Chapter 6: Boat survey protocol for Mid-Atlantic Baseline Studies and Maryland Projects

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Chapter 6 Highlights

The study design, data collection, and data processing protocols for boat-based surveys

Context[1]

Boat-based surveys with distance estimation are a well-established method of surveying marine wildlife such as seabirds and marine mammals. This chapter describes the study design and protocols used while collecting and post-processing boat survey data for the Maryland Project and Mid-Atlantic Baseline Studies projects. These survey data are summarized in Chapter 7, and are used in subsequent analyses in Chapters 9-14. Chapter 9 uses data from boat-based surveys alongside environmental covariate data to predict seabird abundance throughout the study area. This boat survey protocol is also referenced alongside digital video aerial survey data in Part IV of this report (Chapters 10-14), including comparisons of the two survey methods and efforts aimed at integrating data from both surveys.

Study goal/objectives addressed in this chapter

Provide the protocol followed when conducting boat-based wildlife surveys in the Mid-Atlantic.

Highlights

- Sixteen surveys were conducted over two years between April 2012 and May 2014.
- Each survey included 12 linear transects in the vicinity of three Wind Energy Areas (WEAs) in the Mid-Atlantic region, totaling approximately 559 km. In the second year of surveys (March 2013-Feb 2014), an additional total of 12.5 km of transects were added onto the western ends of three transects to extend them into Maryland state waters, increasing the total to 572 km.
- Surveys were conducted on a 55-foot charter vessel during daylight hours by teams of two observers using a combination of strip and line transect sampling.
- Observers recorded all observed species within a 360˚ arc during normal survey conditions. During inclement weather or when too many animals were present to accurately record observations in 360˚, observers recorded all observed species within a 90˚ arc and within 300 m from the boat.
- Data collected per observation included species, number of individuals seen, behavior, direction of movement, radial distance, degree of the animal's angle to the bow of the boat, and where possible, age and molt state.

Implications

Results from the data collected following this protocol are presented in Chapter 7 and Part IV of this report.

[1] For more detailed context for this chapter, please see the introduction to Part III of this report.

Abstract

This chapter outlines the protocol followed while conducting boat-based surveys within the Maryland Project and Mid-Atlantic Baseline Studies study areas. Sixteen surveys were conducted over two years between April 2012 and April 2014. Each survey included 12 transects within the vicinity of three Wind Energy Areas offshore of Delaware, Maryland, and Virginia, USA, totaling 559 km in 2012-2013 and 572 km in 2013-2014, with the additional of approximately 12.5 km of transect in Maryland state waters in 2013 for the Maryland Project. Surveys were conducted on a 55-foot charter vessel during daylight hours using distance sampling. Data collected per observation included species, number of individuals seen, behavior, direction of movement, radial distance, degree of the animal's angle to the bow of the boat, and, where possible, age and molt state. Additionally, environmental covariate data including water temperature, salinity, and hydroacoustic data were collected. Data were post-processed and quality assured/quality controlled prior to use in data analyses discussed elsewhere in this report.

Boat survey protocol

Boat survey transects extended perpendicularly to the coastline from three nautical miles offshore to the 30 m isobath or the eastern extent of the Wind Energy Areas (WEAs), whichever was furthest (Figure 6-1, Figure 6-2). For Mid-Atlantic Baseline Study (MABS) surveys beginning in 2012, each survey included 12 transects spaced 10 kilometers apart. The transect lines extended at least one transect north and south of each WEA. Total transect distance was approximately 559 km. Approximately 60% of Maryland's federal waters were covered by this transect design, including four transects in areas within and to the west of the Maryland WEA, but surveys did not extend into Maryland state waters. In the second year of the study, an additional 12.35 km of transects were added to each survey, extending three transects farther west into Maryland state waters (Figure 6-1, Figure 6-2) to include offshore shoal areas. The western edge of these transects were defined by the 10m isobath. The "Maryland study area" as referenced throughout this report (and indicated in Figure 6-1 and Figure 6-2) includes both the original boat transect lines offshore of Maryland and these extension transects.

We conducted eight surveys per year on a scheduled basis as the weather allowed. Each survey was conducted during a 2-4 week window (Table 6-1); generally a survey was conducted at the earliest opportunity (based on weather) during each window. Surveys took 4 to 5 days to complete. Our surveys were conducted on a 55-foot charter vessel, the *Stormy Petrel II*, and were staffed with four observers who worked in teams of two. Surveys were run from Ocean City, Maryland, and Virginia Beach, Virginia (Figure 6-1). Surveys began at first daylight, once light enough for correct species identification. Survey speed was 10 knots unless weather conditions or boat traffic dictated otherwise. The boat returned in the evenings to overnight in port during surveys, with the exception of 7 nights which were spent offshore of Maryland and Virginia. Surveys were postponed due to foul weather, for safety reasons, at the discretion of the Captain.

