
☐ Punctured
☐ Breast gone
☐ Less than half of body remaining
☐ Skeleton and feathers remaining
☐ Wings only

Degree of decomposition (dead Wildlife):

☐ Fresh
☐ Decomposed
☐ Skeletal

Appendix VII: Codes for Surveys from Vessels, Stationary Platforms and Aerial in Open Water

Codes for general weather conditions and glare

Code	Description
Weather conditions	
0	< 50% cloud cover (with no fog, rain, or snow)
1	> 50% cloud cover (with no fog, rain, or snow)
2	Patchy fog
3	Solid fog
4	Mist / light rain
5	Medium to heavy rain
6	Fog and rain
7	Snow
Glare conditions	
0	None
1	Slight/grey
2	Bright on the observer's side of vessel
3	Bright on the side and forward of vessel

Codes for sea state and Beaufort wind force

Wind speed (knots)	Sea state code and description	Beaufort wind force code and description
0	**0** Sea surface like a mirror, but not necessarily flat	**0** Calm
01–03	**0** Ripples with appearance of scales but crests do not foam	**1** Light air
04–06	**1** Small wavelets, short but pronounced; crests do not break; when visibility is good, horizon line always very clear	**2** Light breeze

Wind speed (knots)	Sea state code and description	Beaufort wind force code and description
07–10	**2** Large wavelets, crests begin to break; foam of glassy appearance; perhaps scattered white caps	**3** Gentle breeze
11–16	**3** Small waves, becoming longer; fairly frequent white caps	**4** Moderate breeze
17–21	**4** Moderate waves with more pronounced form; many white caps; chance of some spray	**5** Fresh breeze
22–27	**5** Large waves begin to form; white foam crests more extensive; probably some spray	**6** Strong breeze
28–33	**6** Sea heaps up; white foam from breaking waves blows in streaks in direction of wind	**7** Near gale
34–40	**6** Moderately high waves of greater length; edge crests break into spindrift; foam blown in well-marked streaks in direction of wind	**8** Gale
41–47	**6** High waves; dense streaks of foam in direction of wind; crests of waves topple, tumble and roll over; spray may affect visibility	**9** Strong gale
48–55	**7** Very high waves with long overhanging crests; dense white streaks of foam; surface of sea takes white appearance; tumbling of sea becomes heavy and shock-like; visibility affected	**10** Storm
56– 63	**8** Exceptionally high waves; sea is completely covered with long white patches of foam; visibility affected	**11** Violent storm
64+	**9** Air filled with foam and spray; sea entirely white with foam; visibility seriously impaired	**12** Hurricane

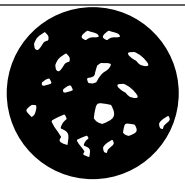
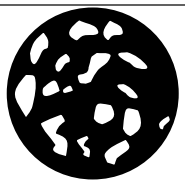
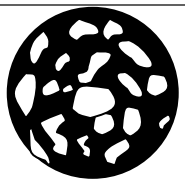
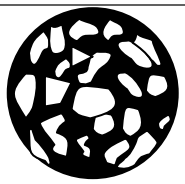
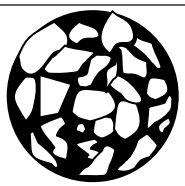
Codes for ice conditions

(Adapted from NOAA: Observers Guide to Sea Ice)

Sea ice forms

Code	Name	Description
0	New	Small, thin, newly formed, dinner plate-sized pieces
1	Pancake	Rounded floes 30 cm – 3 m across with ridged rims
2	Brash	Broken pieces < 2 m across
3	Ice Cake	Level piece 2–20 m across
4	Small Floe	Level piece 20–100 m across
5	Medium Floe	Level piece 100–500 m across
6	Big Floe	Level, continuous piece 500 m – 2 km across
7	Vast Floe	Level, continuous piece 2–10 km across
8	Giant Floe	Level, continuous piece > 10 km across
9	Strip	A linear accumulation of sea ice < 1 km wide
10	Belt	A linear accumulation of sea ice from 1 km to over 100 km wide
11	Beach Ice or Stamakhas	Irregular, sediment-laden blocks that are grounded on tidelands, repeatedly submerged, and floated free by spring tides
12	Fast Ice	Ice formed and remaining attached to shore

