2023 IWC/POWER Cruise
Information for Researchers

Contents

I. INTRODUCTION

The objectives for the 2023 cruise:

The cruise will be conducted in summer 2023 in the central North pacific (high Sea) for the following reasons;

(1) This area has been poorly covered since 2012 thus representing an important information gap for several large whale species;

(2) For at least some species it spans proposed stock boundaries.

The cruise will be focused on the collection of line transect data to estimate abundance and the collection of biopsy/photo-identification and acoustic data. The IWC and Japan (ICR) share all the data and biopsy samples from IWC-POWER cruises. It will make a valuable contribution to the work of the Scientific Committee on the management and conservation of populations of large whales in the North Pacific in a number of ways, including (IWC, 2021):

(a) information for the in-depth assessments of North Pacific sei, humpback and gray whales in terms of abundance, distribution and stock structure;
(b) information on the critically endangered North Pacific right whale population in the eastern Pacific;
(c) baseline information on distribution, stock structure and abundance for a poorly known area for several large whale species/ populations, including those that were known to have been depleted in the past but whose status is unclear;
(d) essential information for the development of the medium-long term international programme in the North Pacific in order to meet the Commission's long-term objectives.

Accommodation and food costs
Researchers will need to bring their own protective clothing, computers, office supplies etc. as in previous years. Power sockets are mainly 2-prong U.S. style although some cabins have 3-prong outlet terminals. The daily subsistence charge aboard the vessel will be ¥2,500 per day for each researcher. Accounts will be paid by the IWC.

Private communications
You may send and receive private communications, including e-mails, at your own expense. Emails are exchanged by radio operations via Outlook and must be provided on a USB stick in MSG file format. If you wish to use your personal computer for emails you must have Outlook installed. You will use the ship's email address for communication, to be provided prior to departure. Accounts must be paid by researchers before arriving at the final port of departure. Payment for e-mails is required in US dollars by cash.

Prepaid card such as the KDDI card (Go Chat card: new system) can be used for private telephone calls. Researchers can buy this card before departure. Calls are discounted (max 40 minutes/card).

Photographs (POWER catalogue)
IWC and ICR equipment are not to be used for private photographs. Researchers may take photographs with their own cameras when the vessels are off-effort. Permission must be given by the cruise leader for private photographs to be taken during research time.

The master set of all photographs taken on the IWC-POWER cruises is kept, classified, geocoded and keyworded by the IWC Secretariat within its Adobe Lightroom (LR) database these are copyright of the IWC and ICR (joint copyright).

Photographs taken under US permit are the property of the US permit holder and will be shared with the IWC and ICR. All marine mammal photographs taken under US permit **must be accompanied at all times by the permit number** per permit requirement as follows:

> *The Permit Holder may use images and audio recordings collected under this permit, including those authorized in Tables A1 and A2 of Appendix A, in printed materials (including commercial or scientific publications) and presentations provided the images and recordings are accompanied by a statement indicating that the activity was conducted pursuant to NMFS ESA/MMPA Permit No. U2023-003. This statement must accompany the images and recordings in all subsequent uses or sales.*

If researchers use their own cameras, the marine mammal and survey photographs remain the property of the IWC/ICR or US permit holder as applicable and must be included in the photographic-data submission at the conclusion of the cruise. All researchers wishing to examine/use the photographs must obtain formal permission from the Steering group and permit holder as applicable following the protocol available from the IWC Secretariat. Only in exceptional circumstances should researchers on the vessel send copies of photographs direct to other researchers during the cruise (e.g. where this is a condition of a permit to conduct research in national waters) as approved by the Cruise Leader. Researchers are not permitted to take photographs in the wheel house, radio operations room or engine room.

Behaviour on board

The Cruise Leader is responsible for all scientific decisions affecting the conduct and strategy of the cruise and will assign duties to the other researchers. *You must follow these instructions and use the designated equipment and protocols at all times.*

All researchers represent the International Whaling Commission are guests on the vessel and, as such, should behave with dignity and courtesy at all times. Alcohol may be brought on board by researchers ; however, for safety and other reasons, consumption of alcohol should be restricted to an appropriate level.

Recent surveys in the North Pacific

Figure 1 show the areas in the North Pacific, which have been covered by cetacean scientific surveys in recent years. The proposed research area for the 2023 survey has poorly surveyed previously.

Figure 2a and 2b shows the research areas from 2010 to 2023 POWER surveys (left), and the planned trackline for the 2023 survey. Black lines represent the boundaries for the US EEZ. For this aim, the starting points of transect lines within the study area were randomized following IWC SC guidelines (IWC, 2021).

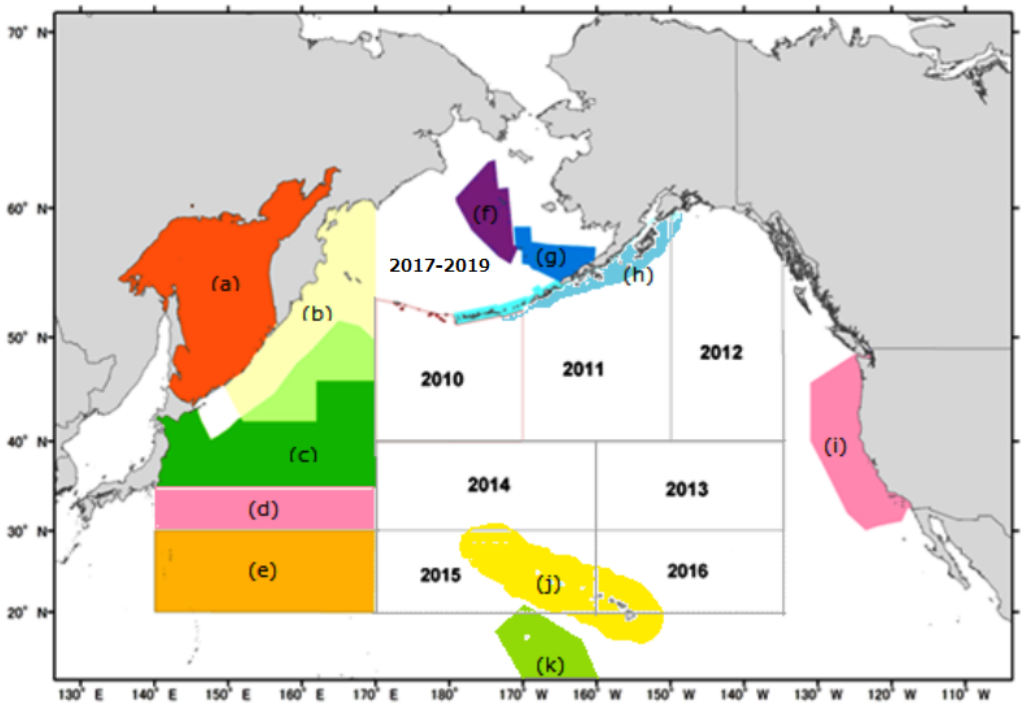
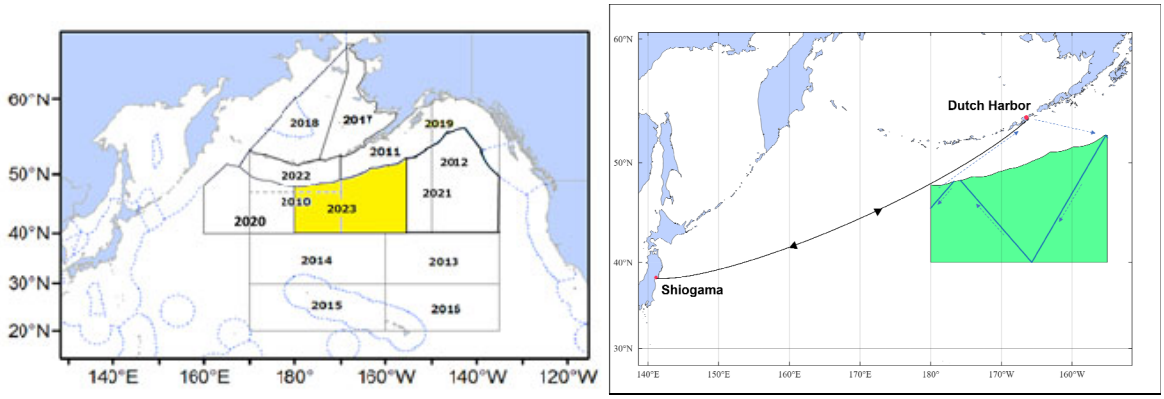


Figure 1. The main systematic surveyed area in the North Pacific in recent years. Coloured areas represent surveys conducted in the North Pacific in recent years: (a): Miyashita and Berzin (1991), (b): Miyashita (2006), (c): Pastene et al. (2009), (d): Matsuoka et al. (2013), (e): Matsuoka et al. (2014), (f): Moore et al. (1999), (g): Moore et al. (2002), (h): Zerbini et al. (2007), (i) Barlow and Forney (2007), (j): Barlow (2006a), (k): Barlow (2006b), (IWC, 2023).



Figures 2a and 2b. The research areas from 2010 to 2022 POWER surveys (left). The 2023 research area and pre-determined trackline its start and end points (IWC, 2023). (right)

Distribution of previous catches of large whales in the proposed research area

To examine the possibility of encounter with large whale species in the proposed survey area the distribution of previous catches in that North Pacific was plotted (Figure 3). This was done for blue, fin, sei, right, sperm and humpback whales using the catch data recorded in the IWC database (ver. 4.0). There are no minke and right whale catch records in the database for the proposed survey area. From the plotting it can be noted that the research area match the catch distribution for the species examined.

Information collected from this single survey will provide essential information for the intersessional workshop to plan for a medium-long term international programme in the North Pacific.

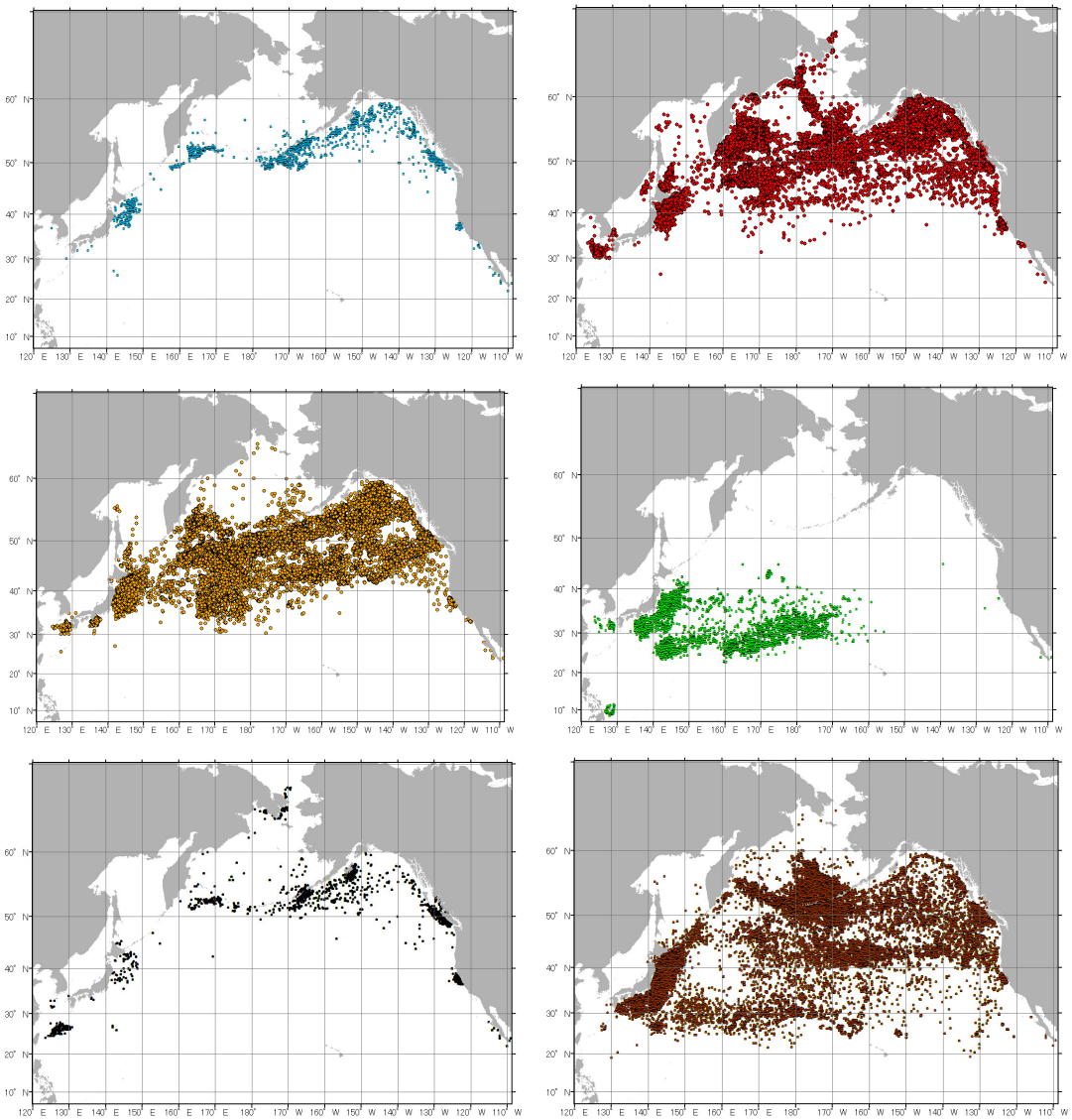


Figure 3. Catch distribution of blue (top, left), fin (top, right), sei (middle, left), right (middle, right), humpback (bottom, left) and sperm (bottom, right) whales in the North Pacific. Catch data are from the IWC database (ver. 4.0).

Cruise track and itinerary

A total cruise of 70 days including transit 24 days and 6 days for port, represents the maximum operation period of the vessel without refuelling/resupplying (39 days) in the research area. Two IWC researchers (USA) will be on board/ left a vessel at Dutch Harbor (D.H.). The US Acoustic equipment will be loaded at D.H..

Table 1. Itinerary for the 2023 North Pacific sighting cruise.

Date	**Event**
27 Jul. 2023	Pre cruise meeting*
28 Jul .	Vessel departs Shiogama, Japan
05 Aug.	Vessel arrives Dutch Harbor. Loading of US equipment (sonobuoy and antenna etc.)
06 Aug.	Pre cruise meeting
08 Aug.	US researchers come on board. Vessel departs Dutch Harbor.
11 Aug.	Vessel starts research area survey.
18 Sep.	Vessel completes the research area survey.
22 Sep.	Vessel arrives Dutch Harbor. US researchers leave Vessel. Loading of US equipment
23 Sep.	Post-cruise meeting
25 Sep.	Vessel departs Dutch Harbor.
05 Oct.	Vessel arrives Shiogama. All researchers leave Vessel
06 October	Post-cruise meeting **

*: Convenor, Fisheries Agency, National Research Institute of Far Seas Fisheries, US researchers (online), Institute of Cetacean Research, IWC researchers (Japan), Captain, Chief Officer, Chief Engineer, Chief Radio Operator, Bosun, Kyodo-Senpaku.
** US researchers (online), Japan researchers, Captain, FAJ, ICR

Research vessel

e-mail address, Telphone and Fax numbers will be available for this cruise on board.

Tel (INMARSAT); **********

Fax (INMARSAT); **********

Table 2. Ship specifications:

	Yushin-Maru No.2
Call sign	JPPV
Length overall [m]	69.61
Molded breadth [m]	10.80
Gross tonnage (GT)	747
Barrel height [m]	19.5
IO barrel height [m]	13.5
Upper bridge height [m]	11.5
Bow height [m]	6.5
Engine power [PS / kW]	5280 / 3900

The searching speed is normally between 11.0 and 12.0 knots. It has space for four researchers.

Reference

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II. RESEARCH ITEMS

1. Objectives

The cruise will be focused on the collection of line transect data to estimate abundance and biopsy/photo-identification data, would make a valuable contribution to the work of the Scientific Committee on the management and conservation of populations of large whales in the North Pacific in a number of ways, including:

(a) baseline information for the in-depth assessments of large whales including North Pacific blue, fin, sei, humpback, gray, and sperm whales in terms of abundance, distribution and stock structure;

(b) information on the critically endangered North Pacific right whale population in the eastern Pacific;

(c) baseline information of large whales in previously depleted and poorly studied region

(d) essential information for the development of the medium-long term international programme in the North Pacific in order to meet the Commission's long-term objectives.

2. Priority research items

Line Transect Survey

Priority will be given to the sightings survey of the research area. Research will be conducted in the following survey modes [details can be found in section III]:

- NSP:Passing with abeam closing mode and
- IO mode
- distance and angle experiments.

The Cruise Leader and the Captain should be responsible for deciding how to obtain the necessary increase in IO mode survey [Details can be found in Section IIIA].