Because of the narrow beam of the *Stormy Petrel II* and unobstructed view from the flying bridge, we recorded all birds seen on a 360° scan (Figure 6-3). Since most surveys were conducted in good weather, this method enabled us to scan both sides of the boat with ease and enabled extensive collection of "distance sampled" data. This was a fairly unusual situation for observations, however; on most survey vessels (and on the *Stormy Petrel II* in periods with high numbers of animals, where we could not accurately count all individuals in a full 360° scan) our protocol was to focus scanning efforts in a 90° arc within a 300 m strip to one side of the boat (Figure 6-3). The side of the vessel used for counts was noted in the data, so that it would be possible to separate observations within the area of primary focus from observations made in the remaining 270° degrees of visibility, if needed. The transect was surveyed continuously using the naked eye or binoculars. Observers regularly scanned ahead for marine mammals and diving birds, or for sitting birds that may have been flushed off the water. Animals within 300 m received priority for recording, though animals outside of the 300 m strip transect were also usually recorded.

One observer continuously scanned for birds, mammals, turtles, and fish, while the second recorded all observations into a Toughbook computer (Panasonic Corp. of North America, Newark, NJ) using the dLOG data entry program (Ford, 1999). Locations, date, and time were automatically recorded every 5 seconds and observations were individually georeferenced. At the beginning of each survey, the recorder entered sea state data using the Beaufort scale (Table 6-2), transect number, observer's initials, visibility, survey ID, station, and platform, changing each as needed throughout the survey (Table 6-3). The second observer/recorder also scanned ahead and to the horizon for marine mammals and sea turtles when possible. We used distance sampling under most conditions, recording distance and angle to every bird or flock of birds, but used the more restricted strip transect (width = 300 m) in areas of high bird density. We defined "high density" as being a greater number of birds in the area than the observers could keep track of, impeding the ability to count all birds present. For each animal, the team recorded: species, number seen, behavior, direction of movement, radial distance, degree of the animal's angle to the bow of the boat, and, where possible, age and molt state (see Table 6-3 for more details about data entry). Behavior codes were assigned based on the behavior initially displayed when the animal was first observed (Table 6-4). Four-letter codes were used to record species identification, as well as abiotic objects of interest such as boats or flotsam and jetsam (Table 6-5).

Animal movements were recorded in such a way as to allow for vector analysis (Spear et al., 1992). Radial distance was estimated from the observer to the animal or the center of a group of animals, based on the initial observation. Distance estimates were calibrated between observers using a handmade distance gauge (Gjerdrum et al., 2012) by estimating distances to stationary objects and were estimated as closely as possible (often to the nearest tens of meters for animals closer to the boat, and to the nearest 50 m for animals farther from the boat). The two teams of observers alternated every two hours. At the end of each day of surveying, all data were backed up on portable hard drives.

When weather deteriorated to the point that salt spray threatened the computer, observers moved inside the pilot house (Figure 6-3). Any changes in observer location were recorded in the data (Table 6-3). Although observing from the pilot house restricted the observer's field of vision, compared to observing from the bridge, observers were able to maintain complete view of the strip transect (300 m distance and 90˚ arc).

Environmental data were recorded during the surveys. Sea state and visibility were recorded hourly. Sea surface temperature and salinity were recorded every half hour, using a YSI Pro30 conductivity device (Yellow Springs, OH), with water drawn up from the ocean through the vessel's saltwater pump (located in the vessel's hull) into a bucket. These measurements were taken by off-duty observers to allow the active observers to maintain their positions. Biomass densities were recorded continuously using a Simrad EK60 scientific echo sounder (Kongsberg Maritime AS), employing a 120 kHz transducer. Echo sounding data were processed using Echoview (Myriax Software Pty, Ltd., Hobart, Australia) processing software (Chapter 8). When staying offshore overnight, a passive acoustic monitoring system was operated from the deck of the vessel to record flight calls of nocturnally migrating birds (Adams et al., 2015).

We photographed cetaceans, whenever possible, and submitted these for individual identification using the established North Atlantic Fin Whale[2] and North Atlantic Right Whale[3] catalogues. Surveys were conducted in passing mode, where the boat stayed on transect and at survey speed except when complying with National Marine Fisheries Service (NMFS) rules regarding approaching marine mammals, including rules on vessel speed and encounters with endangered North Atlantic Right Whales (*Eubalaena glacialis*). Surveys in passing mode have been shown to have reduced bias in estimated encounter rates of marine mammals, though they also have lower rates of species identification and poorer estimation for pod size (Barlow, 1997; Douglas et al., 2014). Our research group believed passing mode surveys to be the best method available to ensure that we obtained accurate counts for all other taxa.

Data were collected using methods allowing for vector analysis, or analysis of relative movement (Spear et al., 1992). Constantly counting flying birds can, in some situations, provide a measure of bird "flux" or an overestimation, rather than a true density of birds (Spear et al., 1992). Using the vector method, however, one can estimate the distance of an animal from the observer; the angle from the observer, and the direction of movement. If desired, these data can be combined with known average flight speeds for avian species to calculate a correction factor during data analysis and find absolute densities of flying birds.