Sea ice concentration

Code	Concentration	Description	
0	< One tenth	“Open water”	
1	Two to three tenths	“Very open drift”	
2	Four tenths	“Open drift”	
3	Five tenths	“Open drift”	
4	Six tenths	“Open drift”	
5	Seven to eight tenths	“Close pack”	
6	Nine tenths	“Very close pack”	
7	Ten tenths	“Compact”	

Codes for associations and behaviours

From Camphuysen and Garthe (2004). Choose one or more as applicable.

Code	Description
Association	
10	Associated with fish shoal
11	Associated with cetaceans
13	Associated with front (often indicated by distinct lines separating two water masses or concentrations of flotsam)
14	Sitting on or near floating wood
15	Associated with floating litter (includes plastic bags, balloons, or any garbage from human source)
16	Associated with oil slick
17	Associated with sea weed
18	Associated with observation platform
19	Sitting on observation platform
20	Approaching observation platform
21	Associated with other vessel (excluding fishing vessel; see code 26)
22	Associated with or on a buoy
23	Associated with offshore platform
24	Sitting on offshore platform
26	Associated with fishing vessel
27	Associated with or on sea ice
28	Associated with land (e.g., colony)
50	Associated with other species feeding in same location

Code	Description	Explanation
Foraging behaviour		
30	Holding or carrying fish	carrying fish towards colony
32	Feeding young at sea	adult presenting prey to attended chicks (e.g., auks) or juveniles (e.g., terns)
33	Feeding	method unspecified (see behaviour codes 39,40,41,45)
36	Aerial pursuit	kleptoparisitizing in the air
39	Pattering	low flight over the water, tapping the surface with feet while still airborne (e.g., storm-petrels)
40	Scavenging	swimming at the surface, handling carrion

Code	Description	Explanation
41	Scavenging at fishing vessel	foraging at fishing vessel, deploying any method to obtain discarded fish and offal; storm-petrels in the wake of trawlers picking up small morsels should be excluded
44	Surface pecking	swimming birds pecking at small prey (e.g., fulmar, phalaropes, skuas, gulls)
45	Deep plunging	aerial seabirds diving under water (e.g., gannets, terns, shearwaters)
49	Actively searching	persistently circling aerial seabirds (usually peering down), or swimming birds frequently peering (and undisturbed by observation platform) underwater for prey
General behaviour		
60	Resting or apparently sleeping	reserved for sleeping seabirds at sea
64	Carrying nest material	flying with seaweed or other material; not to be confused with entangled birds
65	Guarding chick	reserved for auks attending recently fledged chicks at sea
66	Preening or bathing	birds actively preening feathers or bathing
Distress or mortality		
71	Escape from ship (by flying)	escaping from approaching observation platform
90	Under attack by kleptoparasite	bird under attack by kleptoparasite in an aerial pursuit, or when handling prey at the surface
93	Escape from ship (by diving)	escaping from approaching observation platform
95	Injured	birds with clear injuries such as broken wings or bleeding wounds
96	Entangled in fishing gear or rope	birds entangled with rope, line, netting or other material (even if still able to fly or swim)
97	Oiled	birds contaminated with oil
98	Sick/unwell	weakened individuals not behaving as no1mal, healthy birds, but without obvious injuries
99	Dead	bird is dead

