Chapter 4: High resolution digital video aerial survey data protocols
Final Report to the Department of Energy Wind and Water Power Technologies Office, 2015

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Chapter 4 Highlights

Protocol for data analysis, data management, and audit procedures for the high resolution digital aerial surveys in the mid-Atlantic.

Context[1]

High resolution digital video aerial surveys are a relatively new method for collecting distribution and abundance data on animals in the offshore environment, and our study was the first to use this method on a broad scale in the U.S. The technology was developed by HiDef Aerial Surveying, Ltd., in the United Kingdom. This chapter describes the methods used to analyze the survey video, in particular describing the object identification and audit procedures in detail. Data collection methods and some analysis processes are described in Chapter 3. Basic results from the digital video aerial surveys are summarized in Chapter 5, and the data are analyzed alongside boat survey data in Part IV of this report. Recommendations for ways to improve data collection and analysis of the digital video aerial survey data are included in Chapter 6.

Highlights

- Aerial video data were collected on abundance and behaviors of marine birds, mammals, turtles, and other wildlife within the Mid-Atlantic Baseline Studies project area.
- Locations of individual animals (or objects), taxonomic identifications, behaviors, and flight heights were determined from the video images.
- A random 20% of the objects identified were blindly audited through re-review with an extensive arbitration process in cases of disagreement.
- 100% of threatened and endangered species were audited with exact matches required.
- Example images, data collection spreadsheets, and definitions of identification categories are included.

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

Abstract

High resolution digital video aerial surveys were conducted in the mid-Atlantic, as a part of the Mid-Atlantic Baseline Studies Project, to produce data to inform siting and permitting processes for offshore wind energy development. Data were collected on the abundance and behaviors of marine birds, mammals, turtles, and other wildlife. Wildlife locations, taxonomic identifications, animal behaviors, and flight heights were determined from the video images. This chapter describes the protocol for the data analysis process, the procedure for identifying objects, and quality assurance and quality control procedures. Example images are included to illustrate methods used during the analysis, along with definitions of identification categories used, and tables showing the types of data collected during video analyses.

Introduction

The goal of the Department of Energy-funded Mid-Atlantic Baseline Studies Project (2012-2015) is to produce the data required to inform siting and permitting processes for offshore wind energy development in federal waters of the mid-Atlantic region (DE-VA; Figure 4-1). Data on the abundance and movements of marine, coastal and migratory birds, marine mammals, sea turtles, and other megafauna are collected within federally designated Wind Energy Areas (WEAs) and elsewhere within the study area, and analyzed using a variety of technologies and methods.

As one component of this study, BRI and HiDef Aerial Surveying Limited (HiDef) are conducting large-scale surveys across the entire study area using high resolution video on an aerial platform. HiDef's technique uses an array of four high resolution video cameras (which can be either belly or nose mounted depending on aircraft type) on twin-engine Cessna aircraft to capture detailed footage and a consistent viewing frame of the ocean surface; survey flights are conducted at 2,000 feet above sea level (Chapter 3). Wildlife are observed in the video footage, georeferenced, and identified to species or lowest taxonomic order. This technique also allows assessment of individual behavior and estimation of animal flight height.

Some components of the Mid-Atlantic Baseline Studies Project's survey and analysis procedures are conducted by HiDef, while others are conducted by the Video Review Laboratory at BRI. As digital video aerial surveys are a relatively new technique for monitoring wildlife in the offshore environment, protocols for data management, data analysis, and quality assurance procedures have only recently been developed by practitioners in Europe and elsewhere, and these protocols are in many cases under continued development as techniques and technologies are further refined. In order to provide transparency and accountability for all video data review conducted by BRI during the project, Video Review Lab personnel have developed detailed data protocols for the components of the data analysis and data management processes for which they are responsible.

Overview of data analysis process

The general process for recording and analyzing high definition video aerial data includes the following steps. A glossary of terms may be found in Appendix 4A.