Data from boat surveys were consolidated and subject to a quality assurance/quality control (QA/QC) process. Each day of data collection produced an individual .csv file. These data were compiled in Excel for each survey and examined for errors. Common adjustments made during this QA/QC process included: concatenation of split fields; correction of longitude values to make values negative; addition of temperature and salinity measurement fields and incorporation of those data into the table from the comment fields; and ensuring that sighting data were entered in to the correct columns and were checked for consistency. After the initial QA/QC process, data were entered in to an Access database. Data managers then added a unique ID field for each survey and for individual records within each survey, concatenated date and time fields, converted GMT to EST for actual track time, checked for and corrected errors in species codes used, and added taxonomic information for each observation (for full list of species codes and corresponding common and Latin names, see Table 6-5). Finally, the data were geoprocessed to check for locational errors and missing data points. Fully QA/QC'd data were entered in to the USGS Compendium of Avian Occurrence (O'Connell et al., 2009).

[2] http://www.coa.edu/nafwc.htm
[3] http://rwcatalog.neaq.org/Terms.aspx

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Figures and tables

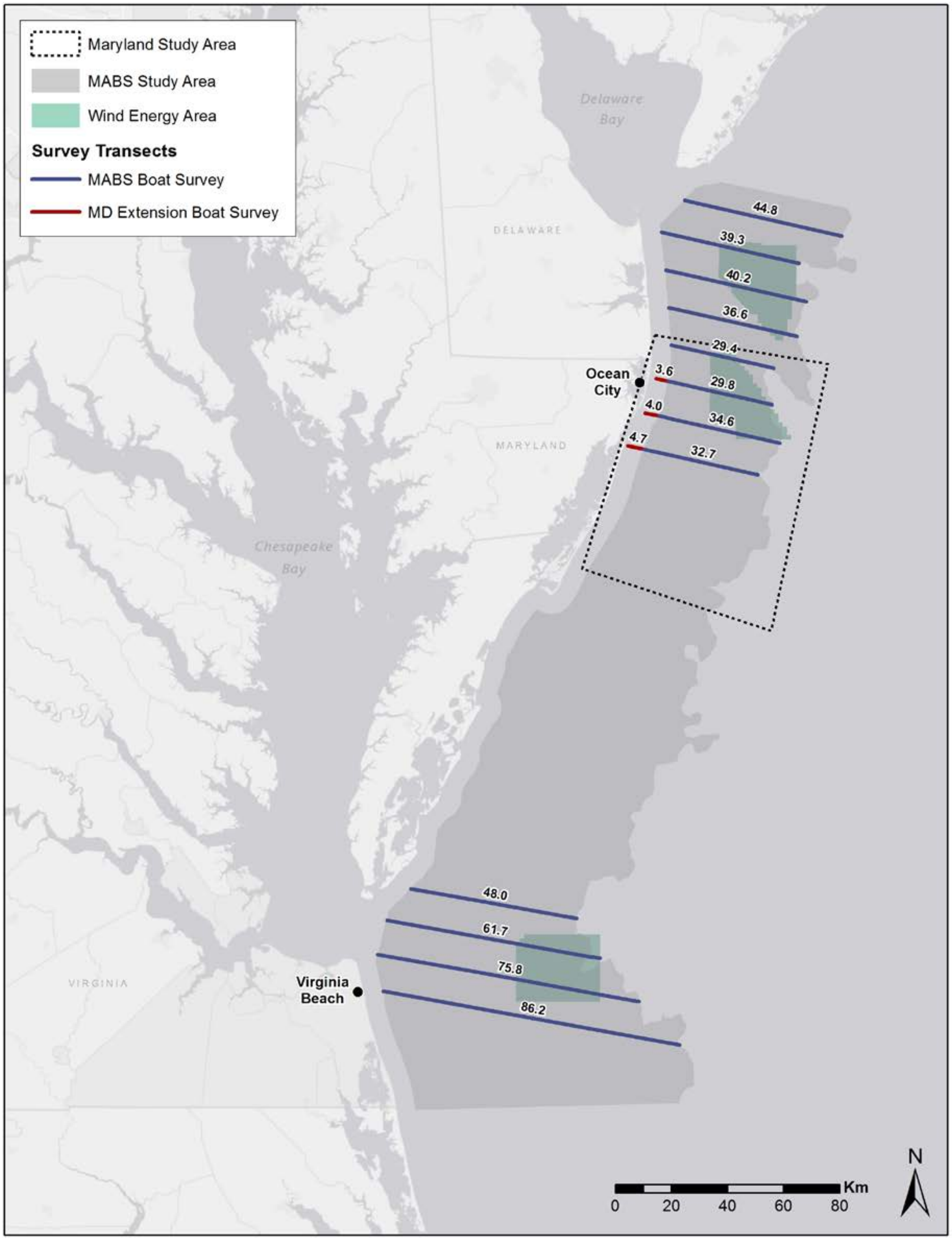

Figure 6-1. Boat survey map with transect length (km) indicated on each line. Mid-Atlantic Baseline Studies transects are shown in dark blue; Maryland Project transects are shown in lighter blue. Surveys were conducted out of Ocean City, MD and Virginia Beach, VA.