Appendix VIII: Estimating Distance

Estimating distance bands using a ruler

Distance can be estimated using the following equation[†]:

$$d_h = 1000\frac{\left(ah3838\sqrt{h}\right) - ahd}{h^2 + 3838d\sqrt{h}}$$

e.g., if a = 0.73 m, h = 12.5 m, and d = 300 m then d_h = 30.0 mm

where:

d_h = distance down from horizon (mm)

a = distance between the observer's eye and the ruler when observer's arm is fully out-stretched (m)

h = height of the observer's eye above the water at the observation point (m)

d = distance to be estimated (e.g., 300 m; the edge of the transect or semi-circle)

Distances are easily estimated using a gauge made from a transparent plastic ruler. A different ruler will be required for each combination of observer arm length (a) and platform height (h). Calculate dh for the boundary of each distance class (A, B, C, and D) and mark it on the ruler (dashed lines in figure). To use the gauge, extend the arm fully and keep the line on the ruler indicating 0 mm aligned with the horizon. The dashed lines now demark the distance class boundaries on the ocean surface. Keep the gauge nearby during surveys to quickly check bird distances when in doubt.

[†] Formula derived by J. Chardine, based on Heinemann, D. 1981. A range finder for pelagic bird censusing. Journal of Wildlife Management 45: 489-493.

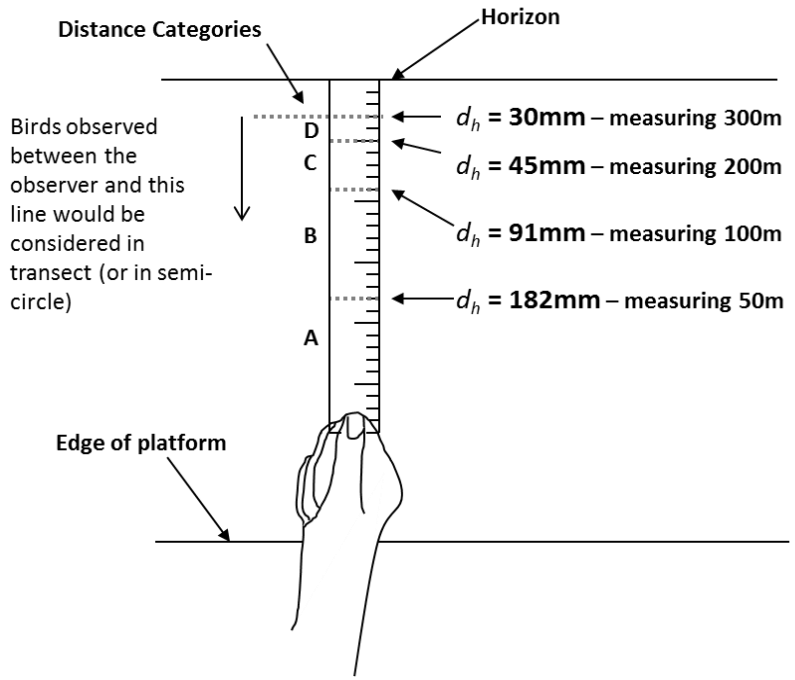


Figure VIII-1. Distance bands using a ruler.

Estimating distance bands using strings in the window

Delineation is based on a coordinate system (*x:y*) with the vanishing point on the horizon being the origin (0:0), within a vertical plane in front of the observer as described in Bolduc and Desbiens (2011). Coordinates of parallel interval limits can be calculated using:

$$y = \frac{Hx}{d_p}$$

where:

H = height of the observer's eyes

d_p = perpendicular distance between transect centerline and interval limit

Coordinates of radial interval limits using:

$$y = \frac{H\sqrt{x^2 + w_p^2}}{d_c}$$

where:

w_p = distance between the observer and the vertical plane in direction of interval limit

d_c = observer's distance to the interval limit.