I. HiDef Aerial Surveying Ltd.

a) HiDef works with their digital video aerial survey vendor to outfit the survey aircraft and undertake survey flights in the mid-Atlantic region.

b) The digital video aerial survey vendor ships the video footage to HiDef in the UK, and also makes hard drive copies of the video and ships them to the BRI office in Maine.

c) The HiDef review team views each frame to mark visible objects (or *targets*) using proprietary video processing software, and notes object categories (e.g., Bird, Buoy, Fish). These data are outputted to an Excel spreadsheet, and the markers generated through this process are used by BRI reviewers to locate animals within a frame. Example images of marked animals can be found in Appendix 4C.

d) On completion, 20% of the frames in each survey are re-reviewed (blind) by a second HiDef observer to determine the rate of agreement between observers. Agreement must be at least 90% for the audit to pass. All objects found by both the observer and the auditor are included in the final file sent to BRI regardless of whether the audit passes. If the audit is not passed, that observer's recent data are examined for consistent errors and issues are addressed.

e) Spreadsheets with marked data are sent to BRI for object identifications (Appendix 4B).

II. Biodiversity Research Institute

a) The BRI review team examines video frames which contain marked targets. Each target is identified to species or group, at the lowest possible taxonomic level, or as abiota of various types (Appendix 4C; also see "ID Category" section below). An assessment of the reviewer's certainty level is associated with each identification. If possible, ancillary data, such as the animal's behavior, direction of movement, and age and sex, are also noted (Appendix 4B, Table 4B-2). Direction of movement is noted in relation to the viewing screen (e.g., up, down, left or right).

b) The identification data spreadsheets are returned to HiDef in the UK.

c) Twenty percent of the objects originally categorized as animals by the HiDef review team are re-reviewed by additional BRI reviewers to determine the rate of agreement between observers. Agreement is defined according to relationships described in the QA/QC Review Protocol below. If <90% agreement is obtained for a given survey, supplementary audit and review processes are conducted as outlined in this protocol.

III. HiDef Aerial Surveying Ltd.

a) HiDef calculates flight altitude for flying targets listed in the identification data spreadsheets, using their proprietary parallax technology (Hatch et al., 2013), and georeferences each video frame containing target objects using GPS data from the survey flight. Direction of movement is translated into a cardinal direction, based on the direction in which each camera was pointed during the time of recording (Appendix 4B, Table 4B-2).

b) The spreadsheets are returned to BRI with added parallax, location, and direction of movement information.

IV. Biodiversity Research Institute
   a) These data are joined to the audited data held by BRI and complete datasets are sent to the US Geological Survey, which is currently managing the federal Compendium of Avian Information database, as well as to project partners for statistical analysis.

Tasks II.a and II.c. are described in "Procedure for target identification" and "Quality assurance and quality control of data collection," below. Detailed information on the survey and data management tasks completed by HiDef Aerial Surveying, Ltd. and their contractors are outside the scope of this protocol.

Procedure for target identification

Video data storage
Video footage is stored on external hard drives and shipped between the aerial operator, BRI, and HiDef. These hard drives are uploaded to the server at BRI upon arrival, and data are accessed by the review team through this server. When data analysis and management is completed for a survey, the video data are transferred to external hard drives for long-term storage in a fire safe at an external location.

Filename conventions for spreadsheets and sequence files
Video file names are in the following format: ZoneID#_Month#_SurveyDay_CameraNumber_Year (example: Zone19_M03_S01_D01_C2_12). Sequences, which contain camera reels, are named in the format 10-15-43.796.

In the above examples, Zone 19 refers to the mid-Atlantic study region; M03 refers to the calendar month (e.g., 03=March); S01 refers to the first survey of that month; D01 refers to when the section was flown over the course of the survey (e.g., Day 1), and changes geographic location from survey to survey; C2 refers to one of the four cameras that the reel came from; and 12 refers to 2012, the year the survey was flown. Sequence 10-15-43.796 refers to the specific video reel and is named for the time that the survey plane started on that transect line.