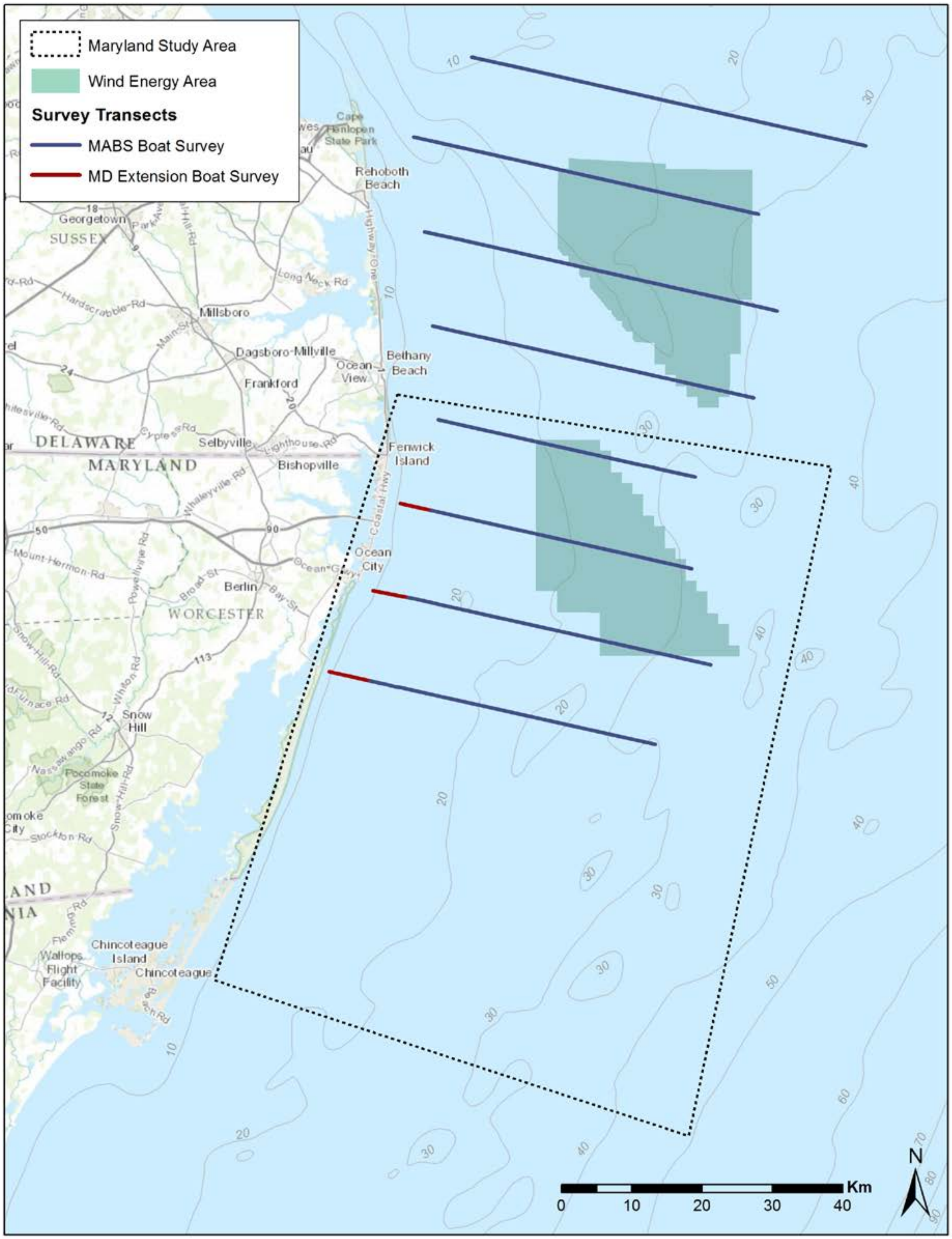

Figure 6-2. Detailed map of boat survey transects within the Maryland study area. Mid-Atlantic Baseline Studies transects are shown in dark blue; Maryland Project transects are shown in lighter blue.