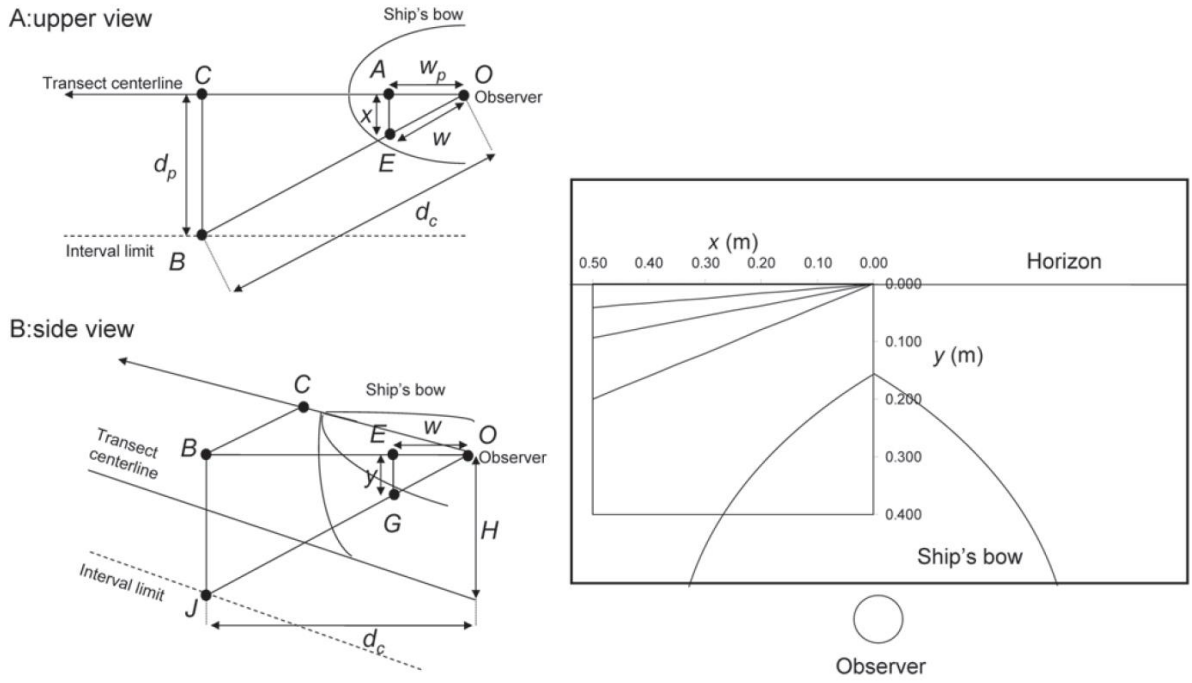


Figure VIII-2. Hypothetical results of the drawing of various distance intervals limits parallel to the ship's course in front of a seabird observer using a coordinate system with the vanishing point as origin (0:0).

Appendix IX: Contact Information for Canadian Wildlife Service Regional Permits Offices

Region	Address	Contact
Bird Banding Office National Wildlife Research Centre	Carleton University 1125 Colonel By Drive Ottawa, ON K1A 0H3	• Telephone: (613)998-0524 • Email: bbo_cws@ec.gc.ca
Atlantic (Newfoundland and Labrador, Prince Edward Island, Nova Scotia and New Brunswick)	17 Waterfowl Lane P.O. Box 6277 Sackville, NB E4L 1G6	• Telephone: (506)364-5068 • Fax: (506)364-5062 • Email: Permi.Atl@ec.gc.ca **For SARA permitting enquiries:** go to https://wildlife-species.canada.ca/SPLEP-SARAPS/ for up to date contact information
Quebec	801-1550 avenue d'Estimauville Québec, QC G1J 0C3	• Telephone: (418)649-6129 • Fax: (418)648-4871 • Email: PermisSCFQuebec-CWSQuebecPermit@ec.gc.ca **For SARA permitting enquiries:** go to https://wildlife-species.canada.ca/SPLEP-SARAPS/ for up to date contact information
Ontario	335 River Road Ottawa, ON K1V 1C7	• Telephone: (613)990-8355 • Fax: (613)990-8400 • Email: wildlifeontario@ec.gc.ca **For SARA permitting enquiries:** go to https://wildlife-species.canada.ca/SPLEP-SARAPS/ for up to date contact information
Prairie (Alberta, Saskatchewan and Manitoba)	115 Perimeter Road Saskatoon, SK S7N 0X4	• Telephone: (306)975-4090 • Fax: (306)975-4089 • Email: prpermisscf-cwspermitpr@ec.gc.ca **For SARA permitting enquiries:** go to https://wildlife-species.canada.ca/SPLEP-SARAPS/ for up to date contact information