Additional Research Modes

Sufficient time must also be allocated to the other priority items (Photo-ID ,biopsy sampling; acoustic recording,and tagging as applicable); this will be determined by the Cruise Leader (CL). As a guide, around 38 hours was spent on these research items in the 2015 cruise (of which 32 hours were in the research area. Normally no more than 40 minutes (after closing) should be spent on each encounter.

Photo-identification: The high priority of target species for this cruise will be North Pacific right whales. Should other IWC-POWER priority species be encountered (blue, grey and humpback whales) then every effort should be made to photo-id them. The other likely encountered species will be the sperm whale. Photos of sperm and killer whales are of lower priority which may also be obtained opportunistically. [Details can be found in Section III-E]

A Natural Marking record form (IV.6) should be completed for each photographed sighting. Images must be uploaded and preliminarily processed in Lightroom at the end of each day (Appendix A). Photo analysis performed during the cruise should include preliminary coding at a minimum. Full coding can be conducted at the discretion of the Cruise Leader if time permits. A manual for Lightroom processing will be made available for researchers on the cruise.

Biopsy sampling: As appropriate and decided by the Cruise Leader, research time will be given for biopsy sampling of North Pacific right, bowhead, grey, blue, fin, sei, common minke and humpback whales. Biopsy of killer, sperm whales and other species (e.g. beaked whales) can be attempted on an opportunistic basis. [Details can be found in Section III-D]

Videotaping: This will be carried out only when Cruise Leader deems it necessary.

Tagging: As appropriate and decided by the Cruise Leader, research time will be given for satellite tagging of blue, fin and sei whales. [Details can be found in Section III-C]

Acoustic recording: Passive acoustic monitoring for marine mammals will be conducted using sonobuoys. A sonobuoy is a free-floating, expendable, short-term passive acoustic listening device that transmits signals in real time via VHF radio waves to a receiver on a vessel. Sonobuoys will be deployed to obtain an evenly sampled cross-survey census of

marine mammal presence. The deployment schedule will depend on the number of sonobuoys available. When in areas of high whale density, or when trying to localize on a calling species of interest, multiple sonobuoys may be deployed to obtain near-continuous recording. The acoustician will monitor the sonobuoys in real-time and/or post process on board, noting species detected and obtaining bearing and directional information of target species when possible. [Details can be found in Section III-I]

The two drifting buoy recorders prepared by SWFSC will be deployed in the research area and US associates will be given access to the acoustic data they collect, along with the drift tracks.

III. DETAILS FOR EACH OF THE RESEARCH ITEMS

A. SIGHTING PROCEDURES

1. Introduction

Activities aboard the ship are classified into two principal groups: On-effort and Off-effort. In the sightings survey portion of the research, On-effort activities are times when full search effort is being executed and conditions (such as weather and sea conditions) are within acceptable parameters to conduct research. Off-effort activities are all activities that are not On-effort. All sightings recorded while the ship is On-effort are classified as Primary sightings. All other sightings are Secondary sightings.

Sighting effort may be conducted from up to 3 platforms (depending on survey mode) as follows:

Top: by 2 observers from the barrel (crow's nest)

IOP: by 2 observers from the IO platform that sits below the TOP

Upper: the upper bridge where the helmsman, captain or officer-on-watch, researchers, and the chief engineer or deputy are present.

Primary search effort is only conducted in acceptable weather conditions. These conditions are defined as:

- visibility better than 2.0 n.miles,
- wind speed less than 20 knots
- Beaufort sea state less than 6, and
- glare minimized on the trackline

These conditions are used as guidelines; in some circumstances, less severe conditions may still be inappropriate for search effort.

The following sections describe each of the potential survey modes used in POWER cruises. Note that as these are general guidelines, they include discussion of issues (e.g. ice) and not all survey modes are used on cruises.Please refer to Priority Research Items (II.2) for details on selected cruise modes.

2. Closing Mode (NSC)

Two topmen observe from the barrel at all times; there is no observer in the IOP. There are open communications between the barrel and the upper bridge. When a sighting is made, the topman (or upper bridge observer) gives an estimate of the distance and angle to the sighting and the ship turns immediately, regardless of the angle to the sighting. The whales are approached and the species and number of animals determined. All subsequent sightings are regarded as secondary until normal search effort is resumed. If the initial sighting distance is more than 3 n.miles (perpendicular distance) from the vessel's trackline and the sighting is thought to be of minke whales or sperm whales, the sighting is passed; if, however, the species is thought to be a large baleen whale, closure to the sighting is attempted. In order to save valuable research time, closure to the sighting position of whales that can be positively identified as long-diving species (such as sperm whales or beaked whales) may be abandoned if it is considered that the animals have dived.

When a sighting is made, the person who made the sighting provides the sighting. The ship then changes course to the appropriate heading to approach the whale, and vessel speed is increased to 15 knots to hasten the closure. Ship speed is decreased when the group is neared, usually at a distance of 0.2-0.4 n.miles from the initial sighting position.

After the whale group has been approached, the species, number of animals in the group, estimated lengths, number of calves present, and behaviour are determined and recorded. After as many data as possible have been collected, other activities might take place, such as natural marking or biopsy experiments. Until the ship resumes the transect with full search effort, any whale sightings made after the initial sighting are classified as secondary sightings.

2.1 Closing while returning to the trackline

This is the same as the standard Closing Mode except that the ship is not on the designed trackline due to closing with a previous sighting while on effort. Sightings that have a perpendicular distance greater than 3 n.miles from the planned trackline (not the return trackline) should not be closed with.

2.2 Closing in high density areas

This mode is initiated when the frequency of whale sightings is so high that effective survey cannot be conducted. It is the same as the standard Closing Mode except that closure is restricted to every nth primary sighting, where n is decided *in situ* by the CL (n is usually 3). The value of *n* must be determined before starting the mode. If the survey still cannot be accomplished, *n* can be increased. If *n* becomes so great that closures do not occur, then the mode should be changed to Passing Mode in high density areas.

2.3 Closing with ice navigation

This is the same as the standard Closing Mode except that some search effort might be compromised by the topmen or other observers assisting in the navigation of the ship through areas of sea ice or icebergs. Procedures remain the same as those in Closing Mode but the type of search effort is recorded differently on the effort record. If search effort appears to be seriously

compromised, then the sightings survey should be suspended.

Relevant NSC Codes:

Code	Definition
BB	Begin searching in blue whale survey mode (selective Closing Mode)
BC	Begin searching in Closing Mode
EC	End searching in Closing Mode
BR	Begin returning to the trackline in Closing Mode
ER	End returning to the trackline in Closing Mode
BL	Begin searching in high whale density area
EL	End searching in high whale density area
BA	Begin searching in Closing Mode with assisted ice navigation.
EA	End searching in Closing Mode with assisted ice navigation

Relevant NSP Codes:

Code	Definition
BP	Begin searching in normal Passing Mode (NSP) including "Passing with abeam closing Mode"
EP	End normal Passing Mode
BH	Begin searching in NSP mode in a high density area.
EH	End searching in NSP mode in a high density area.
BI	Begin searching in NSP mode with ice navigation.
EI	End searching in NSP mode with ice navigation
BR	Begin returning to the trackline in Closing Mode
ER	End returning to the trackline in Closing Mode
BL	Begin searching in high whale density area
EL	End searching in high whale density area
BA	Begin searching in Closing Mode with assisted ice navigation.
EA	End searching in Closing Mode with assisted ice navigation
BZ	Begin searching in big eye BT in NSP mode

3. Normal Passing Mode (NSP)
This mode is identical to the IO mode except that there is no Independent Observer in place.

3.1Passing in high density area
When the high density of whales in the area causes problems for the observers in discriminating between the same and different schools while conducting IO mode survey, searching mode will be changed to NSP. A special effort code is used to record that the search effort mode was changed due to the high whale densities.

3.2 Passing with ice navigation
If the ship is navigating through ice fields while in IO mode and the topmen are assisting in navigation to the extent that their search effort might be slightly reduced, the search effort mode is changed to NSP. If search effort appears to be seriously compromised, then the sightings survey should be suspended.

4. Independent Observer Mode (IO)
This mode utilizes all three platforms. Two topmen are observing from the barrel at all times and two topmen are stationed in the independent observer platform (IOP). Communications are essentially one-directional, with the topmen reporting information to the upper bridge observers, but no information being exchanged between the barrel and IOP. The observers on the upper bridge should communicate with the topmen only to clarify information and should not direct the topmen to disrupt their normal search procedure unless directed to do so by the CL.

Immediately after a sighting is made from the barrel or IOP, the observer informs the bridge of his estimate of the distance and angle to the sighting (and also, if possible, the species and number of animals present), but does not change his normal searching pattern in order to keep contact with the sighting. The observers on the upper bridge must attempt to locate the sighting made by the observerand decide whether it is possible for them to confirm the species and number before the sighting passes abeam of the vessel. The observer gives no further information to the upper bridge unless the whale group happens to surface again within the normal searching pattern. A designated researcher on the upper bridge determines which of the sightings made from the barrel, IOP, and upper bridge are duplicates, in consultation with other researchers.

4.1 Resighting
The resighting record is to be used to record resighting data during IO modes. The resighting data are to provide an additional source of information for the estimation of g(0) and for the assessment of duplicate status.

Angles, distances, cue type and times (etc) to successive cues for a sighting which the personnel on the upper bridge are tracking should be either recorded directly on the resighting form or ondigital recorder. If information is digitally recorded it should later be transcribed onto the resighting record.

It is not intended that the upper bridge observers do any tracking over and above that normally done for the purposes of identification of duplicate sightings status. Similarly, recording of the resighting data does not involve additional tracking of the sightings by either the IOP or the topmen in the standard barrel. (The topmen relay resighting information to the upper bridge only when the group happens to surface again within their normal searching pattern.).

The resighting times, angles, distances and cue types of all resightings should be recorded only up to and including the time at which the cetacean(s) are judged to have been seen by both the topmen in the standard barrel and the IO or until the cetacean(s) pass abeam of the vessel if the topmen in the standard barrel or the IO do not sight them.

Recording of data should be abandoned if the sighting rate is so high that collection of these data is compromising normal data recording and search effort.

Relevant IO Codes:

Code	Definition
BO	Begin searching in IO Passing Mode.
EO	End IO Passing Mode

5. Passing with abeam closing Mode (NSP)

This is in effect Passing Mode. Two topmen are observing from the barrel at all times and there is no Independent Observer in place. There is open communication between the upper bridge and the barrel. The observers on the upper bridge should communicate with the topmen only to clarify information and should not direct the topmen to disrupt their normal search procedure unless directed to do so by the CL.

Immediately after a sighting is made from the barrel, the topman informs the bridge of his estimate of the distance and angle to the sighting (and also, if possible, the species and number of animals present), but does not change his normal searching pattern in order to keep contact with the sighting. The observers on the upper bridge must attempt to locate the sighting made by the topman and decide whether it is possible for them to confirm the species and number before the sighting passes abeam of the vessel. The topman gives no further information to the upper bridge unless the whale group happens to surface again within the normal searching pattern of the topman. A designated researcher on the upper bridge records the species and estimated number of whales in the school when the sighting passes abeam of the vessel, in consultation with other researchers.

When the sighting passes abeam of the vessel, the ship then changes course to the appropriate heading to approach the whale, and vessel speed is increased to 15 knots to hasten the closure. Ship speed is decreased when the group is neared, usually at a distance of 0.2-0.4 n.miles from the initial sighting position.

After the whale group has been approached, the species, number of animals in the group, estimated lengths, number of calves present, and behaviour are determined and recorded. After as many data as possible have been collected, other activities might take place, such as natural marking or biopsy experiments. Until the ship resumes the transect with full search effort, any whale sightings made after the initial sighting are classified as secondary sightings.

6. Other general considerations

6.1 Determination of group size

School size determination is critical to make the data useful in population estimation. However, accurate determination of the school size of all sightings is not possible. It is the responsibility of the researchers to evaluate if the school size has been accurately determined. Schools where the number of animals, or an accurate estimated range of the number of animals, is determined are classified as *confirmed* schools. The data from the confirmed schools are used in the analysis to determine a mean school size. Therefore, it is critical that the schools that are confirmed are representative in size of the schools that are in the survey area. Normally, schools believed to be confirmed for school size are approached to within 1n.mile for large whales and to within 0.3 n.miles for minke whales. Obviously, there are differences in the environmental conditions and behaviour of the animals for every sighting, however, (with particular reference to minke whale sightings) every effort should be made to be as consistent as possible in regard to the maximum time spent on identification of species and confirmation of numbers. Normally, if the sighting is thought to be minke whales, no more than 20 minutes (after closure has been completed) should be spent trying to complete these tasks. (Otherwise there is the potential for confusion with other sightings in the vicinity).

6.2 Identification of species

Use the following guidelines for classification of identification:

Positive identification of species is based on multiple clues and usually requires the clear observation of the whale's body. Occasionally, repeated observations of the shape of the blow, surfacing and other behavioural patterns may also be sufficient; this judgement should be made only by the CL or other designated researcher. Normally, sightings believed to be minke whales should not be identified as positive identification of species unless the sighting has been approached to within 1.5 n.miles.

Probable identification of species is based on multiple clues, which are nevertheless insufficient to be absolutely confident in identification. This usually

occurs when blows are seen, the surfacing pattern is correct, but the whale's body cannot be seen or clearly seen.

6.3. Protocol if glare encountered on the trackline

This protocol should be implementedwhen, in the opinion of the Cruise Leader in consultation withresearchers, glare directly ahead of the vessel is sufficiently severe as to compromise the assumption that all groups on the trackline are detected with certainty.

The vessel should divert from its course by an angle of 20 degrees, in the opposite direction to which the sun is heading. The revised course forms the new trackline and all other protocols (such as returning to the trackline after closing) should be conducted as if the zig-zag trackline is the planned trackline. The vessel should continue on this course for a distance of 6 miles, and should then return to the trackline so as to meet the trackline at an angle of 20 degrees. If, on returning to the trackline, glare ahead of the vessel is still severely compromising detectability on the trackline, the vessel should continue on its zig-zag course for a further six miles (on the opposite side of the trackline), before returning to the trackline as before. This procedure should be continued as long as glare on the original planned trackline is deemed to be significantly reducing the detectability of groups directly ahead of the vessel. At the discretion of theCL, the diversion angle may be increased or decreased. It is thought that in most cases, 20 degrees should be sufficient but this would depend on the width of the glare. Similarly the length of each zig-zag may be changed from the standard 6 n.miles (particularly in IO mode in order to minimise problems associated with tracking sightings).

6.4. Protocol if wind blows stack gas towards observers

A protocol similar to glare shall be implemented if wind is blowing stack gas (engine exhaust) towards observers. Should these conditions persist or the course change does not improve the gas conditions, the CL shall discuss with the vessel Captain halting surveys until wind conditions improve.

6.5 *Protocol for skipping trackline due to prolonged days of fog or wind*

Prolonged days of high winds, fog and poor visibility may require the CL to move ahead (‘skip’) sections of trackline. The CL should attempt to spread the gaps of survey as evenly as possible over the survey area and between modes of survey. Additional factors may also influence the strategy of skipping trackline including but not limited to, tiered survey area priorities, biopsy and tagging effort status, and priority species presence .

It is recommended to avoid large gaps along the trackline that smaller sections (10-20 nm) be skipped on good weather days to spread gaps across the survey area and provide a buffer of miles to allow for the vessel to hold station in periods of poor weather.

To guide the CL in day to day planning it is recommended that a mileage tracker spreadsheet be created. The tracker will aid in monitoring the pace of the survey and guide in day to day decisions od skipped mileage. To establish the tracker, the CL should calculate the average number of miles per day the vessel should progress to cover the total planned survey miles.

For example:

1500 nm over 35 survey days= 50nm/day

The actual day to day accumulated mileage can be compared to planned average progress which will inform decisions on when and how much trackline to skip.

See appendix XX for example spreadsheet.

7. Data forms

More information on data forms is given in Section IV.1A and B, and IV.2A and B.

Sighting data are recorded on the Sightings record. The sightings record is designed to contain all the observed information relevant to any cetacean sighting during a cruise - it can also be used for recording off-effort sightings although much of the data may not be obtainable. The record is completed by the researchers.

A single Sightings record is used for each cetacean sighting, regardless of search effort mode or composition of the sighting. A record should be completed for each distinct aggregation of cetaceans seen, eg. a pod of whales with dolphins around them is a single sighting. If a group of animals separates when approached, all subgroups are to be considered part of the original sighting.

In IO, NSP, or any other Passing Mode survey, there is one-way communication concerning observations: the topmen in both the barrel and IOP are **not** informed of sightings made from other platforms but the researchers on the upper bridge are informed of all sightings. Separate records are completed for all standard barrel and IOP sightings whether or not they are duplicates. If the upper bridge makes a sighting prior to the same whale group being observed by the topmen in either the barrel or IOP, then a separate record is completed; otherwise the upper bridge information is added to the sighting record(s) completed for the barrel and/or IOP.

For example, if the observers on the upper bridge are the first to sight a whale group, and subsequently the topmen from both the standard barrel and IOP sight the group, three sighting records will be completed for the same school, with independent estimates of angle and distance for initial sightings from each of the platforms. This is termed a 'triplicate' sighting.