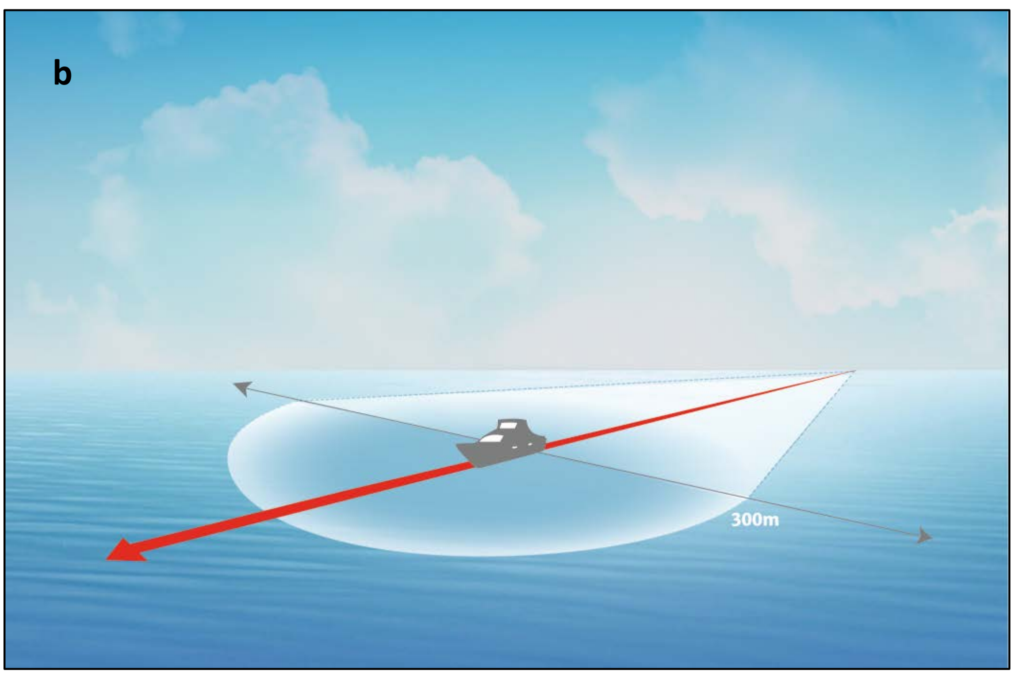

Figure 6-3. (a) Photograph of the Stormy Petrel with an observer surveying from the flying bridge, above the pilot house. (b) Diagram illustrating the field of view available during boat surveys. The boat transect has an intended minimum strip width of 300 m, although observations were made up to 1,000 m from the vessel. In most conditions, observers surveyed the full 360˚ from the flying bridge. In inclement weather (when surveying from within the pilot house), and when it was not possible to continuously survey the entire 360˚ arc, observers focused survey efforts within a 90˚arc on one side of the boat.

Table 6-1. Ideal schedule for boat surveys.

Survey Period	Timing for Boat Surveys
Early spring	Late March (into early April if needed)
Late spring	Early to mid-May
Early summer	June (pref. late June)
Late summer	Early August
Early fall	September (pref. early to mid-Sept.)
Late fall	October (pref. mid- to late Oct.)
Early winter	December (pref. mid-Dec.)
Late winter	Late Jan. or early Feb.

Table 6-2. Beaufort scale.

Beaufort Wind Force	Wind Speed (knots)	Sea state description	Beaufort wind force and description
0	0	Calm, mirror-like	Calm
1	1 – 3	Ripples with the appearance of scales are formed, but without foam crests.	Light air
2	4 – 6	Small wavelets, still short but more pronounced. Crests have glassy appearance and do not break.	Light breeze
3	7 – 10	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white caps.	Gentle breeze
4	11 – 16	Small waves, becoming longer, fairly frequent white caps.	Moderate breeze
5	17 – 21	Moderate waves, taking a more pronounced long form; many white caps formed. Chance of some spray.	Fresh breeze
6	22 - 27	Large waves begin to form; the white foam crests are more extensive everywhere. Probably some spray.	Strong breeze
7	28 – 33	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.	Moderate gale
8	34 – 40	Moderate high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.	Fresh gale
9	41 – 47	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.	Strong gale
10	48 – 55	Very high waves with long over-hanging crests. Foam blown in dense white streaks along the direction of the wind. Sea takes a white appearance. Visibility affected.	Whole gale
11	56 – 63	Exceptionally high waves (small and medium-sized ships might be for a time lost behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind. Edges of the wave crests are blown in to froth. Visibility affected.	Storm
12	64 +	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected.	Hurricane

Table 6-3. Data fields, descriptions, and examples for each field. All fields were required, unless noted otherwise in the description. Fields in italics were automatically entered by dLOG every 5 seconds. Fields in bold and italics were entered by the recorder at the start of the survey and changed when necessary (i.e., sea state changes, observers switch). Fields in bold were entered by the recorder when entering a record for a sighting, temperature and salinity readings, or other notes.