Region	Address	Contact
British Columbia	5421 Robertson Road Delta, BC V4K 3N2	• Telephone: (604)350-1950 • Fax: (604)946-7022 • Email: scfpacpermitscwspacpermits@ec.gc.ca **For SARA permitting enquiries:** go to https://wildlife-species.canada.ca/SPLEP-SARAPS/ for up to date contact information
Northern (Northwest Territories, Nunavut & Yukon)	P.O. Box 1870 Suite 301-933 Mivvik Street Iqaluit, NU X0A 0H0	• Telephone: (867) 975-4638 • Fax: (867) 975-4645 • Email: CWSPermitNorth@ec.gc.ca **For SARA permitting enquiries:** go to https://wildlife-species.canada.ca/SPLEP-SARAPS/ for up to date contact information

Appendix X: Blank Data Sheets for Oil on Birds and on Water

Data sheet for Oiled Birds

Observer(s)	
Date (DD-MMM-YYYY)	D D – M M M – Y Y Y Y
Transect	

Time	Lat.	Long.	Obs. No[1]	Sp.	Flock Size	No. Check.[2]	Perc. Oil and Degree of Oiling[3] (by Area)												Behav.[4]	Oil on Water[5]	Comment
							Overall (%)	Deg.	Neck (%)	Deg.	Head (%)	Deg.	Breast (%)	Deg.	Belly (%)	Deg.	Back (%)	Deg.			

[1] Observation number: used to link together all the birds of one flock that have been recorded on separate lines. These numbers are sequentially entered on the form, with the same number for all members of a flock.
[2] Number checked: indicates the number of birds from the flock that were checked for oil. Birds that were not checked for oil are not recorded.
[3] Degree of oiling: ***L*** = light, ***M*** = moderate, ***H*** = heavy, ***P*** = possible oil covering the body (use when oiling is suspected, but the observer is unsure).
[4] Behaviour: ***PR*** = excessive preening, ***BA*** = excessive bathing, ***BU*** = buoyancy loss, ***DI*** = problems diving, ***SI*** = sick, ***NO*** = normal behavior, ***OT*** = other.
[5] Oil present on water near bird(s): ***Y*** = yes, ***N*** = no.

Data sheet for Oil on Water

Observer(s)	
Date (DD-MMM-YYYY)	D D – M M M – Y Y Y Y
Transect	

Time	Latitude	Longitude	Start/ End	Percent of surface covered with TAR codes[1]:										Section width (m)[2]	Comment
				A	B	C	D	E	F	G	H	I	J		

[1] TAR codes are as follow: ***A*** = barely visible, thickness 0.04 µm, ***B*** = silver sheen, thickness 0.075 µm, ***C*** = first colour trace, thickness 0.15 µm, ***D*** = bright colours, thickness 0.3 µm, ***E*** = dull colours, thickness 1 µm, ***F*** = dark colours, thickness 3 µm, ***G*** = yellowish brown, thickness 10 µm, ***H*** = light brown or black, thickness 100 µm, ***I*** = thick dark brown or black, thickness 1000 µm, ***J*** = heavy oil near the source, thickness 10,000 µm.
[2] Sections are the divisions along the transect formed by the changes in degree or type of oiling. Width is the distance from the boat that the observer feels confident about determining presence or absence of oil without going off transect.