In all Closing Modes there is no use of the IO platfroma and there is open communication between the upper bridge and the barrel, so only one sighting form is completed for a single sighting, regardless of which platform makes the initial sighting.

The objective in completing the Sighting record is to record the best information possible. If there is conflicting information from two or more platforms about one school, evaluate what is the most reliable and detailed information and use that to complete the form. It is solely the researchers' responsibility to determine what data are recorded on the sighting record. Whenever a problem is encountered in completing the information, the form should be annotated in sufficient detail that others reading the annotation will understand the circumstances and difficulties involved. If possible, the annotation should include suggestions on how to interpret the information.

NB ANGLE BOARDS WITH POINTERS MUST BE USED FOR ANY ANGLE MEASUREMENTS AND RETICLE BINOCULARS MUST BE USED FOR ANY DISTANCE MEASUREMENTS.

B. GUIDELINES FOR CONSTRUCTION OF CRUISE TRACKS AND STANDARDISED MODIFICATIONS
THIS WILL NOT BE NEEDED FOR THIS CRUISE.

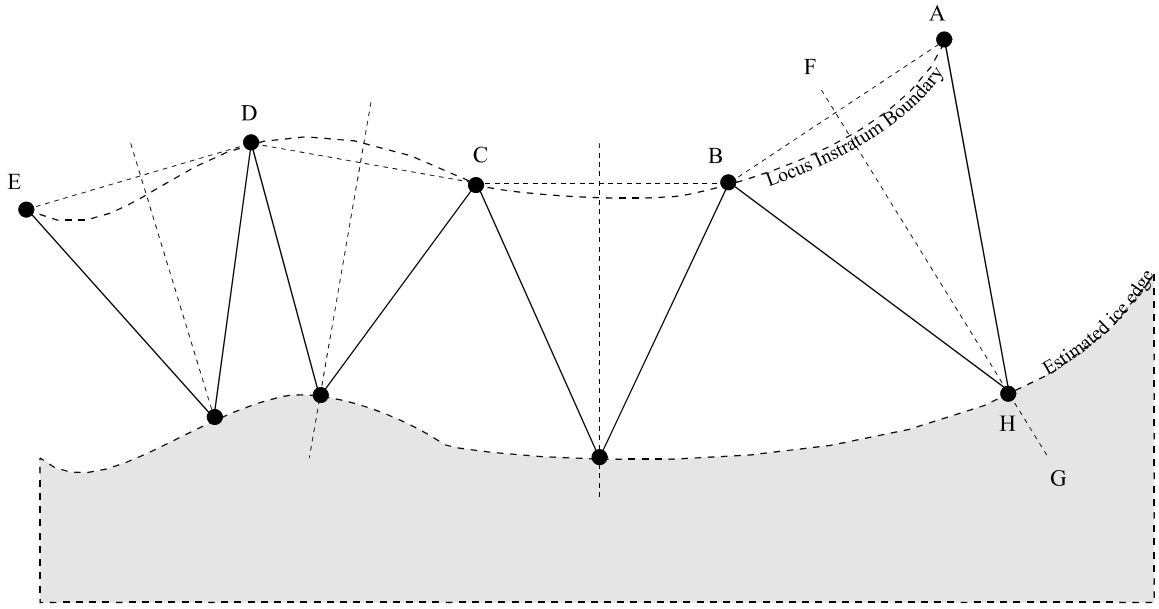


Fig. 1. Cruisetrack constructed in relation to an Interstratum Boundary established as a locus of points equidistant from an estimated ice edge. (Cruisetracks are indicated for the Southern Stratum only).

The research area is normally divided into two strata, a Northern and a Southern stratum. The Southern stratum is usually 60-90 n.miles in width (approximately) and its southern boundary is the ice edge, land, or the 100 fathom isobath (if this extends north of the ice edge). The boundary between the strata is constructed either on a line of latitude or as a locus of positions equidistant from the southern boundary.

The following summary of cruisetrack construction relates to a 'standard' cruise aimed at obtaining an abundance estimate for minke whales.

1. Cruisetrack based on Locus Interstratum Boundary

1.1 Cruisetrack construction procedure:

(1) Estimate position of the ice edge.

(2) Decide the width of the Southern Stratum and construct the Interstratum Boundary as the locus of points equi-distant from the estimated ice edge. Note this is shown as curve AE in Fig. 1. For simplicity, however it is usually constructed as a series of straight lines.

(3) Decide the number of transects in the Southern Stratum (taking account of the intended coverage intensity and the number of days available for survey). Establish the waypoints on the Interstratum Boundary by dividing the Interstratum Boundary into equal-length segments corresponding to the number of transects desired (waypoints A, - E in Fig. 1).

(4) Construct the perpendicular bisectors of the straight lines joining the waypoints on the Interstratum Boundary and construct ice edge waypoints at the intercepts of the perpendicular bisectors with the estimated ice edge (e.g. in Fig. 1, line FG is the perpendicular bisector of line AB and waypoint H is at its intercept with the estimated ice edge).

(5) Decide the number of transects in the Northern Stratum and establish the southern boundary waypoints of the Northern Stratum on the Interstratum Boundary.

1.2 Modifications to the locus Interstratum Boundary.

Modifications to the locus Interstratum Boundary may be necessary when the position of the true ice edge is substantially different from that of the estimated ice edge.

Examples of modifications to the locus (as well as standard modifications to the cruisetrack) when the true ice edge is substantially farther south of the estimated ice edge are shown in Fig. 2. Fig. 3 shows further examples of modifications to the locus and cruisetrack when the true ice edge is substantially north of the estimated ice edge.

Southern waypoints for the Northern Stratum cruisetracks (not shown) are constructed on the locus. If a Northern Stratum waypoint has already been constructed on the locus, then the locus is fixed and cannot be adjusted.

As for Fig. 2, southern waypoints for the Northern Stratum cruisetracks are constructed on the locus.

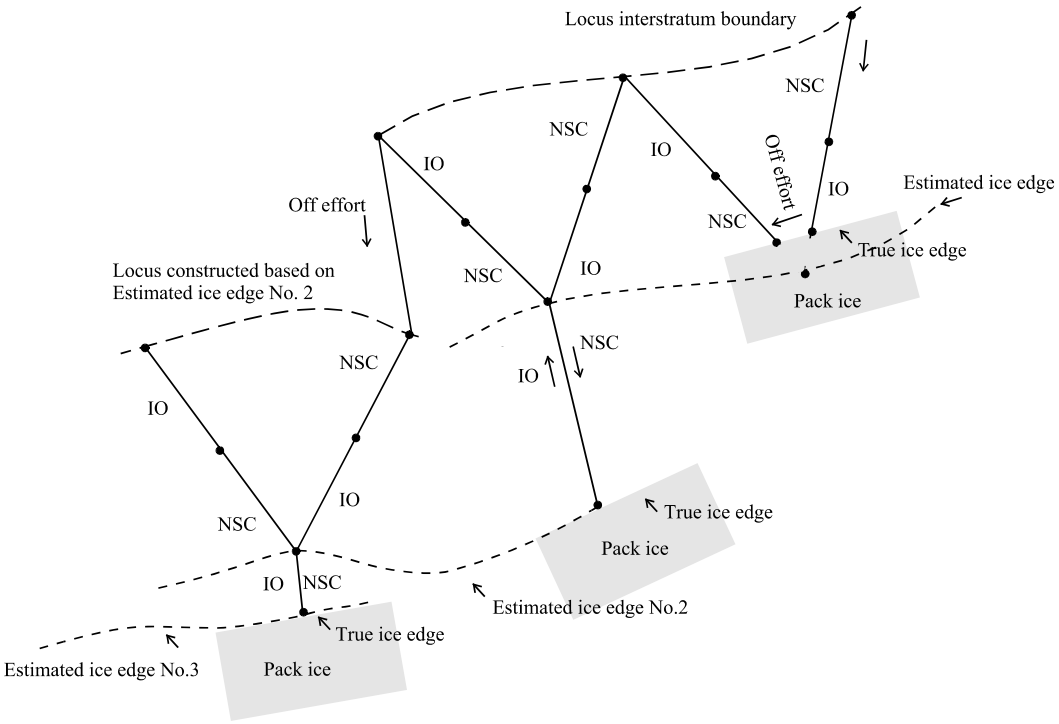


Fig. 2. Examples of standard modifications used with the locus cruisetrack design, in particular, showing modifications to the locus when the true ice edge is located much farther south than the estimated ice edge.

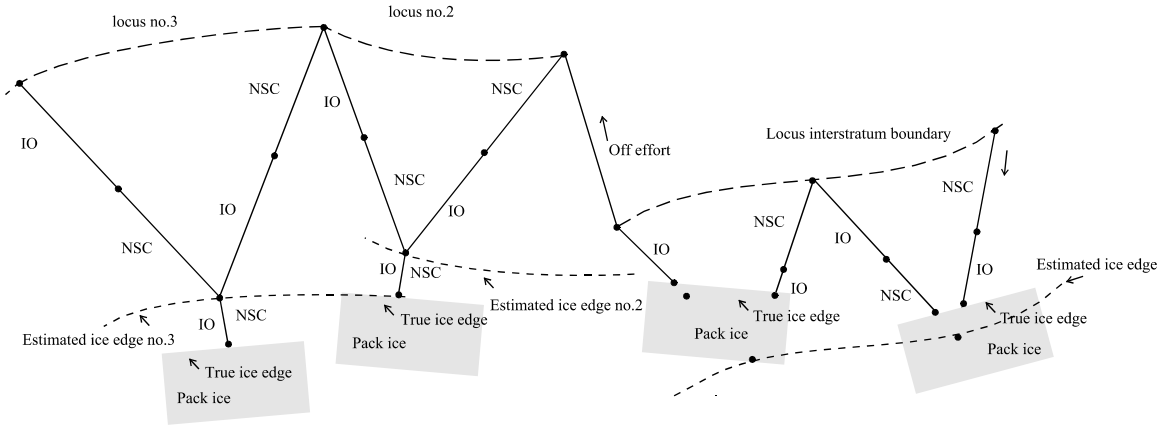


Fig. 3. Examples of standard modifications used with the locus cruisetrack design, in particular, showing modifications to the locus when the true ice edge is located much farther north than the estimated ice edge.

2. Modifications to the cruisetrack

Examples of standard procedures for cruisetrack modifications are shown in Figs 4-8.

Ice edge waypoints are established 2.5 n.miles from the ice edge. If the ice edge is encountered prior to reaching a planned waypoint, 2.5 n.miles from the estimated ice edge, the vessel shall follow the ice edge, off-effort, until survey can be resumed on the planned trackline (as shown in Fig. 4).

If the ice edge is not encountered on reaching a planned ice edge waypoint, research shall be conducted on a bisector. Survey mode is to be changed at the planned waypoint (unless the ice edge is within 5 n.miles of the waypoint), and again on reversing direction when the true ice edge is encountered (Fig. 4). If the constructed cruisetrack intersects a peninsula of pack ice, the vessel will steam around the peninsula until effort can be resumed on the constructed trackline (according to either Fig. 5A or B below). Waypoints are to be established at the positions where the vessel deviates from and rejoins the constructed cruisetrack.

If the constructed cruisetrack intersects pack ice requiring the Topmen to assist with ice navigation, a waypoint is established and the research mode changed to the appropriate ice navigation mode (BA or BI).

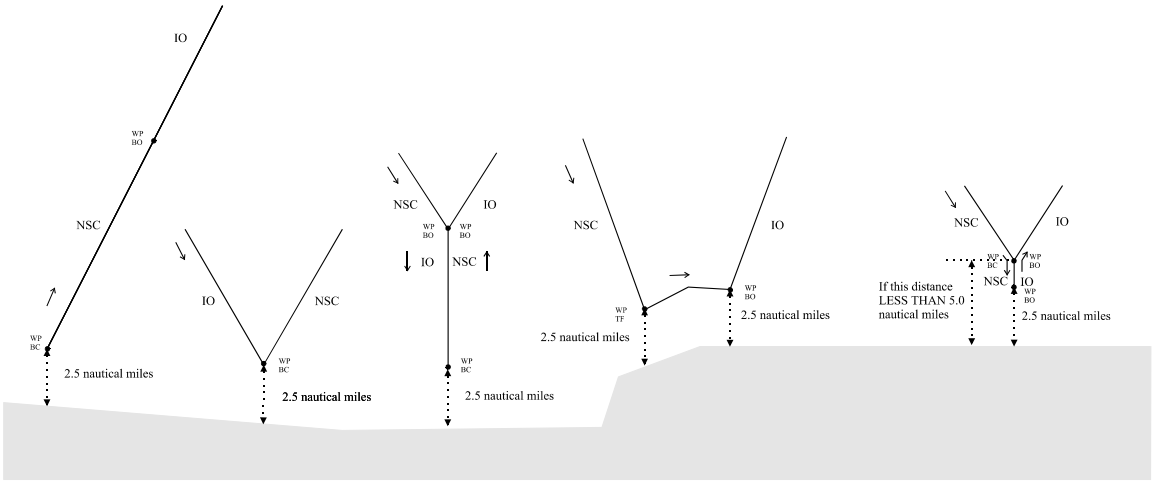


Fig. 4. Standardised cruisetrack modifications in relation to differences between the estimated ice edge and the true ice edge.

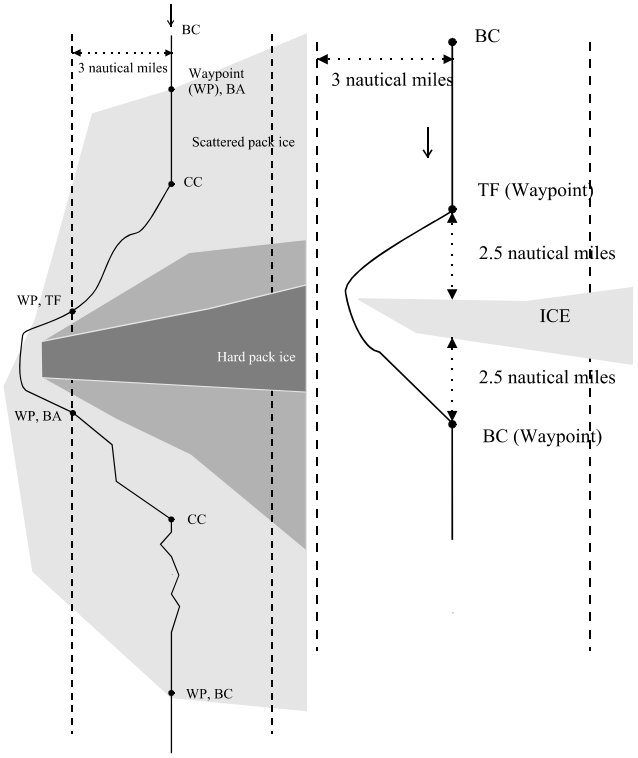


Fig. 5A (Left) and Fig 5B (Right). See text.

During ice navigation, if the vessel moves outside the 3 n.mile bound, the vessel will steam off-effort around the ice to investigate if effort can be resumed on the trackline (either at the 3 n.mile bound, in ice navigation mode, as shown in Fig. 5A or on the constructed trackline as shown in Fig. 5B, if the trackline is ice free).

If the constructed cruisetrack intersects pack ice requiring the Topmen to assist with ice navigation, a waypoint should be established and the research mode changed to the appropriate ice navigation mode (BA or BI). During ice navigation, if the vessel moves outside the 3 n.mile bound, the vessel will steam off-effort around the ice to investigate if effort can be resumed on the trackline (either at the 3 n.mile bound, in ice navigation mode, as shown in Fig. 5A or on the constructed trackline as shown in Fig. 5B, if the trackline is ice free).

Waypoints are to be established at the positions where the vessel deviates from and rejoins the constructed cruisetrack (as well as for major course alterations).

(Note: During research in ice navigation modes, standard return to trackline procedures, as shown in Fig. 6, do not apply).

If the constructed cruisetrack intersects a peninsula of pack ice, the vessel will steam off-effort around the peninsula until effort can be resumed on the constructed trackline. Waypoints are to be established at the positions where the vessel deviates from and rejoins the constructed cruisetrack.

Fig. 6. (next page) shows examples corresponding to the following situations:

• In Closing Mode, after confirming a sighting, the vessel returns on-effort to the planned trackline (BR activity code) on a convergent course making a 45° angle to the trackline. However, if confirming or subsequent experimental activities take the vessel outside a 3 n.miles bound either side of the constructed cruisetrack, it returns off-effort (TF activity code) to a point on the trackline corresponding to the furthermost location in the direction of the trackline reached during these activities.

• The vessel will also return off-effort to this position on the trackline, if after confirming a sighting or subsequent experimental activities, the vessel is still within the 3 n.miles bound but has regressed more than 0.5 n.miles in relation to a point on the trackline corresponding to the initial sighting position.