Excel spreadsheets
Each camera for each day has an associated spreadsheet for analysis. HiDef completes several fields for each identified object: Location (Zone), Date of flight, Camera Number, Resolution, Reel Name, Observer, Time, Frame number, Category of object, and Marker Number[2] (Appendix 4B, Table 4B-1). The spreadsheet is protected to prevent changes being made to these columns that would affect later processing. Columns in (Appendix 4B) are filled out by the review team. Spreadsheets are stored on the BRI server in their respective year, survey, month, day and camera folders and can be accessed by the entire review team.

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[2] For March through October of 2012, the marker number for each object identified within the frame was added manually by BRI reviewers. From December 2012 onwards, HiDef included the marker numbers for all objects in the data spreadsheets, eliminating the need for manual entry.

Selecting a reel

The object marker files are named to match reel names in video sequences. If a video sequence is unable to open, it is possible to repair the corrupted reel on-site using a proprietary module that re-builds headers for each file. Review of video sequences is recorded in spreadsheets associated with each day and camera; reviewers track who is reviewing which reels on the video review room white board.

Viewing a frame

Each object has a marker number and a frame number associated with it. The frame number refers to the frame that the HiDef reviewer has marked as containing an object for review (e.g., the frame in which the object is closest to the red center line that bisects the camera field of view; Appendix 4C). The start or end of a reel or a section of footage containing atmospheric interference (e.g., clouds) may also be assigned a frame number. Some frames may have zero markers or a single marker identified, while others will have multiple markers, if there are numerous animals in the frame (Appendix 4C). The frame number from the spreadsheet is equivalent to the number in the file header information located at the top of the proprietary video processing software.

Identifying a marked target

For each frame that features a target marked by the HiDef review team, a BRI reviewer enters the frame number into the proprietary video processing software to view the object. The reviewer closely examines each target for features (size, shape, color, behavior, flight pattern) that will allow for identification to species according to defined criteria (Appendix 4E). If it cannot be identified to species, the object is categorized to a higher taxon level or a broad category (e.g., "UNKN; Unknown"). The aim is to identify targets to the lowest taxonomic level possible, with accuracy. Reviewers move through all of the frames in which that object is recorded to get a sense of the target's movement, and to find the clearest images for review. Using proprietary video processing software, reviewers can adjust the image brightness and other qualities to create a clearer image of the object being identified, or to pick up lighter or darker colors that may be obscured (Appendix 4C).

Data fields completed by BRI

Fields L-AA in the data spreadsheet (Appendix 4B, Table 4B-2) are filled out for each marked object. When a reviewer finishes reviewing the data for a spreadsheet, he or she checks their spreadsheet with a QA/QC checklist and makes required edits (see Appendix 4G).

Marker number

If an object is missed at the review stage and crosses the red line, a marker number is added to the spreadsheet and highlighted in bright yellow with a frame number filled in to the "Added Frame Number" column. A new marker number is added to the screen by clicking on the object and selecting "Ok" (Appendix 4C). Marker numbers are generated automatically by the proprietary video processing software and go up sequentially. The marker number is added to the marker number column in the spreadsheet.

ID category

Objects are identified to species, if possible, based on the animal's size, coloring, movement, general shape, and movement/flight pattern. Options include bird, mammal, shark, ray, fish, and turtle species, as well as algae and abiotic objects (a complete listing of codes employed through May 2014 is included in Appendix 4D). Species group codes may also be used; these correspond to groups of species that may be difficult to differentiate. For example, the "SMTU" code ("small turtle") includes green, Kemp's ridley, hawksbill, and loggerhead sea turtle species, and is used in cases where more definitive species identifications are deemed to be impossible. Other group codes include:

CESS; Cetacean/Seal/Shark - Animal is too obscured to tell if it is a cetacean, a seal, a shark, or a large fish

UNBI; Unidentified Bird – Object is a bird but no further taxonomic distinctions can be made

In addition, non-object codes can be used for marked objects that cannot be placed in a biotic category:

Nothing; Nothing – Something has been marked as an object, but there is nothing there. This is also used when a wave or feces is marked as an object.