Field	Description	Example
Latitude	GPS-entered Latitude	36.944967
Longitude	GPS-entered Longitude	-75.93854
Hour	GPS-entered Hour	11
Minute	GPS-entered Minute	8
Second	GPS-entered Second	0
Year	GPS-entered Year	2013
Month	GPS-entered Date - Month	3
Day	GPS-entered Date - Day	20
Type	Notes whether data are entered by user or by computer. "GPS" data are entered by the computer every 5 seconds from the built in GPS. When a user enters a sighting or any other information this field is coded as USER.	USER
Spp	Four letter species code (See Table 6-5 for details). Also includes codes for boats and other items of interest.	HERG
Count	Number of animals seen.	2
Behavior	Add one word describing animal's behavior. Field is not locked. Common behaviors are described in Table 6-4 below.	FLYING
Direction	Optional. Direction of movement. Possible options are N, NE, E, SE, S, SW, W, or NW. Not applicable for birds that are milling, feeding, or sitting, or for other animals that are stationary.	N
Distance	Radial distance from the observer to the animal or the center of the group of animals. This distance is based on the observer's estimate, calibrated to other observers. Estimate based on the first instance you see the animal. Distance estimate is rounded to the nearest 50 or 100 m, unless the animal is within 50 meters of the boat and a more accurate estimate is possible.	100
Degree	The animal's location in degrees from the bow of the boat. The bow is 0°, one quarter around towards the starboard is 90°, directly off the stern is 180°, and three quarters around off of port is 270°. Estimate is based on the first instance that you see the animal, and is rounded to the nearest 10°.	350
Plumage	Optional. Describe the stage of the bird's molt, whether it is a light or dark morph bird, or the gannet plumage type.	PRIMARY MOLT
Age	Optional. Adult, Immature, or Juvenile - or go in to more detail about the bird's age (e.g., 1S for a first summer gull).	2W
Comment	Optional. Any additional comments about the sighting. Also use this field for temperature and salinity measurements or any notes as needed.	WITH GBBG
Beaufort	Approximate description of the current sea state using the Beaufort Scale (see Table 6-2). Update every hour.	3
Transect	Transect number. If recording between transects use T11 – T12 to indicate which transects you are moving between. Update at the start and end of each transect.	T11
Obs	Observer's three initials. Update every time the observer changes.	ETB
Visib	Visibility. Options are 5 = 5 miles plus, 4= 3-5 miles, 3= 1-3 miles, 2= 500 m-1 mile; 1 = 300-500 m visibility. Update as visibility changes.	5
SurveyID	ID code for the survey taking place. Remains the same throughout the survey.	DOEMARCH2013

Field	Description	Example
	Use the formula DOE(MONTH)(YEAR) as in DOEFEB2013.	
Station	Report which side of the boat the observer is standing on using PORT or STARBOARD. Update when the observer changes sides.	STARBOARD
Platform	Name of the vessel used for surveys. On the *Stormy Petrel II*, we conduct surveys on the flying bridge. If weather conditions deteriorate and observers must go inside the pilot house, indicate that by changing the platform to ONBRIDGE and make a note explaining the change in location. If you return to the flying bridge make a note and change back to STORMYPET	STORMYPET

Table 6-4. Common behavior codes. Codes apply to an animal's initial behavior when first observed.

Behavior	Description
FLYING	Bird or bat is flying – indicate flight direction
MILLING	Not flying in any specific direction but circling around above the water. This can indicate birds in a feeding flock.
SITTING	Bird sitting on the water. If sitting on an object use this code and make a note saying what it is on.
DIVING	Animal at the surface dives under water.
TAKING OFF	Bird taking off from the water.
FEEDING	Active feeding behaviors observed.
PLUNGE DIVING	Specific to birds that feed by plunge diving (e.g., gannets, terns, shearwaters, gulls)
PATTERING	Flying low and hitting the water's surface with feet, mainly storm-petrels
FOLLOWING	Bird following the boat. This code is used when a bird has already been counted, but continues to follow along with the boat.
STATIONARY	Non-avian animal stationary in the water.
SWIMMING	Non-avian animal swimming – indicate direction of movement.
PORPOISING	Marine mammal moving through the water like a porpoise, up and down through the water.
BREACHING	Whale rising up and breaking through the surface of the water and splashing back down into the water.
BLOWING	Whale blowing from its spout at the surface.
DEAD	Dead animal.

Table 6-5. Boat survey species code list for the Mid-Atlantic Baseline Studies and Maryland Projects. Codes are listed in alphabetical order of common name.