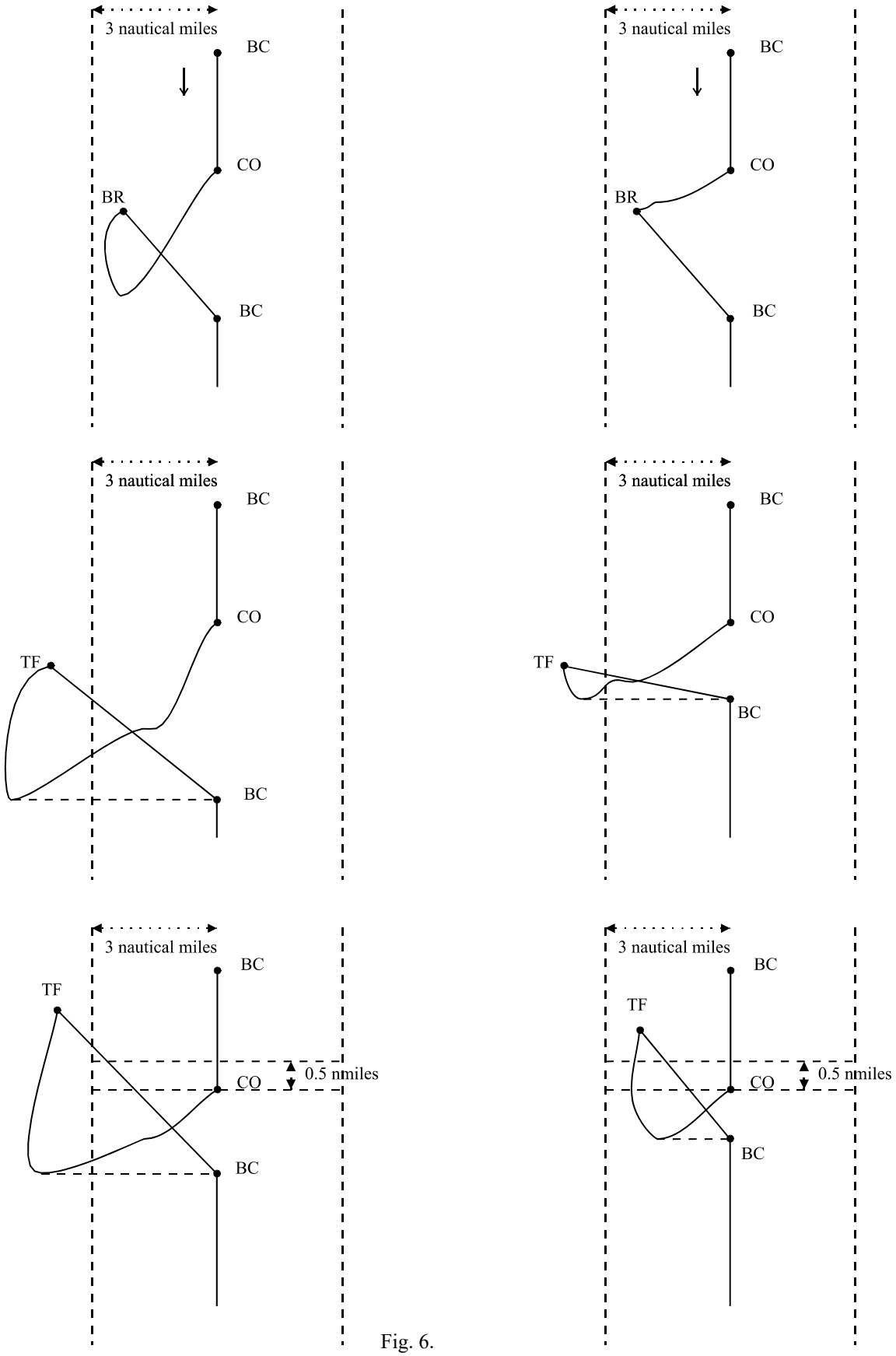

3 nautical miles
BC
CO
BR
BC
3 nautical miles
BC
CO
BR
BC
3 nautical miles
BC
CO
TF
BC
3 nautical miles
BC
CO
TF
BC
3 nautical miles
BC
TF
CO
0.5 nmiles
BC
3 nautical miles
BC
TF
CO
0.5 nmiles
BC

Fig. 6.

Figs 7A and B show examples of the procedure for returning to the constructed trackline if the vessel has progressed past a mode-change waypoint (NSC to IO mode) during confirming activities in Closing Mode. The vessel returns off-effort (TF activity code) to the constructed trackline as shown in the examples in Figs 7A and B.

When closure to a sighting (for example, a group of blue whales) is conducted from abeam during IO mode, the ship will return (off effort) to the trackline, *normally* to join the trackline at a point corresponding to the furthest along the trackline reached during the confirming/experimental activities (as shown in Fig. 8). However, as each case will different, generalisation is not altogether possible. (For example, if the confirming activities are conducted at considerable distance from the trackline and last for a considerable duration, it may be most appropriate that the vessel returns to the position on the trackline from where primary effort in IO mode was interrupted to commence the abeam closure).

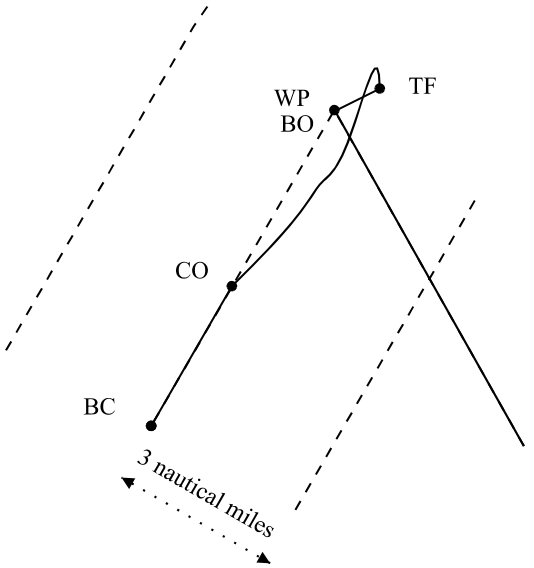


Fig. 7A. If at the completion of confirming a sighting, the ship has passed a mode-change waypoint, but the point corresponding to the furtherest along the trackline reached during the confirming activities is no more than 0.5 n.miles ahead of the waypoint, the ship will return (off-effort) to the waypoint to commence searching in IO mode.

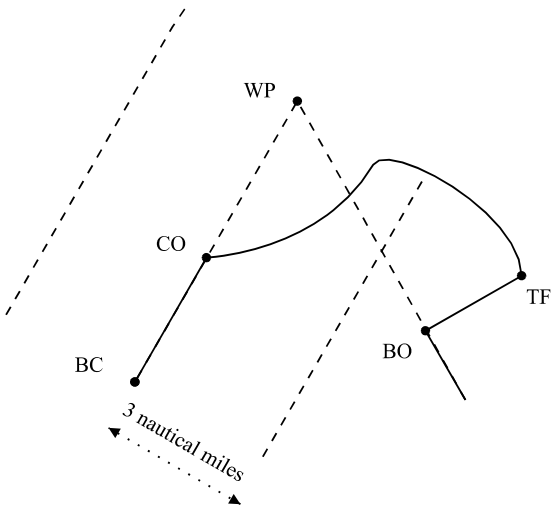
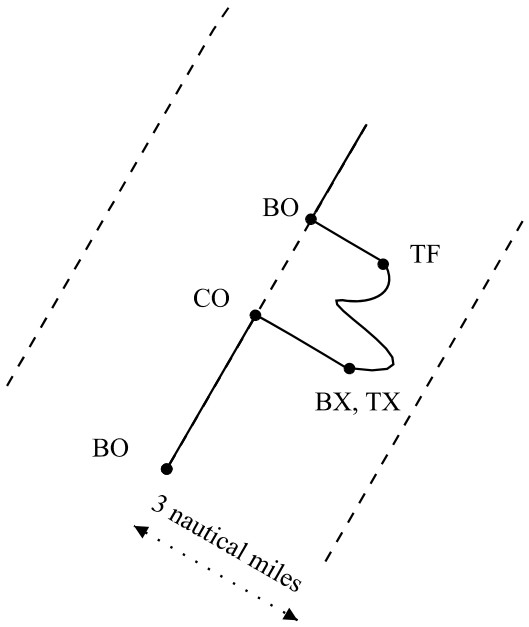


Fig. 7B. When confirming a sighting is completed and the ship has passed a mode-change waypoint and has proceeded more than 0.5 n.miles ahead of the waypoint during these activities, the ship will return (off effort) to the constructed trackline to commence research in IO mode at a point corresponding to the furthest along the trackline reached during the confirming activities.



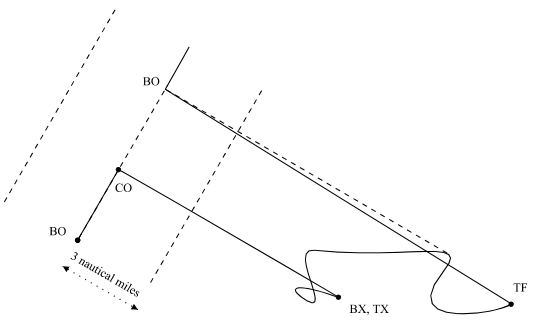


Fig. 8. (lower two figures on right). Examples of return to trackline procedures after abeam closure to sightings from IO mode. Both examples shown return (off effort) to the constructed trackline to commence research in IO mode at a point corresponding to the furtherest along the trackline reached during the confirming activities.

C. STUDY FOR TAGGING

1. Study for telemetry

1.1 Introduction

In 2021, a feasibility experiment to investigate the use of telemetry to elucidate the diving behaviour of sei and fin whales was undertaken with the objective of using such data to investigate availability bias in order to try to correct abundance estimates (IWC, 2023).

It has been suggested that the surfacing patterns **using TDR logger** might be diagnostic of sei, fin and humpback whales and thus dive time/swimming speed measurement experiments may provide useful information. In addition, they can provide useful input for certain population estimation techniques. In practice therefore, such experiments can best be carried out in parallel with biopsy experiment. Telemetry studies will be considered for long-term movements (relevant to distribution, movements within the surveyed area and identification of breeding areas) for such as blue whale (IWC, 2023).

1.2 Equipment

TDR tags (type: SPLASH10-f-333, Wildlife Computers, US) in the Low-Impact Minimally Percutaneous External electronics Tag (LIMPET) with two 6.8 cm darts with six petals, using ARTS system. Mote (Wildlife Computers, US) is used for retrieving continuously log telemetry data from satellite tags on animals within the reception range. Yagi and omnidirectional antenna were equipped on the top barrel (approx. 20m above the sea level). The yagi antenna has directivity and about a 60 ° beamwidth within which we will receive distant signals (about 8.5 nautical miles when placed at 20 meters). The omnidirectional antenna can receive signals from all directions, but the distance will be shorter than yagi.

SPOT-177S (Wildlife Computers, US) will be the primary equipment for tracking horizontal movements for blue whale. The tag is 14.5 cm long and programmed without a duty cycle and with 15 s repetition intervals. The ARTS system will be used for deployment.

1.3 Research protocol

During any single encounter, no more than two attempts per individual will be made. If signs of harassment such as rapid changes in direction, prolonged diving and other behaviours are observed from an individual or a group, the attachment activities will be discontinued on that individual or group. The animals to be attached will be approached by the vessel within approximately 15 to 20m of the bow of the vessel - normally do not shoot at distances less than 10m. Care should be taken to avoid the head region.

3.4 Data forms

See Section IV. 3.

D. BIOPSY SAMPLING

1. Equipment

The following equipment will be available: the Larsen gun. Please ensure that all equipment is well maintained.

Biological sample collection will occur from large vessel surveys using biopsy sampling (skin/blubber collected by projectile dart). Projectile biopsies will be collected using black powder gun.

2. Techniques

During any single encounter, no more than five biopsy sampling attempts per individual will be made. It is rare that an animal would be targeted for biopsy more than twice during one encounter, but we conservatively request five sample attempts to allow for occasional low success rates. If signs of harassment such as rapid changes in direction, prolonged diving and other behaviours are observed from an individual or a group, the biopsy activities will be discontinued on that individual or group. The animals to be sampled will either approach the vessel on their own or be approached by the main research vessel during normal survey operations. The projectile biopsy sample will be collected from animals within approximately 5 to 30m of the bow of the vessel.

When approaching the whales, follow the same procedure as for photo-identification (Section III.5) i.e. avoid rapid engine and direction changes and follow a path convergent with the direction of travel of the whale. While it is possible to collect samples at ranges of up to 50m - normally do not shoot at distances less than 10m. Care should be taken to avoid the head region. Experience on the previous two cruises has shown that it can be difficult to obtain blue whale biopsies, so if a chance arises - take it - even if photo-id shots have not been taken (see 'Priorities' under Section II).

For large cetaceans, small samples (<1 gram) will be obtained from free-ranging individuals using a biopsy dart with a stainless steel tip measuring approximately 4 cm in length with an external diameter of 9mm and is fitted with a 2.5 cm stop to ensure recoil and prevent deeper penetration (so that only 1.5cm of the tip is available to penetrate the animal). Between sample periods, the biopsy tips are thoroughly cleaned and sterilized with bleach. Biological samples may be collected from adults, juveniles, females with calves and calves. The same size biopsy dart would be used for calves as for adults. No biological samples will be taken from newborn calves.

Samples for molecular genetic analyses are to be divided in half, with one half of the sample for Japan and the other half for the IWC. Prior to 2006-07 samples for Japan have been frozen and samples for the IWC have been preserved in DMSO/salt solution, on this cruise all samples will be frozen. In addition, when biopsy samples have a significant amount of blubber attached, the blubber is to be separated from the skin, wrapped in aluminium foil, and frozen.

3. Data forms

See Section IV.5.

4. U.S. ESA/MMPA permit

For biopsy efforts that occur under a U.S. ESA/MMPA permit, additional conditions for biopsy efforts may apply and the IWC researchers shall review the permit with the permit holder representative.

A copy of the US permit must be retained with samples collected during transport and in storage. Samples cannot be utilized without permission of the permit holder and the permit number must accompany any publication of results of analyses.

All biopsies collected under a U.S. permit are the property of the permit holder. The permit holder will share samples with the IWC and ICR but retain control over use of shared samples unless or until there is a formal parts transfer per regulatory requirements.

Records of all the data taken in US EEZ waters be made available for unrestricted scientific research.

E. PHOTO-IDENTIFICATION GUIDELINES

1. Blue whales and other rorquals

This section is based on Sears (1990). A copy of *Rep. int. Whal. Commn* (special issue 12) which contains this paper and a number of other relevant papers is part of the reference documentation. The guide by Calambokidis is also very useful and a copy will be available.

1.1 Equipment

Digital SLR cameras will be the primary equipment for this study. **Shoot raw files** (if the camera permits you can simultaneously also shoot fine jpegs).

1.2 Techniques

It is preferable to take photographs perpendicular to the whale. As the identification pattern can be different on both sides of the animal, it is important to try and photograph both sides, but priority should be given to the left hand side, i.e. that side should be attempted first whenever possible. If working a group, try to concentrate on one whale before starting on another and use "marker frames" between animals in order to avoid ambiguities in analysing photographs. It is important to keep detailed notes. The aim is to photograph as much of the flanks as possible. Try to avoid both glare reflecting off the body and backlighting, both of which can result in unusable images. If the animal is one that shows its flukes on diving then try to photograph this, but only after you are satisfied that the flanks have been adequately photographed.

Note: From the viewpoint of the development of a visual key, *it is particularly important* to try to also obtain photographs from other side of the animal.

In closing with the animals, it is important not to approach too fast nor change direction or speed frequently. It has been most productive to follow a course almost parallel to the whale but converging slowly with it.

2 North Pacific right whales

2.1 Equipment

As above for blue whales.

2.2 Techniques

The key area for identification is the head (callosities and lip patches) and any scars noted along the body, caudal peduncle and flukes .For NP right whale images of the top of the head are preferred. however images of both sides of the head are acceptable. If only one side is possible, it should be the left hand side. Head photographs should be taken as vertically as possible, i.e. from the barrel (although this is of course not possible from the Zodiac). Other distinguishing or unusual marks or scars should also be photographed, as well as the flukes of fluking animals. If working a group, try to concentrate on one whale before starting on another and use "marker frames" between animals in order to avoid ambiguities in analysing photographs. It is important to keep detailed notes, especially when working with groups.

A similar approach method to that described for blue whales is recommended.

3 Humpback whales

3.1 Equipment

As above for blue whales.

3.2 Techniques

The key area for identification is the ventral side of the flukes: coloration, scars and the trailing edge outline are all important. Try to obtain a good fluke photograph as highest priority. A good photograph should almost fill the frame. Dorsal fins and lateral colour patterns have also been used in identification, particularly for "non-flukers". Although if possible it is good to photograph dorsal fins/lateral patterns from both sides of the animal, as a rule try to get the left side as a minimum. Remember to photograph the peduncle of the animal (i.e. the ridge behind the dorsal fin) as extensively as possible - 'knuckles' can be very useful. As always, take detailed notes, particularly when relating dorsal fin/lateral patterns to fluke photographs. Fluke photos should be of the ventral surface and therefore are taken from behind the animal. Avoid rapid changes of speed and direction on approaching the animal.

9.4 Data forms

See Section IV.6.

F. VIDEOTAPING

1. Equipment
Suitable video and SLR cameras will be available.

2. Videotaping
Videotaping can start either on the initial hydrophone deployment (if the whale is close enough) or after closure for biopsy/photo-identification. It can continue during the subsequent pursuit of the animal, to record a whole suite of behaviour, from undisturbed to full flight. Blowhole views can be obtained at that time, as well as views for individual identification.

Filming should take place from the barrel and be carried out by those researchers undergoing 'training' - see Section III.1A.

Emphasis should be given to videotaping

(1) the relative body proportion of the animals;
(2) the detail of the head with particular emphasis on the blow hole.

Long sequences should be recorded since in the past, analysis of short sequences has proved problematic.

3. Photography
Sequence photographs of surfacings should be obtained with particular emphasis on the head region and particularly the blow hole. Photographs should be taken from the barrel or independent observer platform.

4. Data forms
See Section IV.7.

G. ESTIMATED DISTANCE AND ANGLE EXPERIMENT

This experiment is designed to examine the precision and accuracy of distance and angle estimates to a sighting. A buoy with a radar-reflecting lens is used as the sighting target and distance and angle estimates are made by the observers while the ship is underway at normal searching speeds.

The new approach developed for the 2015 survey should be repeated (SC/66b/Rep02 and SC/66b/IA09). **NB:** observers need only be tested from those platforms that they would normally watch (e.g. there is no need for topmen to be tested from the upper bridge).

The recommended improvements from the 2014 TAG report (SC/66a/Rep02) were:

(1) use of relatively inexpensive GPS technology (less than $200 for a waterproof tough model) on the buoy to improve detectability (a) at greater distances and (b) in more realistic sea/weather conditions than may be possible using the present radar system;

(2) use of two or more buoys which can (a) reduce the potential lack of independence with one buoy with the correct experimental protocols and (b) allow increased efficiency which will assist when having a greater distance range and when including researchers as well as the crew in the experiment (multi-buoy experiments have been successfully conducted in the North Atlantic).

With respect to the additional buoy, the meeting suggested that perhaps a smaller buoy than the one currently used (to simulate a whale's body rather than the blow) could be provided on the vessel.

A training exercise should be conducted on a priority basis near the beginning of the cruise to familiarise the observers with distances, angles, and the use of reticule binoculars and angleboards. The exercise uses the estimated distance and angle experiment procedures, except that several observers can make estimates at one time, and the observers are informed of the radar values in each trial. The exercise may be done with the ship underway or stationary. The number of trials conducted is at the discretion of the Cruise leader/Senior Scientist.

A large buoy with a radar transponder is used as the sighting target. At pre-determined distances and angles from the buoy, visual observations by the observers are taken simultaneously with radar readings. Twelve trials per observer, per sighting platform are scheduled. Primary observers should be tested from platforms where they normally conduct sighting effort and should use the same procedures and equipment used in their normal sighting procedures (including, as for BT option-II, trials for naked eye observers in the IOP). The experiment should be conducted during weather and sea conditions representative of the conditions encountered during the survey. It is preferable for the experiment to be scheduled for the middle of the survey period. Since sea conditions near the ice edge are usually less changeable, it is recommended that the experiment be attempted near the middle of the cruise about the time that the vessels swap strata.

The cruise leader/Senior Scientist should select at random, distances from twelve of the following seven ranges (in n.miles): 0.00 - 0.25; 0.26 - 0.50; 0.51 - 1.00; 1.01 - 1.50; 1.51 - 2.00; 2.01 - 2.50; 2.51 - 3.00.

Similarly the angles should be selected, at random, from twelve of the following four trials (in degrees): 00 - 10 four trials; 11 - 20 four trials; 21 - 40 four trials; 41 - 60 four trial.

Any source of bias that is not existent in normal searching should be identified and avoided. To avoid known problems the following procedures should be followed:

- Observers should not know what distances and angles are being examined.
- Observers should not discuss the previous test with other observers.
- Observers should be below deck between trials.
- Observers should not look for the buoy until told to.
- Observers should not be told the results of the test until after the survey.
- Distances and angles should be over a range and not consistently a single value for all observers during a single trial.

Priority is given to the barrel and IOP trials. Trials with researchers as observers have the lowest priority.

The form should be completed by the Senior Scientist, or under the Senior Scientist's direction. The logistics of conducting the experiment will be determined aboard each ship, but the assistance of the chief and/or second officer will be required.

Information on data forms can be found in Section IV.8.

H. WEATHER, EFFORT, ICE-EDGE AND MARINE DEBRIS DATA COLLECTION

1. Weather

The weather form (Section IV.10) is the sole record of environmental conditions and data should be collected using a consistent methodology throughout the cruise. The record is a sampling of conditions, rather than a complete weather log. That is, the conditions are recorded at a preset interval (every hour) rather than recorded when conditions change.

The weather record is maintained by the ship's officers and is completed every hour from 0600 hrs to 1900 hrs while in the research zone. During transit the recording should start at the hour prior to the scheduled starting time of research and end at the hour after the scheduled ending time (unless the research begins or ends on the hour—recording would then begin or end on that hour). If research extends beyond the standard schedule by more than 30 minutes, additional weather information should be included on the form.

On this cruise it is important to continue to collect good glare data, recognising that appropriate analytical techniques to incorporate this information into abundance estimates are still being developed. If glare is a concern immediately ahead, a zigzag course would be adopted. [See Section 6.3 for more detail]

2. Effort

This form (Section IV.11) is designed to record all the relevant activities of the vessel so that all searched and non-searched transects can be determined in analysis. The form allows the computation of time, distances covered and location of all activities.

The Effort record is completed every day of the research programme. The Chief and Second Officers are responsible for the completion of the daily records. The cruise leader should work with the officers, especially in the beginning of the cruise and during unusual activities, to assist in the correct coding of all activities. If uncertainties arise, use the most appropriate coding and then annotate the entry. Provide a full explanation of the problem and the course of action taken.

Research activities are identified by the Effort code. Effort codes are classified into four categories: On-effort, Off-effort, Experiments, and Navigation. The following sections describe these codes:

2.1 On-effort codes

These codes indicate the initiation or termination of full-effort sighting survey.

The codes indicating the start of on-effort work must be used whenever On-effort sighting effort starts or the type of on-effort activities change. Use of the ending codes (those beginning with **E**) is optional in most cases.

The following table lists the acceptable On-effort codes:

Code	Definition
BB	Begin searching in blue whale survey mode (selective Closing Mode)
BO	Begin searching in IO Passing Mode.
EO	End IO Passing Mode
BP	Begin searching in normal Passing Mode (NSP) including “Passing with abeam closing Mode”
EP	End normal Passing Mode
BH	Begin searching in NSP mode in a high density area.
EH	End searching in NSP mode in a high density area.
BI	Begin searching in NSP mode with ice navigation.
EI	End searching in NSP mode with ice navigation
BC	Begin searching in Closing Mode
EC	End searching in Closing Mode
BR	Begin returning to the trackline in Closing Mode
ER	End returning to the trackline in Closing Mode
BL	Begin searching in high whale density area
EL	End searching in high whale density area
BA	Begin searching in Closing Mode with assisted ice navigation.
EA	End searching in Closing Mode with assisted ice navigation
BW	Begin searching in big eye BT in IO mode
BY	Begin searching in big eye BT in BI mode
BZ	Begin searching in big eye BT in NSP mode
BT	Begin searching in BT option 2
SS	Begin SS-III experiment
SZ	Begin searching in SS-II mode

Table 1. Search effort codes: On effort

2.2 Off-effort codes

All time and major position shifts must be accounted for during the research day. The off-effort codes are used to indicate activities (or lack of) when search effort is not being conducted. The ED code must be entered every day.

The following table lists the acceptable Off-effort codes:

Code	Definition
TD	Begin transit, on the constructed trackline, without full search effort
TF	Begin transit, off the constructed trackline, without full search effort
DR	Begin drifting
ED	End of the scheduled research for the day
CO	Beginning confirming sighting information
CH	Begin chasing whales
WP	Trackline waypoint

Table 2. Search effort codes: Off-effort codes

The TD code designates the beginning of transit, on the constructed trackline, without full search effort being conducted. The TF code designates the beginning of transit, off the constructed trackline, without full search effort being conducted. The TF code is to be used when the vessel is transiting between transects, returning to the constructed trackline , if confirming activities have taken the vessel outside the 3 n.mile bound either side of the constructed trackline or when following the ice edge if ice obstructs the constructed trackline.

Navigational and other Off-effort codes should be used to record the activities during TD and TF modes.

The DR code records the beginning of drifting (including waiting, resting, non-experimental photo-opportunity, fog, ice-retrieval). This is the general code to designate that the vessel is not on search effort and that it is not underway. Also use this code when the vessel is hove-to in a storm and when it is returning a short distance, at variable speed and course, to the original drifting position. Do not use this code when drifting after the end of the scheduled research for the day.

The ED code records the end of the scheduled research for the day. This should be the last code on a daily effort record unless the ship is continuing on a predetermined course that will place the next day's starting position distant from the ED position (e.g., during transit).

The CO code designates the beginning of whale confirming activities. Use this code whenever the vessel turns to confirm a sighting regardless of the effort mode (closing, passing, or off-effort). The vessel is considered off-effort during confirming. Additional CO codes are not entered if other schools are observed (and subsequently approached) while confirming a school.

The CH code is restricted to those experiments that require pursuing the animals. Since pursuit of the animals will be conducted only during experiments that have their own codes (ie. biopsy and natural marking), it is unlikely this code will be used. The vessel is considered off search effort while pursuing the cetaceans.

The WP code designates the occurrence of a navigational waypoint. An effort code must immediately follow this entry.

2.3 Experiment codes

All experimental periods must be flagged with beginning (BX) and ending experiment (EX) codes. The BX code must be followed by the specific experiment code to designate what type of activity is taking place. If activities are suspended due to weather conditions or other causes, use the appropriate off-effort codes; when the trial resumes the specific experiment code is again used. The EX code is used only when the entire trial is completed or aborted, or the end of the day has been reached. Conducting some experiments does not necessarily imply that searching effort must be interrupted. For this reason note that the BX code (Begin experiment) is the only one which requires an EX (End experiment) code.

The following table lists the acceptable codes:

Code	Definition
BX	Begin experiment
EX	End experiment
DX	Estimated distance and angle experiment
PX	Photo-identification experiment.
SX	Dive time experiment
TX	Biopsy tissue sampling experiment.
OX	Other experiment

Table 3. Search effort codes: Experiments

2.4. Navigation codes

These course and/or speed changes are recorded only when the vessel is in On-effort mode, or steaming with topmen down (TD or TF). Minor changes such as negotiating around ice floes are **not** recorded unless the changes will remain constant for periods greater than five minutes.

The following table lists the acceptable codes:

Code	Definition
SC	Speed change without change in activity or course
CC	Course change without change in activity or speed
CS	Course and speed change without change in activity

Table 4. Search effort codes: Navigation codes

3. Ice edge **(not relevant on the this cruise)**

This form (Section IV.12) is used to record information on the position of the pack ice/open water boundary and should be completed by either vessel that encounters pack ice (the 100 fathom line is also used as a boundary) during the survey (this is usually only the southern stratum vessel).

Data for this form can come from a variety of sources: visual, satellite, and other ship observations, charts (for land boundaries), and interpolations based on these sources. The Senior Scientist should try to integrate the sources for the most robust estimate of the ice edge.

The data are used to construct a boundary of the survey area and therefore it is important that, when connected, the data points produce a continuous line that is representative of the limits of open water. Whenever possible the data should be entered into the computer and plotted, or plotted on a chart to assure that the line is continuous. The Senior Scientist should also produce separate ice-edge records that are the most reasonable estimates for the best, north, and south extremes of the pack ice edge. If there is no evidence to suggest that the pack ice boundary may be different from the best estimate, then the other estimates need not be completed.

NOTE: Since the three estimates of the ice edge are often composites of existing files (SSM/I, AMSR-E, visual observations) and estimates of recession, not all the data may exist on the ice-edge record data form. Do not transcribe the information onto data forms; produce a properly formatted and labelled printout of the file in place of the data forms. Daily visual observations, however, must be recorded on the data forms.

If a discontinuity in the estimated ice-edge line exists (if the ship completes a sector, for example), then 9s should be filled in across one line of the form.

4. Marine debris

Marine debris is an element of concern in all marine environments and could have an impact on the total ecosystem. We have therefore been collecting data on floating marine debris in this program to observe the type and extent of the marine debris in waters.

Details are given in Section IV.13.

5. Glare

Glare can affect the ability of observers to make sightings. AS noted earlier, it is important to collect good data on glare on the 2023 cruise.

The record (Section IV.14) should be recorded at the beginning of each on-effort period and then at any time conditions change. The glare record is the responsibility of the researchers.

I. Acoustics

During the 2023 POWER field survey, passive acoustic monitoring for marine mammals will be conducted using sonobuoys. A sonobuoy is a free-floating, expendable, short-term passive acoustic listening device that transmits signals in real time via VHF radio waves to a receiver on a vessel. Sonobuoys will be deployed every two to three hours to obtain an evenly sampled cross-survey census of marine mammal presence. However, when in areas of high whale density, or when trying to localize on a calling species of interest, multiple sonobuoys may be deployed more frequently to obtain near-continuous recording. The acoustician will monitor the sonobuoys in real-time or post process while on board, noting species detected and obtaining bearing and directional information of target species when possible.

3.1 Equipment

The following equipment will be used in passive acoustic data collection: sonobuoys, two UHF antennas (one omnidirectional, one directional), pre-amplifiers, two laptop computers, a MOTU soundcard, up to three WinRadio receivers, and assorted tools to aid in sonobuoy preparation. Both antennas and pre-amplifiers will be placed in the crow's nest of the vessel with the directional antenna facing astern. Low-loss RG8 coaxial cables will run from both antennas down into the cabin to the monitoring station.

3.2 Sonobuoy preparation

Prior to deployment, the sonobuoys will need to be modified and prepared for deployment. These modifications include: Popping the sonobuoy out of the protective outer case, and removing the parachute and any extraneous plastic or unnecessary pieces. The sonobuoys may need to be tied up to shorten the deployment depth to ~25-27 m. This is not only to accommodate shallow water depths, but also is ideal for detecting North Pacific right whales, who often vocalize near the surface.

Other modifications may include replacing the display batteries if needed. This involves opening up the housing of the sonobuoy, removing the dead battery, and replacing it with a new 9V battery. If the dead battery is a lithium battery, this may also include splicing a 9V battery cap onto the battery lead wires. Once tied up and with new batteries, a piece of tape is placed on the tube with all relevant sonobuoy information (year, type, manufacturer, etc.). The sonobuoy will then be stowed or secured in a predetermined place, referred to as the staging area, where it will be ready for deployment.

3.3 Acoustic data collection

3.3.1 Sonobuoy deployment

Starting at 06:00, one sonobuoy will be deployed every two to three hours during the normal survey schedule. When in areas of high whale density, or when attempting to localize on a calling whale, multiple buoys may be deployed simultaneously. At night, once visual ops have concluded, one sonobuoy will be deployed while the vessel is drifting. Because of the slow drifting speed of the vessel, the sonobuoy should remain within range for most of the life of the buoy. This buoy will not be monitored in real time, but will be recorded and post-processed the following day.

At the time of deployment, the acoustician will notify the Chief Scientist and Captain that a sonobuoy will be deployed, and will ask for the current water depth. They will then get one prepped sonobuoy from the staging area, program the sonobuoy accordingly, and deploy it by throwing it over the rail of the vessel into the water. The buoy will be deployed from the stern of the vessel. Once deployed, the acoustician will inform the Chief Scientist and Captain, before returning to the monitoring station.

3.3.2 Real-time monitoring

When monitoring the sonobuoys, only one antenna will be used at a time. The Yagi will be used primarily during transit when the sonobuoy is guaranteed to be behind the vessel, and the omnidirectional antenna will be used for monitoring multiple sonobuoys simultaneously, or when other shipboard scientific operations cause the sonobuoy(s) to not be directly behind the vessel. A switch located in the bridge next to the acoustic station will be used to alternate between antennas depending on the direction of travel.

The acoustic signals received from the sonobuoys to the antennas will be sent to three G39WSBe WinRadio receivers, then input into a MOTU Ultralite mk3 multi-channel external soundcard. This soundcard is connected to a laptop where recordings will be monitored in real-time using ISHMAEL software. The receivers will be controlled using a second laptop. Directional bearing information of calls will be obtained using DiFAR

demultiplexing software and a custom MATLAB interface. A GPS feed (provided by the vessel) will provide the ship's position every minute as well as the sonobuoy deployment location information and time. A custom tracking and plotting program implemented in MATLAB will allow for real-time plotting of the vessel and sonobuoy locations, as well as bearing and location coordinates of calling whales. All data will be simultaneously recorded to an external hard drive, and backed up daily.