Species Code	Common Name	Latin Name
ALGA	Algal bloom	
ABDU	American Black Duck	*Anas rubripes*
AMCO	American Coot	*Fulica americana*
AMPI	American Pipit	*Anthus rubescens*
AMRE	American Redstart	*Setophaga ruticilla*
AMRO	American Robin	*Turdus migratorius*
HOCR	Atlantic Horseshoe Crab	*Limulus polyphemus*
ATPU	Atlantic Puffin	*Fratercula arctica*
ASDO	Atlantic Spotted Dolphin	*Stenella frontalis*
AUSH	Audubon's Shearwater	*Puffinus lherminieri*
BAIT	bait ball	
BAEA	Bald Eagle	*Haliaeetus leucocephalus*
BALN	balloon	
BARS	Barn Swallow	*Hirundo rustica*
BLSC	Black Scoter	*Melanitta nigra*
BLSK	Black Skimmer	*Rynchops niger*
BLTE	Black Tern	*Chlidonias niger*
BLVU	Black Vulture	*Coragyps atratus*
BLKI	Black-legged Kittiwake	*Rissa tridactyla*
BLPW	Blackpoll Warbler	*Dendroica striata*
BTBW	Black-throated Blue Warbler	*Dendroica caerulescens*
BOAC	boat--aircraft carrier	
BOBA	boat--barge/barge and tug	
BOCA	Boat--cargo	
BOCF	Boat--commercial fishing	
BOCS	boat--container ship	
BOCR	boat--cruise	
BOFI	boat--fishing	
BOPL	boat--pleasure	
BORF	boat--recreational fishing	
BORV	boat--research vessel	
BOSA	boat--sail	
BOSU	boat--submarine	
BOTA	boat--tanker	
BOTD	boat--trawler/dragger	
BOAT	Boat--unidentified	
BOGU	Bonaparte's Gull	*Larus philadelphia*
BODO	Bottlenose Dolphin	*Tursiops truncatus*

Species Code	Common Name	Latin Name
BRAN	Brant	*Branta bernicla*
BRPE	Brown Pelican	*Pelecanus occidentalis*
BHCO	Brown-headed Cowbird	*Molothrus ater*
BUFF	Bufflehead	*Bucephala albeola*
CANG	Canada Goose	*Branta canadensis*
CATE	Caspian Tern	*Sterna caspia*
CEDW	Cedar Waxwing	*Bombycilla cedrorum*
CHAN	Change in personnel, station, transect, etc.	
CODO	Common Dolphin	*Delphinus delphis*
COGO	Common Goldeneye	*Bucephala clangula*
COLO	Common Loon	*Gavia immer*
COMU	Common Murre	*Uria aalge*
COTE	Common Tern	*Sterna hirundo*
COSH	Cory's Shearwater	*Calonectris diomedea*
DASC	Dark scoter - either black scoter or surf scoter	
DEJU	Dark-eyed Junco	*Junco hyemalis*
DCCO	Double-crested Cormorant	*Phalacrocorax auritus*
DOVE	Dovekie	*Alle alle*
DUNL	Dunlin	*Calidris alpina*
FIWH	Fin Whale	*Balaenoptera physalus*
FLJE	flotsam and jetsam	
FOTE	Forster's Tern	*Sterna forsteri*
GLGU	Glaucous Gull	*Larus hyperboreus*
GCKI	Golden-crowned Kinglet	*Regulus satrapa*
GBBG	Great Black-backed Gull	*Larus marinus*
GBHE	Great Blue Heron	*Ardea herodias*
GREG	Great Egret	*Ardea alba*
GRSH	Greater Shearwater	*Puffinus gravis*
GRHE	Green Heron	*Butorides Virescens*
GWTE	Green-winged Teal	*Anas crecca*
HERG	Herring gull	*Larus argentatus*
HOGR	Horned Grebe	*Podiceps auritus*
HUWH	Humpback Whale	*Megaptera novaeangliae*
LAGU	Laughing Gull	*Larus atricilla*
LESA	Least Sandpiper	*Calidris minutilla*
LETE	Least Tern	*Sterna antillarum*
LETU	Leatherback Turtle	*Dermochelys coriacea*
LBBG	Lesser Black-backed Gull	*Larus fuscus*

Species Code	Common Name	Latin Name
LEYE	Lesser Yellowlegs	*Tringa flavipes*
LIGU	Little Gull	*Larus minutus*
LOTU	Loggerhead Turtle	*Caretta caretta*
LTDU	Long-tailed Duck	*Clangula hyemalis*
MALL	Mallard	*Anas platyrhynchos*
MASH	Manx Shearwater	*Puffinus puffinus*
MERL	Merlin	*Falco columbarius*
MIWH	Minke Whale	*Balaenoptera acutorostrata*
MOON	Moon Jellyfish	*Aurelia aurita*
MOWA	Mourning Warbler	*Oporornis philadelphia*
MYWA	Myrtle Warbler	*Dendroica c. coronata*
NONE	none	
NOFL	Northern Flicker	*Colaptes auratus*
NOFU	Northern Fulmar	*Fulmarus glacialis*
NOGA	Northern Gannet	*Morus bassanus*
NOHA	Northern Harrier	*Circus cyaneus*
NOWA	Northern Waterthrush	*Seiurus noveboracensis*
NOTE	note	
MOLA	Ocean Sunfish (Mola)	*Mola mola*
OSPR	Osprey	*Pandion haliaetus*
PAWA	Palm Warbler	*Dendroica palmarum*
PAJA	Parasitic Jaeger	*Stercorarius parasiticus*
POJA	Pomarine Jaeger	*Stercorarius pomarinus*
PONY	Pony	
PMOW	Portuguese Man o' War	*Physalia physalis*
PUMA	Purple Martin	*Progne subis*
RAZO	Razorbill	*Alca torda*
REBA	Red Bat	*Lasiurus borealis*
REPH	Red Phalarope	*Phalaropus fulicaria*
RBME	Red-breasted Merganser	*Mergus serrator*
RBNU	Red-breasted Nuthatch	*Sitta canadensis*
RNGR	Red-necked Grebe	*Podiceps grisegena*
RNPH	Red-necked Phalarope	*Phalaropus lobatus*
RTLO	Red-throated Loon	*Gavia stellata*
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*
RIWH	Right Whale	*Eubalaena glacialis*
RBGU	Ring-billed Gull	*Larus delawarensis*
ROST	Roseate Tern	*Sterna dougallii*
ROYT	Royal Tern	*Sterna maxima*
RCKI	Ruby-crowned Kinglet	*Regulus calendula*