Immediately after deploying a sonobuoy, the acoustician will mark the deployment with a date/time/location stamp from the gps. They will then monitor in real-time using noise cancelling headphones as many as three sonobuoys simultaneously. Shortly after deployment, the acoustician will calibrate the bearing information of each sonobuoy using the vessel noise as a sound source. In this way, a bearing angle correction may be added to each bearing calculation from that sonobuoy. Record all species detected for each buoy. Species detections will not be shared with the visual crew to maintain independent, non-biased sampling, except upon their request.

3.4 Localization of calling animal

Should a target species be detected, multiple buoys may be deployed for localizations. In this instance, the acoustician will discuss with the Chief Scientist and the Captain the possibility of diverting from course long enough to deploy additional sonobuoys in ideal localization positions. In the event the critically endangered North Pacific right whale is acoustically detected and localized, the acoustician will notify the Chief Scientist and Captain, and a decision will then be made regarding diverting from course to attempt to visually sight the calling animal.

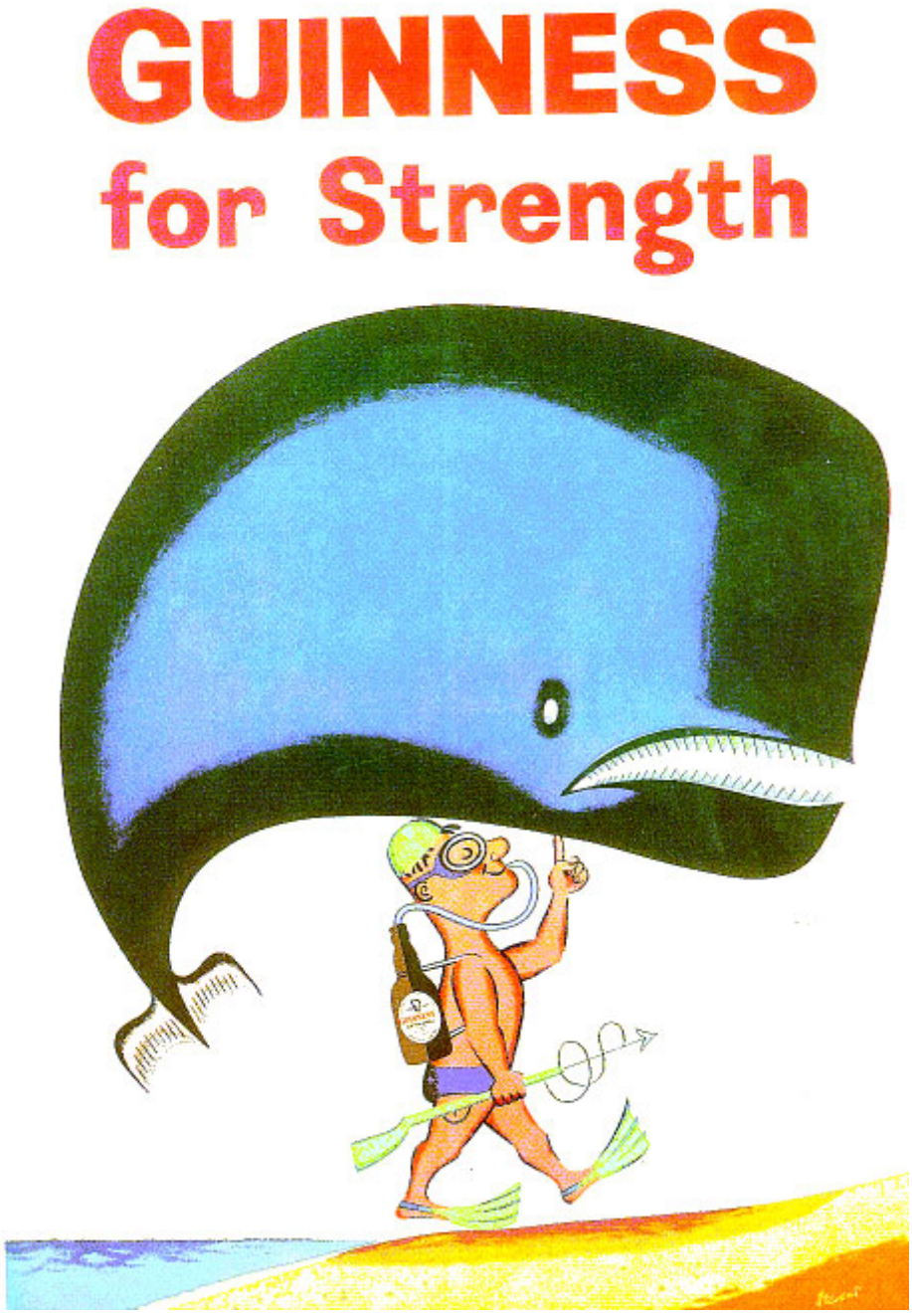
3.5 Post-processing

Because one sonobuoy will be deployed and left recording overnight, those data will need to be reviewed. The acoustician will post-process the previous night's acoustic data (and any other data not monitored in real time) following the same protocols as when monitoring in real time. All species detections will be noted.

3.6 Data forms

Two hard copy data forms will be used during acoustic monitoring. The first, "sonobuoy deployment sheet" will be used to record the deployment information, the date, time, latitude and longitude, as well as the sonobuoy type, manufacturer and year, any modifications done to the sonobuoy, and all species detected for each sonobuoy deployed. The second data sheet "sonobuoy recording log" will be used to record the start and end times of each recording, as well as the antenna used (omni or yagi) and any times that need to be post-processed. All data sheets will then be input into an excel spreadsheet to have digital copies of all data. For more information on the data sheets, see Section IV.4.

IV. DATA FORM INSTRUCTIONS



1A. SIGHTING RECORD (ONLY ELECTRIC FILE)

The following sections describe how to complete the Sightings Record form. The left column shows the data fields on the data form and the right column describes how to complete the form.

Survey Mode

NSC ☐	Place a tick (√) in the box if the sighting was made while in Closing Mode (NSC)
IO ☐	Place a tick (√) in the box if the sighting was made while in Independent Observer mode (IO)
NSP ☐	Place a tick (√) in the box if the sighting was made while in Normal Passing Mode (NSP)
OE ☐	Place a tick (√) in the box if the sighting was made while off effort. This includes all sightings made during TD, TF, DR, and after ED.

Header

Form Number ☐☐☐☐☐	(Squares 1-5) This is the cruise serial number of the sighting.
Year Month Day ☐☐☐☐☐☐	(9-14) Record as year, month, day in the form YYMMDD. For example, 15 August 2023 is recorded as 220815 (But input 2023 into electric file).
Sighting Number ☐☐☐	(15-17) This is the chronological number of each sighting, each day. Begin with 001 at the start of each day.
Type ☐	(18) This is the description of the sighting type in relation to search effort. Use the codes: 1: Primary - made when the vessel is in searching mode. 2: Secondary, full effort - made while the vessel is confirming another group and the vessel was previously on search effort. 3: Secondary, partial effort - made while on TD or TF (off-effort) steaming. 4: Secondary, no effort - made while drifting or conducting other non-searching activities. Include sightings made while confirming but when the vessel was not previously on search effort.
Event ☐	(19) Record the activity associated with this sighting. Record as: 1: Immediate closure completed 2: Sighting passed, no closure attempted 3: Closure attempted but was not successful 4: Closure completed after delay 5: Closure started but not completed due to easy identification 9: None of the above is appropriate (use Caveat)
Sighting Time Hour Minute Sec. ☐☐☐☐☐☐	(20-25) The local ship time at which the sighting was first made. Record to the nearest second. (eg., 171325). If the sighting time cannot be determined within 15 seconds, record the time to the nearest minute and enter "99" for the seconds. (Only electric file)
Compass ☐☐☐	(26-28) Record the compass heading of the ship (Only electric file). •This item is recorded automatically from GPS into electric file.

C/T	(29) Record if the compass reading was taken from the gyrocompass repeater or was the course the ship was being steered. Record as: C: If a simultaneous compass reading was taken (Use C if electric data is available). T: If a simultaneous reading was not taken and the compass bearing being steered was recorded.
P/S	(30) Record where the initial sighting was in relationship to the ship's trackline. Record as: A: If the sighting was observed dead ahead B: If the sighting was observed dead astern P: If the sighting was observed at port side S: If the sighting was observed at starboard side
Angle	(31-33) The estimated angle from the bow of the ship to the sighting. This estimate should be made at the moment the sighting is made and not after the ship has progressed along the trackline or after the ship has turned toward the sighting. Angleboard readings should be used whenever possible.
Estimated Distance	(34-36) Record (in n.miles to the nearest two decimal places) the estimate of the radial distance from the ship to the sighting at the time this was made. Reticule binocular readings should be used whenever possible.
Cue	(37) Record the indicator, or sighting cue, which led to the sighting. Record as: 1: Blow 2: Jump or splash 3: Animal 4: Slick or ring 5: Blow and animal 6: Colour under water 7: Associated wildlife
Swim direction	(38-40) Record the estimated swimming direction at the moment the sighting is made. Swimming direction should be read from the gyrocompass. If the individuals of a group each have a similar but slightly different swimming direction record the mean swimming direction of the group. If individuals of a group are milling or have a substantially different swimming directions record as 888 If swimming direction cannot be determined enter 999. North should be entered as 360 not 000.
Seen By	(41-43) Record who made the sighting, either: 1: Topman in standard barrel 2: Topman in IOP 3: Upper bridge -- primary observer. (Captain and Quartermaster) 4: Upper bridge -- other than primary observer 5: Standard barrel topman and upper bridge simultaneously 6: IOP topman and upper bridge simultaneously 7: Wheelhouse 8: Other In boxes 42-43, enter code for observer(s) who first made the sighting. A list of Codes for each observer on each vessel should be sent to the IWC.

School Identity and Numbers

The following section describes the data fields for the first school observed. If more than one species is present in the group use the next available sighting record(s) to record details of the other species. Use the same sighting number and annotate clearly in the margin.

Code	(44-45) This is the numeric computer code used to identify and classify the species identification. Enter the species code from the table of species categories and codes provided. PLEASE NOTE THE FOLLOWING SPECIAL INFORMATION

In the exceptional circumstance that there is no suitable category in which to place a sighting, DO NOT create a new species code. After consultation with the Cruise Leader, enter the species code as XX and ensure that full notes explaining the situation are given. Specific reference must also be made to such an eventuality in the cruise report—for the attention of the IWC Secretariat. NOTE – a species list arranged numerically is given on the final page of this guide

Name	Explicitly record the name of the cetacean species observed using the following guidelines and normally using only the categories on the list provided under species code: Record the common or scientific name (such as "minke" or "fin") for *positively identified* species; **a positively identified species is one for which the diagnostic features have been observed.** Where this is not the case but the observer has seen enough to be reasonably sure of the species identity then record the qualification "like" (eg. use "like minke" if a clear view of the body was not obtained but the observer believed the sighting was *probably* a minke whale). Always record the sighting to the highest taxonomic level that you are confident with, eg. on a scale of uncertainty "fin whale" ⇒ "like fin whale" ⇒ "unidentified large baleen whale" ⇒ "unidentified whale". Where possible, try to include an explanation in the notes if you chose other than a positively identified species category.
Highest Lowest Best	(46-57) Record the highest, lowest, and best estimates of school size. Note that the best estimate is not necessarily the mean of the highest and lowest estimates. All animals and calves must be included. In cases where school definition is problematic, the Caveat square should be completed and a description (eg., illustration) of the distribution of cetaceans should be entered on the form.
Co	(58) This is a subjective assessment **by the researcher** as to whether or not the school size has been accurately and confidently determined. Record as: Y: The final estimate of school size is confirmed. This means that the point estimate or range estimate given was determined with a high degree of confidence. N: If the school size estimate is not confirmed. These are the schools that were inadequately observed to obtain a point estimate or range estimate of school size with confidence.
No. calves	(59-60) Record the number of calves present in the group. Use size and behaviour to determine calves. Code as 99 if the total number of calves cannot be confidently determined.
length	(61) Record whether length estimates have been made. If yes, record the length estimates in the Comments field

+ / – Sea Surf. Temp.	(62-65) Enter the sea surface temperature at the time of the sighting (Electric file only). Enter "+" in column 62 if the temperature is greater than zero. Enter "–" in this column if it is less than or equal to zero. In columns 63-65 enter the temperature to the nearest tenth of a degree Celsius.
Time Left	(66-69) In Passing Mode or cases where the sighting was passed (EVENT 2) this refers to the time when the animals were last seen at an angle less than or equal to 90 degrees. In Closing Mode record the local time (to the nearest minute) when confirmation or chasing of the animals ceased and some other activity began.
Closest Distance	(70-72) Record to two decimal places of a mile when possible. When animal is passed (EVENT 2) this refers to the distance when the animal is seen closest to the vessel. The minimum distance is to be recorded as 0.01, not 0.00.
Squares 73-79	Record the latitude of the ship in degrees and to the nearest hundredth of a minute at the moment of initial sighting. S denotes South latitude (Electric file only).
Squares 80-87	Record the longitude of the ship in degrees and to the nearest hundredth of a minute at the moment of initial sighting. Use E or W to denote East or West longitude (Electric file only).
Rschr	(88) Record the letter code for the researcher who fills out the form. The letter code is usually the first letter of the researcher surname (or given name if duplication occurs).

Behaviour (Completion of these boxes has the **same priority** as other information on the sightings form.)

Rct

(89) Record any observed reaction of an individual or of the entire group to the approach of the ship. Use the following codes (if more than one code is appropriate, record the most obvious and note the other codes with an explanation at the bottom of the form) :

1	No observed reaction	6	Surface activity (e.g. breaching) or swimming speed changed
2	Active avoidance when > 0.5 n.miles away		
3	Active avoidance when <= 0.5 n.miles away	7	Other reaction (record in remarks)
4	Active attraction when > 0.5 n.miles away	8	Undetermined
5	Active attraction when <= 0.5 n.miles away	9	Not recorded

Cpt

(90) Record the compactness of the undisturbed school.

1	All animals within 5 body lengths (BL) of another school member	5	Animals dispersed
2	Most animals within 5 BL of another	6	Animals widely dispersed (>1.0 n.miles^2)
3	All animals within 5 BL of another	7	Animals v. widely dispersed (> 3 n.miles^2)
4	Most animals within 5 BL	8	Undetermined (i.e. unsure what to put)
		9	Not recorded (i.e. you forgot!)

Dyn

(91) Record any observations of the dynamic structure of the group.

1	No change during entire observation period	6	Individual leaves group
2	School disperses into small number of subgroups of large relative size	7	Other
3	School dispersed into numerous subgroups of small relative size	8	Not determined (as above)
4	Subgroups merge	9	Not recorded (as above)
5	Exchange of individuals between schools/subgroups		

Gen

(92) Record the most dominant behaviour observed within the school.

See the codes 1-9 below When more than one behaviour is observed, record the most frequent or significant behaviour. Use remarks section to detail the behavioural information if necessary.

General behaviour codes:

1	Slow travel	Predominantly uni-directional travel at less than about 5 knots for large and medium size whales and about 10 knots for dolphins and porpoises
2	Fast travel	Predominantly Uni-directional travel at more than about 5 knots for large and medium whales and about 10 knots for dolphins and porpoises
3	Milling	Multi-directional travel and/or circling
4	Resting	Individual(s) stationary and not exhibiting any of the social behaviours seen in 6 (eg. sperm whale at the surface after a dive)
5	Feeding	Individual(s) observed swimming in the immediate vicinity of prey, eg. baleen whale(s) swimming through krill patch, killer whales attaching/consuming prey or swimming through characteristic 'oily slick' on the sea surface, dolphins swimming through fish schools
6	Social	Individuals within a group engaged in social activity eg. physical contact, chasing and/or exhibiting social behaviours (roll, breach, pectoral slap, jump, leap, fluke slap etc.)
7	Sexual	Individuals engaged in copulatory behaviour confirmed by intromission or a visible penis
8	Undetermined	Behaviour code could not be ascertained after observation
9	Not recorded	General behaviour not recorded

D? | Sight. No.	(93-100) Cross-reference any definite, possible, or remote duplicate sightings. Duplicates will occur when the same group is sighted independently from more than one observation platform (the standard barrel, IOP, upper bridge, or any other position on the ship). For a duplicate use the first set of boxes, and for a triplicate also use the second set of boxes. Complete the D? square to indicate the duplicate status. Record as: D: Definite duplicate (90% probable) P: Possible duplicate R: Remotely possible duplicate. The Sight No. square cross-references the sighting number of the corresponding sighting record. The Caveat should be used, and a full description provided when confusion arises because different observers are thought to have identified the same congregation as different number of schools.
Resighting	(101) This box is to indicate the 'completeness' of recording of resightings data during IO mode. Code 1, all observed resightings recorded. This category includes those sightings not seen again after the initial sighting i.e. there were no resightings (and therefore no Re-sightings Records were completed for such sightings); code 2, resightings occurred but not all were recorded.
C	(102) Enter Y if problems were encountered completing the data record or the information may be ambiguous. Use the space to explain the situation, describing in full what happened and, if possible, suggest appropriate corrective actions. Remember this will be the only explanation the analysts will have to account for events that lie outside the validation values.
R	(103) Enter Y if there is additional information. Record ancillary information such as distinctive markings, associated wildlife, complex or unusual behaviours, or if additional behaviours that could not be coded were observed. In particular record any length estimates here and whether a researcher has any photos of unusual species.
Photos	(104-106) If natural marking photographs have been taken, insert the natural marking form number.
Biopsy	(107-109) If biopsy sampling was attempted, insert the biopsy sampling form number.