Species Code	Common Name	Latin Name
RUTU	Ruddy Turnstone	*Arenaria interpres*
SAGU	Sabine's Gull	*Xema sabini*
SAND	Sanderling	*Calidris alba*
SEWH	Sei Whale	*Balaenoptera borealis*
SEPL	Semipalmated Plover	*Charadrius semipalmatus*
SESA	Semipalmated Sandpiper	*Calidris pusilla*
SBDO	Short-billed Dowitcher	*Limnodromus griseus*
SMTU	Small turtle - Loggerhead, Green, Hawksbill, or Kemp's Ridley	
SOSP	Song Sparrow	*Melospiza melodia*
SOSH	Sooty Shearwater	*Puffinus griseus*
SUBU	Sulfur Butterfly spp.	*Coliadinae spp.*
SUSC	Surf Scoter	*Melanitta perspicillata*
TEWA	Tennessee Warbler	*Vermivora peregrina*
TBMU	Thick-billed Murre	*Uria lomvia*
TRAN	transect point (such as temperature/salinity values)	
TRES	Tree Swallow	*Tachycineta bicolor*
UNAL	Unidentified Alcid	*Alcidae spp.*
BUMB	Unidentified Bee	
UNBI	Unidentified Bird	*Aves*
UBUT	Unidentified Butterfly	
UNCO	Unidentified Cormorant	*Phalacrocorax spp*
UNDO	Unidentified Dolphin	*Unidentified Delphinidae*
UNDU	Unidentified Duck	
UNEI	Unidentified Eider	*Somateria spp.*
FISH	Unidentified Fish	*Osteichthyes*
UFFI	Unidentified Flying Fish	*Exocoetidae spp.*
UFOB	Unidentified flying object (animal-origin)	
UNGU	Unidentified Gull	
UNHU	Unidentified Hummingbird	
UNJA	Unidentified Jaeger	*Stercorarius spp.*
UNJE	Unidentified Jellyfish	*Scyphozoa spp.*
UNLA	Unidentified Large Alcid (Razorbill or Murre)	
UNLG	Unidentified Large Gull	
UNLW	Unidentified Large Whale	*Cetacea spp.*
UNLO	Unidentified Loon	*Gavia spp.*
UNMM	Unidentified Marine Mammal	*Mammalia*

Species Code	Common Name	Latin Name
UNPA	Unidentified Passerine	
PEEP	Unidentified Peep	
UNPH	Unidentified Phalarope	*Phalaropus spp.*
UNRA	Unidentified Ray	*Rajiformes spp.*
SCAU	Unidentified Scaup	*Aythya marila or A. affinis*
UNSC	Unidentified Scoter	*Melanitta spp.*
TURT	Unidentified Sea Turtle	
UNSH	Unidentified Shearwater	*Procellariidae spp.*
SHOR	Unidentified Shorebird	
UNSK	Unidentified Skua	*Stercorarius spp.*
UNSA	Unidentified Small Alcid (Puffin/Dovekie)	*Alle alle/Fratercula arctica*
UNSS	Unidentified Small Shearwater (Audubon's, Manx, or Little)	*Puffinus lherminieri , P. puffinus, or P. assimilis*
SPAR	Unidentified Sparrow	*Emberizidae spp.*
UNSP	Unidentified Storm-petrel	
SWAL	Unidentified Swallow	*Hirundinidae spp.*
TEAL	Unidentified Teal	
UNTE	Unidentified Tern	*Sterna spp.*
THSH	Unidentified Thresher Shark	
UNWA	Unidentified Warbler	
UNWH	Unidentified Whale	*Cetacea spp.*
UNKN	unknown	
WHIM	Whimbrel	*Numenius phaeopus*
WRSA	White-rumped Sandpiper	*Calidris fuscicollis*
WWSC	White-winged Scoter	*Melanitta fusca*
WILL	Willet	*Catoptrophorus semipalmatus*
WIPL	Wilson's Plover	*Charadrius wilsonia*
WISP	Wilson's Storm-petrel	*Oceanites oceanicus*
WODU	Wood Duck	*Aix sponsa*