2A. GENERAL RESIGHTING RECORD

Form No. **R E**	
Year / Month / Day	Record as year, month, day in the form YYMMDD. For example, 12 January 2023 is recorded as 20230112
Page	Consecutive number of pages used for each sighting no.
Sighting no.	This is the chronological number of each sighting, each day. Begin with 001 at the start of each day.
Time: Hour / Min. / Sec	The local ship time at which the sighting was first made, or times of subsequent resightings. Record to the nearest second. (eg. 171325). If the sighting time cannot be determined within 15 seconds, record the time to the nearest minute and enter "99" for the seconds.
P/S	Record where the initial sighting was in relationship to the ship's trackline. A – sighting observed dead ahead; B – sighting observed dead astern; P – sighting observed to port; S – sighting observed to starboard
Angle	The estimated angle from the bow of the ship to the sighting or resighting. This estimate should be made at the moment the sighting is made and not after the ship has progressed along the trackline or after the ship has turned toward the sighting. Angleboard readings should be used wherever possible.
Estimated distance	Record the estimate of the radial distance from the ship to the sighting or resighting at the time the sighting was made. Reticule binocular readings should be used whenever possible.
Cue	Record the indicator, or sighting cue, which led to the sighting or resighting. 1 Blow; 2 Jump or splash; 3 Animal; 4 Slick or ring; 5 Blow and animal; 6 Colour under water; 7 Associated wildlife
Whale heading	Record the estimated swimming direction at the moment the sighting or resighting is made, reading it from the gyrocompass. If the individuals of a group each have a similar but slightly different swimming direction record the mean swimming direction of the group. If individuals of a group are milling or have a substantially different swimming directions record as 888. If swimming direction cannot be determined enter 999. North should be entered as 360 not 000.
Ship's Course	True course the ship is making good, recorded to the nearest degree. If possible do not use the instantaneous heading shown on the gyrocompass, but rather compute from two or more fixes. Ask the crew.

3. FEASIBILITY STUDY FOR TDR TAG ATTACHMENT

Form no. T D	This is the serial number for this record. Record using the form TDxxx, where xxx is the consecutive numbering of the dive time experiments.
Year Month Day	Record as year, month, day in the form YYMMDD. For example, 12 January 2023 is recorded as 230112.
Sighting Number	This is the chronological number of each sighting, each day. Begin with 001 at the start of each day.
Code	This is the numeric computer code (see sighting record).
Name	Explicitly record the name of the cetacean species observed (see sighting record).
School size Best	Record the best estimates of school size (see sighting record).
Area code	Record the area code.
Tag type	Record Tag type.
Equipment	Record equipment.
Shoot Number	Record shoot number.
Whale No.	Record whale number.
Shoot Y/N	Record Shoot or not (Y/N).
Hit Y/N	Record Hit or not (Y/N).
Shoot Dist.	Record shooting distance (meter).
Serial #	Record Serial number.
PTT ID	Record PTT ID.
Attached position	Record attached position.
Reaction	Record reaction.
Remarks	Record remarks.

4. BIOPSY RECORD

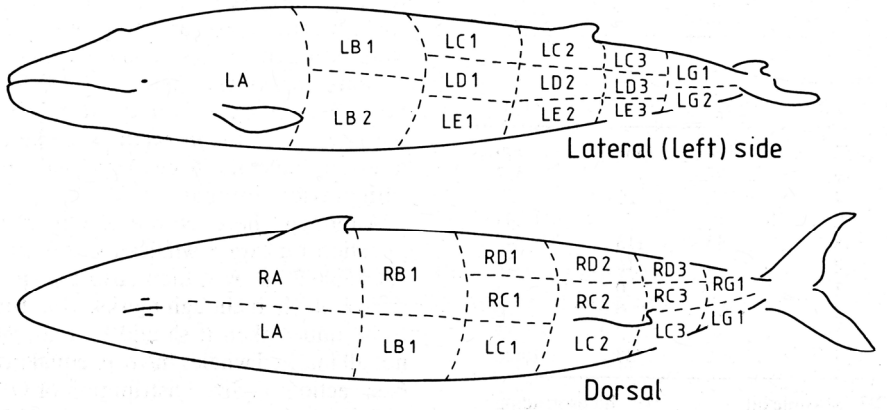
This form is to record results of each biopsy sampling session and should be completed by the researchers. Use one form for each school; use a second page if necessary. MISSES should be recorded.

Heading

Form No.: **B Y**	This is the serial number for this record. Record using the form BYxxx, where xxx is the consecutive numbering of the biopsy trials.
Year / Month / Day	Record as year, month, day
Sight. No	Record the same sighting number that is on the Sighting form.
Name / Code	Record the name of the species. Enter the species code from the table of species categories and codes provided for the Sighting Record.
Best estimate of school size Est. no. animals biopsied Photo-ID Form no. **I D**	Record the best estimate of school size for the group and your best estimate of the number of animals biopsied at the end of the session. Record corresponding Photo-ID Form number.
Latitude Longitude	Record the position at which the group was initially sighted (i.e the same position as on the correspoinding Sightings Data form) to the nearest hundredth of a minute (Only electric file)
Effort: Hour / Min. / Sec Start (TX) Finish (EX)	Record the time you begin biopsy attempts and the time you cease the session (Only electric file)
System / H/S / H/NS / Stuck / Miss	Summarise the biopsy attempts for the session by system type (1=Paxarms; 2=Air gun; 3=Crossbow; 4=Larsen gun; 5= Other-specify in notes). H/S = hit and sample obtained; H/NS=hit and no sample obtained; Stuck=dart stuck in animal; Miss=miss! (Only electric file)

Details

Whale No.	Identify the individual whale and give school-specific sequential number. The first biopsied whale in each school starts at '01'. Two samples of the same whale will have the same sample number and whale number.
Whale Letter.	The individual whale identity as per the **natural marking form**. Mother of a mum-calf pair will always be 'A', calf 'B'
Sample No. Year: 2 3 / Sp. / Bt: 1 / S/No.	Year: where 23 = 2023 Sp.: species code as in sightings form; Bt: Boat - 1= YS2 S/No: Serial number - consecutively for the cruise, beginning at 1, whatever the sampling method. Samples from the same animal but obtained by different methods, should all be given the same number.

Position Struck	
Whale reaction	Record any reaction the whale may have had to being shot at. 1 No reaction; 2 Skin/muscle twitch; 3 Sudden dive; 4 Faster swimming; 5 Trumpet blow; 6 Breach or porpoising; 7 Defecation; 8 Vomiting; 9 No record
System	Identify the equipment used: 1=Paxarms 3=Crossbow 2=Air gun 4=Larsen gun 5= Other (specify in notes)
Duplicate?	This refers to the likelihood of an animal being sampled more than once. Use: 1 = definitely resampled 2 = probably resampled 3 = perhaps resampled 4 = definitely not resampled 5 = unknown
Split?	This refers to whether the sample has been split into blubber and tissue. Use 1=split, 2=no blubber, 3=no split
Comments	Record any additional information (e.g. whaleID number). Give a description and size of the sample obtained.

5. NATURAL MARKING RECORD

This form is to record results of each photo-id session and should be completed by the researchers. Start a new form for each new group. If a form is filled before the observations are completed, continue on another form. Remember to shoot "blanks" before and after each group.

Form No. I D	This is the serial number for this record. Record using the form IDxxx, where xxx is the consecutive numbering of the natural marking sessions.
Year / Month / Day	Record as year, month, day
Sight. No	Record the same sighting number that is on the Sighting form.
Cameras	Record number of cameras that obtained images of the sighting
Page	Consecutive number of pages used for each sighting no.
Name / Code	Record the name of the species. Enter the species code from the table of species categories and codes provided for the Sighting Record.
Best estimate of school size Est. no. animals photographed No. animals photo ID'd	Record the best estimate of school size for the group and your best estimate of the number of animals photographed at the end of the session. Following preliminary photo-analysis, record the number of animals with sufficient images for photo-identification.
No. animals biopsied Biopsy Form No. B Y	Record number of animals biopsied (not number of samples) and Form No. from Biopsy Sampling Record sheet
Latitude Longitude	Record the position at which the group was initially sighted (i.e. the same position as on the corresponding Sightings Data Form) to the nearest hundredth of a minute (Only electric file)
Local time G M T + - .	
Effort / Hour / Min. / Sec Start (PX) Finish (EX)	Record the time you begin photo-id attempts and the time you cease the session (Only electric file)
Photographer	Three initial abbreviation e.g. JWG same used as prefix for image file naming
Frames Start / End	Note beginning and end frames for sequences or single frames within a sighting. Particularly useful to note sequences of individuals in a large group and/or when frame of one body part can be matched to another of the same whale – use to describe information that might not be evident during photo-analysis e.g if a fluke shot follows a body shot of a different whale. Always note frame(s) for confirmation biopsy shots

Whale Letter.	Identify individuals in the school e.g. when 4 whales in the school, will be identified as A, B, C, D. Typically the first **photographed** would be 'A', second 'B' although you may wish to change this if a whale is distinct e.g. male killer whale, or biopsied first, or is the mother of a mum-calf pair (always 'A' and calf 'B').
Sample number	If the whale has been biopsied successfully, insert the sample number and add the confirmation image frame number (this is the image taken at exact time sample obtained, irrespective of image quality, preferably with dart in shot) and add timestamp of image to the notes.
Photo-ID results (e.g. LD, RD, FL)	Target of images described by Start to End Frames. Record as:
Skinny	Indicate if it is your impression that the whale photographed appears: 1= normal; 2=skinny; 3=very skinny; 4=unsure
Notes	Use for additional comments e.g. behaviours that were photographed (along with number in Frames column), when possible insert the time of biopsy 'Hit' and 'Miss' to prevent confusion during photo-analysis
Comments and sketches	If the animals showed any distinctive markings suitable for identification provide illustrations if necessary. Add any behaviours that were not photographed e.g. underwater exhalation

FL	Flukes	RD	Right dorsal fin
LL	Left lateral	HD	Head
RL	Right lateral	DM	Distinctive marking (elsewhere)
LD	Left dorsal fin	OT	Other

6. VIDEOTAPING

Form No. I D	This is the serial number for this record. Record using the form VTxxx, where xxx is the consecutive numbering of the videotaping experiment.
Year Month Day	Record as year, month, day
Page	Consecutive number of pages used
Sight. No	Insert the sighting number from the sighting form.
Species Code	Insert the species name and code from the sighting form.
Number	Insert the number of best estimate of the number of animals in the group
Closest distance .	Insert the closest distance of approach to the nearest 0.01 n.miles
No. photographed	Record the number of whales in the school that were photographed.
By	Record the letter code for the person who took the photos.
Tape number	Give the tape number.
Start Hr Min Sec	Give the time the videotaping *session* begins to the nearest second
Finish Hr Min Sec	Give the time the videotaping *session* ends to the nearest second
Features/behaviour recorded	State what identification features you believe are well shown (e.g. blowhole shape, flanks, dorsal fin, behaviour etc.)

7. ESTIMATED DISTANCE AND ANGLE EXPERIMENT RECORD

One form is completed for each approach to the buoy. If there are more than six trials per approach (a trial being an estimate by one observer from one platform during one approach), start a new form for the additional trials, making sure that the form is appropriately annotated.

Header

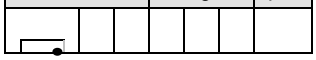
Form No. W	This is the serial number for this record. Record using the form TExxx, where xxx is the consecutive numbering of approaches.
Year | Month | Day	Record as year, month, day
Weather	Record the weather at the beginning of the approach. Use the same codes and methods of evaluation as on the Weather Record:
Wind Direction | Speed	Record the wind direction to the nearest 5 degrees. Record the wind speed to the nearest knot.
Visibility	Record an estimate of the maximum distance a minke whale blow could be seen in n.miles. Record as precisely as possible and reasonable. If the visibility range varies by more than 1.0 n.miles, code as 888.
Sightability	This is the Sightability, a subjective impression of the conditions for spotting whales. Use the codes: 1: Very poor 4: Good 2: Poor 5: Excellent 3: Moderate
Caveat?	Mark this with Y if there were problems recording information on the form or unusual occurrences during the approach. Detail these situations at the bottom of the form. Leave blank if there were no such circumstances.
Page	Record the consecutive number of forms used in the experiment.

01	Blue sky (0-20% cloud cover)	05	Rain	09	Drizzle
02	Partly cloudy (21-80%)	06	Mist	10	Snow
03	Cloudy (81-99%)	07	Fog	11	Snow fog
04	Overcast (100%)	08	Fog patches	12	Rain fog

Individual Estimate Record

The following describes the data fields for the first individual estimate record. The five other records require the same information.

Time	Record the time, to the nearest minute, that the observer makes an estimate.
Compass	Record the ship's compass at the time the estimate is made.
RADAR Distance | Angle | p/s	Record the RADAR distance and angle readings taken simultaneously with the observer's estimate. Record the location of the buoy relative to the ship's projected trackline. Use the codes: A: Directly ahead; B: Directly behind; P: to port; S: to starboard.

Estimate Distance | Angle | p/s 	Record the observer's distance estimate. Observers may make estimates in any distance unit (metres, yards, feet, chains, etc.) but the information must be recorded here in n.miles. Record the observer's angle estimate to the nearest degree. Record the location of the buoy relative to the ship's projected trackline as determined by the observer. Use the codes: A: Directly ahead; B: Directly behind; P: to port; S: to starboard.
Observer	Record the observer who made the estimate. Use the topmen codes recorded on the weather record for the boatswain/quartermasters/sailors who participated. Use C to denote the captain and use the letter codes used on the Sighting forms to designate the researchers.
Barrel - IO	Record the platform from which the estimate was made. Use the codes: B: Barrel; I: IOP; F:Front/upper bridge; N: naked eye estimate from IOP
Problem?	Enter Y if the observer had severe difficulties in locating the buoy and the trial may have been compromised. Leave blank if there were no severe problems. If severe problems were recorded, attempt to repeat the trial after all scheduled trials have been completed.

8. WEATHER RECORD

The Weather Record is the sole record of environmental conditions. Data should be completed every hour from 0600 hrs to the end of scheduled research for the day in the research zone(normally 1800 hrs for research in Closing Mode or 1900 hrs for research in Passing Mode with independent observer). During transit the recording should start at the hour prior to the scheduled starting time of research and end at the hour after the scheduled ending time (unless the research begins or ends on the hour--recording would then begin or end on that hour). If research extends past the normal research time by more than 30 minutes (that is, starts before 05:30 or ends after 18:30), additional information should be recorded in the greyed lines of the form and a note included on the form.

Header

Form No. **W**	This is the serial number for this record. Record using the form Wxxx, where xxx is the consecutive daily numbering of the weather records.
Year | Month | Day	Record as year, month, day
Page	The consecutive number of the form for the entire trip. The Weather record for the first day of the cruise will be page 01.

Individual weather record

Time **0 6**	The hour for which the data are to be collected. This has already been completed.
Position	Record the latitude/longitude of the ship in degrees and to the nearest minute. S denotes South latitude. Use E or W to denote East or West longitude.
Weather	A description of the general weather conditions. Use the codes:

01	Blue sky (0-20% cloud cover)	05	Rain	09	Drizzle
02	Partly cloudy (21-80%)	06	Mist	10	Snow
03	Cloudy (81-99%)	07	Fog	11	Snow fog
04	Overcast (100%)	08	Fog patches	12	Rain fog

Wind Direction | Speed	Record the wind direction to the nearest 5 degrees and the wind speed to the nearest knot.
Sea Surface ± | Temp. .	Record the sea surface temperature to the nearest 0.1 degrees centigrade. Place a + or - sign in the first box.
Air ± | Temp. .	Record the air temperature to the nearest 0.1 degrees centigrade. Place a + or - sign in the first box.
Visibility .	Record an estimate of the maximum distance a minke whale blow could be seen in n.miles. Record as precisely as possible and reasonable. If the visibility range varies by more than 1.0 n.miles, code as 888. **This estimate should be made by the captain in consultation with the Senior Scientist.**
Ice .	Record the estimated ice cover, in tenths, within the searching area (use a radius of 5.0 n.miles).

Topmen				
Barrel		IOP	Bridge	

Record the numeric code for the observers in the barrel who will be on watch during the next hour interval. If survey is not being conducted when the weather record is completed due to meteorological conditions, but survey is started prior to the next hour, record the codes for the observers who are in the barrel during the hour interval. Leave blank if no survey is conducted during the hour interval.

Record the numeric code for the observer in the IOP who will be on watch during the next hour interval. If survey is not being conducted when the weather record is completed due to meteorological conditions, but IO survey is started prior to the next hour, record the code for the observer who is in the IOP during the hour interval. Leave blank if no IO survey is conducted during the hour interval.

Record the numbers or letter code of the two primary observers who are on watch on the upper bridge during the next hour interval.

Sightability

This is the Sightability, a subjective impression of the conditions for spotting whales. Because sightability may vary between observation platforms, an impression of the average sightability over all platforms should be recorded. Use the codes:

1	Very poor (too poor to survey)	3	Moderate	5	Excellent
2	Poor	4	Good	6	

Sea state

This is sea state as described in the Beaufort scale. Record Beaufort scale numbers 0-7 and use code 9 for Beaufort 9 and above. (If no data are recorded the letter U is used).

0	Flat (wind speed 0 knots)
1	Ripples without crests (1-3)
2	Small wavelets. Crests of glassy appearance, not breaking (4-6)
3	Large wavelets. Crests begin to break; scattered whitecaps (7-10)
4	Small waves (11-16)
5	Moderate (1.2 m) longer waves. Some foam and spray (17-21)
6	Large waves with foam crests and some spray (22-27)
7	Sea heaps up and foam begins to streak (28-33)
8	Moderately high waves with breaking crests forming spindrift. Streaks of foam (34-40)

Swell

This is the swell height as described in the International Scale.

Scale	Swell	Wavelength	Height
0	No swell		
1	Low swell	Short or average	<2m
2	Low swell	Long	< 2m
3	Moderate swell	Short	2-4 m
4	Moderate swell	Average	2-4 m
5	Moderate swell	Long	2-4 m
6	Heavy swell	Short	> 4m
7	Heavy swell	Average	> 4m
8	Heavy swell	Long	> 4m
9	Confused swell	Pronounced swells from two or more directions	

9. EFFORT RECORD

The Effort record is completed every day during the research cruise to record all research activities. The following sections describe how to complete this form.

Header

Form No. **E**	A cruise serial number. Each daily record has a unique number.
Year / Month / Day	Enter as year, month day.
Page	Consecutive number of pages used in one day. Each day the first page will be 01.

Individual effort record

Activity	Activity code. Any change in activity, course, or speed must be recorded. The following are the only acceptable codes (the optional on-effort ending codes are not shown but can be found on pp. 26-7):

BA	NSC, ice navigation	CC	Course change
BC	NSC	SC	Speed change
BL	NSC, high density		
BR	NSC, returning	CS	Course, speed change
BH	NSP, high density	CH	Chasing
BI	NSP, ice navigation	CO	Confirming
BP	NSP		
BO	IO	DR	Drifting
BW	Big Eye BT, IO mode		
BY	Big Eye BT, BI mode	ED	End day
BZ	Big Eye BT, NSP	EX	End experiment
BT	BT option 2	OX	Other experiment
BB	Begin blue whale research		
BX	Begin experiment		
SX	Dive time experiment		
PX	Photo-ID session	TD	Off-effort steaming
TX	Biopsy sampling session	TF	Off-effort steaming
SZ	SS IISS SS III experiment		
DX	Est. distance experiment	WP	Waypoint

Time (Hour / Min. / Sec)	The local time at which each activity begins or changes. Record to the nearest second. Make sure the time on other data forms (particularly the Sighting form) agree. Time is recorded for every entry.
	The latitude or longitude where each activity begins or changes. Record to the nearest hundredth of a minute if available from the GPS. If not available, enter **99** in the last two boxes. Enter **E** or **W** for east or west longitude as appropriate.
Course (Degrees)	True course the ship is making good, recorded to the nearest degree. If possible do not use the instantaneous heading shown on the gyrocompass, but rather compute from two or more fixes. Do not record changes due to ice navigation unless the changes will remain constant for more than five minutes. Record North as 360, not 000; record variable course (course remains variable for more than five minutes) as 888. Record for the following codes: BA, BC, BH, BI, BL, BO, BP, BR, CC, CS, SC, TD, TF and possibly ED (in transit only).
Speed (Knots)	Speed the ship is making good recorded to the nearest tenth of a knot. If possible calculate the average speed from two or more fixes covering most of the duration of the recorded activity. Record for the following codes: BA, BC, BH, BI, BL, BO, BP, BR, CC, CS, SC, TD, TF and possibly ED (in transit only).

10. MARINE DEBRIS RECORD

This form is completed by the researchers, in consultation with the ship's officers. Use one form for several observation of marine debris. Classify the type of debris in the code boxes and then fully describe it in the Description section. Draw pictures if necessary and be as complete as possible.

Form no. **M D** (1–5)	This is the serial number for this record. Record using the form MDxxx, where xxx is the consecutive numbering of the marine debris observations.
Year (9–10) Month (11–12) Day (13–14)	Record as year, month, day.
Time (15–18)	Record the time of the initial observation to the nearest minute. Enter time as Hr Min (Hour Minute). All time is local time.
p/s (19)	Record where the initial sighting was in relationship to the ship's trackline. Record as: A: If the sighting was observed dead ahead. B: If the sighting was observed dead astern. P: If the sighting was observed at port side. S: If the sighting was observed at starboard side.
Angle (20–22)	The estimated angle from the bow of the ship to the sighting. This estimate should be made at the moment the sighting is made and not after the ship has progressed along the trackline. Angleboard readings should be used whenever possible.
Distance (23–25)	Record the estimate of the radial distance (to the nearest 01. nmile) from the ship to the sighting at the time this was made. Reticle binocular readings should be used whenever possible.
Latitude (26–30) N/S **S**	Record the latitude of the ship in degrees and to the nearest minute at the moment of initial sighting. S denotes South latitude.
Longitude (31–36) E/W **W**	Record the longitude of the ship in degrees and to the nearest minute at the moment of initial sighting. Use E or W to denote East or West longitude.
Code (37–38)	Use the list of codes shown on the next page to classify the type of debris observed.
Description:	Describe the object including total size, condition, any associated wildlife, etc

100. Gillnet
101. Gillnet, small mesh, small fragment
102. Gillnet, small mesh, 1-10 tans
103. Gillnet, small mesh, more than 10 tans
104. Gillnet, medium mesh, small fragment
105. Gillnet, medium mesh, 1-10 tans
106. Gillnet, medium mesh, more than 10 tans
107. Gillnet, large mesh, small fragment
108. Gillnet, large mesh, 1-10 tans
109. Gillnet, large mesh, more than 10 tans
110. Trawl net
111. Trawl net, small mesh, small fragment
112. Trawl net, small mesh, medium size
113. Trawl net, small mesh, large piece
114. Trawl net, medium mesh, small fragment
115. Trawl net, medium mesh, medium size
116. Trawl net, medium mesh, large piece
117. Trawl net, large mesh, small fragment
118. Trawl net, large mesh, medium size
119. Trawl net, large mesh, large piece
120. Unidentified net
121. Unidentified net, small mesh, small fragment
122. Unidentified net, small mesh, medium size
123. Unidentified net, small mesh, large piece
124. Unidentified net, medium mesh, small fragment
125. Unidentified net, medium mesh, medium size
126. Unidentified net, medium mesh, large piece
127. Unidentified net, large mesh, small fragment
128. Unidentified net, large mesh, medium size
129. Unidentified net, large mesh, large piece
130. Longline, small piece
131. Longline, medium piece
132. Longline, large piece
133. Plastic packing band
134. Single fishing float
135. Clustered fishing floats (2-10 floats together)
136. Wood plank
137. Wood crate, 1 side only
138. Wood crate, more than 1 side
139. Wood structure
140. Wood object, unidentified
141. Metal can, unidentified
142. Metal can, 1 litre or less
143. Metal can, 1-50 litres
144. Metal can, 50-150 litres
145. Metal can, 150-250 litres
146. Metal can, 250 or more litres
147. Styrofoam, unidentified
148. Styrofoam board, less than 1 square metre
149. Styrofoam board, 1-3 square metres
150. Styrofoam board, greater than 3 square metres
151. Styrofoam box (at least 2 sides)
152. Cardboard, unidentified
153. Cardboard, less than 1 square metre
154. Cardboard, 1-3 square metre
155. Cardboard, greater than 3 square metres
156. Cardboard box (at least 2 sides)
157. Paper, unidentified
158. Paper, less than 1 square metre
159. Paper, 1-3 square metre
160. Paper, greater than 3 square metres
161. Plastic, unidentified
162. Plastic, less than 1 square metre
163. Plastic, 1-3 square metres
164. Plastic, greater than 3 square metres
165. Plastic bag, small
166. Plastic garbage bag, empty
167. Plastic garbage bag, full
168. Garbage, unidentified
169. Garbage, 1-10 pieces
170. Garbage, 11-50 pieces
171. Garbage, 51-200 pieces
172. Garbage, more than 200 pieces
199. Other

11. GLARE RECORD

Form no. G L 1 2 3 4 5	This is the serial number for this record. Numbering should start at 001, increasing consecutively each day
Year Month Day 9 10 11 12 13 14	Record the date as year, month, day e.g. 6 January 2023 is 230106
Page 15 16	Consecutive number of pages used in one day. Each day the first page will be 01.
Time Hr Min Sec	The local ship time at which glare conditions changed. Record to nearest second (e.g. 171325).
Intensity	The intensity of glare according to the following scale: 0 = no glare; 1 = glare present but with minimal impact on sightability; 2 = glare present but with some impact on sightability; 3 = glare present and substantial or total affect on sightability
Ship's Bearing	The ship’s bearing from the gyrocompass.
Left: P/S, Angle; Right: P/S, Angle	These records refer to the left and right extreme edge of the glare. Record whether on port (P) or starboard (S) and then the angle as read from the angle board.

13. ACOUSTICS

Sonobuoy deployment sheet:

Station number	Number assigned to sonobuoy deployment, starting with 1 and continuing consecutively from the start of the cruise.
Channel number	Channel number corresponding to the frequency at which the sonobuoy is set.
Date	Date of sonobuoy deployment, recorded as MM/DD/YY local time.
Time start	Time of sonobuoy deployment, recorded as HH:MM:SS local time.
Deploy success?	Indicate whether the deployment was successful (“1”) or not (“0”).
Reason SB failed	If deployment was unsuccessful, give a reason (e.g., float never popped, bad electronics, did not transmit, etc).
Position of Sonobuoy: Latitude	Record the latitude of the sonobuoy deployment location in decimal degrees to five decimal places, e.g., 56.32810
Position of Sonobuoy: Longitude	Record the longitude of the sonobuoy deployment location in decimal degrees to five decimal places, e.g., -164.75235
Water depth (m)	Record the depth of the water column (in meters) at time of deployment.
Sonobuoy: Type, Manuf., Year	Record the type (53F or 77C), manufacturer (UND or SPW), and year of sonobuoy. E.g., “53F, UND, 2008”
Settings: Hours, Depth, Other, Tied?	Record the settings of the sonobuoy: the hours it was set to (should be 8), the depth it was set at (d1 = 90 ft), any other settings (df = Difar mode), and whether it was tied to shorten it. E.g., “8, d1, df/of, tied”.
Species Detected: RW, Gray, Hump, Fin, Orca, ...	Mark the corresponding column to denote the species acoustically detected. There will be columns available for the following species: North Pacific right whale, gray whale, humpback, fin, killer whale, sei, minke, walrus, other pinniped, and unknown (for those detections that are biological, but unidentified). There will also be an “Other” column, for any unexpected detections that are identifiable.

Sonobuoy recording log:

Date	Record the date the recording started, as MM/DD/YY
Time Start	Record the time the recording started, as HH:MM:SS
Time End	Record the time the recording ended, as HH:MM:SS
Rec. Chan. (A/2, B/3...)	Record the channel in Ishmael that the recording corresponds to. A, B, or C refers to the top, middle, or bottom channel of Ishmael, and 1, 2, or 3 refers to the total number of channels. E.g., B/3 refers to the middle channel of three total channels. If only one sonobuoy is deployed, it is A/1.
Sono Stn	Record the sonobuoy station number that the recording corresponds to.
Sono CH	Record the channel number that the sonobuoy frequency was set to.
Antenna (o/y)	Note which antenna is being used during the recording. O = omni, Y = yagi.
Post-process? (list times)	If you were unable to monitor in real time, list those times where you did not monitor and data need to be post-processed, e.g., 22:10-23:00.

Appendix

1		コククジラ	Gray whale
2		ミンククジラ	Common Minke whale
3		ニタリクジラ	Bryde's whale
4		イワシクジラ	Sei whale
5		ナガスクジラ	Fin whale
6		シロナガスクジラ	Blue whale
7		ザトウクジラ	Humpback whale
8		セミクジラ	North Pacific Right whale
9		ホッキョククジラ	Bowhead whale
10		マッコウクジラ	Sperm whale
11		ツチクジラ	Baird's beaked whale
12		シワハイルカ	Rough toothed dolphin
13		バンドウイルカ	Bottlenose dolphin
14		ハシナガイルカ	Spinner dolphin
15		マダライルカ	Spotted dolphin
16		スジイルカ	Striped dolphin
17	*	マイルカ	Common dolphin
18		サラワクイルカ	Fraser's dolphin
19		カマイルカ	Pacific white-sided dolphin
20		セミイルカ	Northern right whale dolphin
21		ハナゴンドウ	Risso's dolphin
22		ユメゴンドウ	Pygmy killer whale
23		オキゴンドウ	False killer whale
24		マゴンドウ型コビレゴンドウ	Southern form short-finned pilot whale
25		タッパナガ型コビレゴンドウ	Northern form short-finned pilot whale
26		カズハゴンドウ	Melon-headed whale
27		シャチ	Killer whale
28		ネズミイルカ	Harbour porpoise
29		リクゼン型イシイルカ	Truei type Dall's porpoise
30		イシイルカ型イシイルカ	Dalli type Dall's porpoise
31		型不明イシイルカ	Unidentified type Dall's porpoise
32		クロ型イシイルカ	Black type Dall's porpoise
33		スナメリ	Finless porpoise
34		コマッコウ	Pygmy sperm whale
35		オガワコマッコウ	Dwarf sperm whale
36		アカボウクジラ	Cuvier's beaked whale
37		種不明アカボウクジラ科鯨類	Unidentified Ziphiidae
38		種不明オウギハクジラ属鯨類	Unidentified Mesoplodon
39		種不明トックリクジラ属鯨類	Unidentified Hyperodon
40		種不明コマッコウ属鯨類	Unidentified Kogia
41		種不明イルカ類	Uniedntified dolphin
42		種不明小型鯨類	Unidentified small cetacean
43		種不明大型鯨類	Unidentified large cetacean
44		種不明鯨類	Unidentified cetacean
45		オットセイ	Northern fur seal
46		種不明鰭脚類	Unidentified pinnipedia
47	*	種不明ゴンドウクジラ類	Unidentified pilot whale
48		ハッブスオウギハクジラ	Hubbs's beaked whale
49		オウギハクジラ	Stejneger's beaked whale
59		タイヘイヨウアカボウモドキ	Longman’s beaked whale
60		ミナミツチクジラ	Arnoux's beaked whale
61		ミナミトックリクジラ	Southern bottlenosed whale
62		タスマニアクジラ	Shepherd's beaked whale
63		ヒモハクジラ	Strap toothed whale
64		コブハクジラ	Blainville's beaked whale
65		タイヘイヨウオウギハクジラ	Andrew's beaked whale
66		イチョウハクジラ	Ginkgo toothed whale
67		ミナミオウギハクジラ	Scamperdown whale
68		ニュージーランドオウギハクジラ	Hector's beaked whale
69		アカボウモドキ	True's beaked whale
70		ヒレナガゴンドウ	Long finned pilot whale
71		ウスイロイルカ	Humpback dolphin
72		ハラジロカマイルカ	Dusky dolphin
73		ダンダラカマイルカ	Hourglass dolphin
74		セッパリイルカ	Hector's dolphin
75		メガネイルカ	Spectacled porpoise
76		カワゴンドウ	Irrawaddy dolphin
77		シロハラセミイルカ	Southern right whale dolphin
78		ドワーフミンククジラ	Dwarf minke whale
80		シロナガスクジラらしい	Like blue whale
81		ナガスクジラらしい	Like fin whale
82		イワシクジラらしい	Like sei whale
83		ニタリクジラらしい	Like Bryde’s whale
84		ザトウクジラらしい	Like humpback whale
85		セミクジラらしい	Like right whale
86		マッコウクジラらしい	Like sperm whale
87		イワシ/ニタリらしい	Like sei/Bryde’s whale
88		種不明大型ヒゲクジラ類	Unidentified large baleen whale
99		ミンククジラらしい	Like minke whale