ERRO; Error – This is used to identify objects in an inoperable or damaged reel that is unable to be repaired. This is also used to identify objects on land.

Species confidence

Each target identified has a confidence level associated with it (Table 4-1). All objects must have an associated confidence. For non-species based identifications (e.g., "DUPL; Duplicate," "NA; Not Applicable"), "Definite" is used as the confidence.

Behavior

When a target is identified as an animal, the general behavior of the target is described using the options in the drop-down menu (Appendix 4B, Table 4B-2). Some categories of behavior refer specifically to avian or bat targets (sitting, flying, taking off), while others refer to aquatic animals (stationary, moving). Direction of the animal's movement is indicated when applicable.

Flying at sea level

This designation is used for targets identified as birds or bats that are flying. Reviewers consider whether or not there is evidence that the animal in flight is flying close to the ocean surface. Splashing may indicate the bird has just taken off, or a shadow close to the target object may indicate it is low over the water (Appendix 4C).

Submerged

Reviewers note whether the animal is submerged or surfaces within the recorded frames. This designator is only used for aquatic animals.

Approximate age
If possible, reviewers note the approximate age of the animal based on measurements of size (mammals, turtles, rays) or plumage (birds).

Plumage
Any details about plumage are noted in this text field. Options include gannet and fulmar plumages (see Appendix 4B, Table 4B-2).

Molt
Molt stages are noted for birds if possible (see Appendix 4B, Table 4B-2).

Probable sex
Probable sex is noted where possible. There are many species that cannot be identified to sex, so this is only marked when the reviewer is able to determine sex easily (e.g., scoters).

Measurements
If an on-screen measurement of an object is taken during the ID process using the proprietary point-to-point caliper module, the measurement is recorded in the Measurements[3] column in centimeters (Appendix 4C). The types of measurements included in this field (Appendix 4B, Table 4B-2) are listed in Table 4-2; all other measurement types (i.e., sitting birds, caudal fin measurements, partial measurements) are placed in the comments field.

Outside zone
Animals are occasionally marked that do not cross the red line. When that happens, reviewers indicate this by choosing "Yes" here.

Flag
Flags are used to mark an animal that reviewers want to revisit for any reason. The reason for flagging must be noted in the comments.

Added frame
When an unmarked object is found, this is where the position of the marked object (frame number) is noted.

Comments
Reviewers fill out comments on the object when necessary. Reel names of any missing objects are included here. In addition, if changes are made to the data after they are sent back to HiDef for parallax and georeferencing (for example, as the result of an audit arbitration; see QA/QC Review Protocol below), reviewers use the following wording in the comments: Post-parallax edits-MM/DD/YYYY and any other comments associated with the post-parallax change along with their initials. In addition, reviewers change the ID Category fill color to dark green.

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[3] For March 2012, the measurement tool was not available and objects were measured using a ruler. Prior to December 2012, measurements did not follow the definitions found in Table 4-2.

Identification date
Reviewers enter the date of identification for every line of data.

Identifier
Reviewers enter their initials here for every line of data at the time it is completed.

Completion of data analysis

Following the data analysis outlined above, as well as the data collection and data completion QA/QC procedures outlined in the QA/QC Review Protocol below, BRI sends data spreadsheets to the HiDef head office in the United Kingdom. The UK office georeferences all frames with target objects, and estimates the approximate flight height of flying objects using a proprietary parallax technique (Hatch et al., 2013). The columns produced through this process are Latitude, Longitude, Flight Height, Flight Height Confidence, and a modified field for Behavior that includes cardinal direction of movement where applicable (Appendix 4B, Table 4B-3). While HiDef is completing these data analyses for the survey, BRI concurrently begins regular and Threatened and Endangered Species audit procedures as outlined in the QA/QC Review protocol below.

Quality assurance and quality control of data collection

Goals
1. Data are consistent, accurate, valid, and repeatable
2. Problem areas and successes are identified, addressed, documented, and reported
3. ID criteria and SOPs are up to date and applied consistently by each reviewer
4. Exceptional data quality is maintained for:
    a. Basic analysis/summary reports
    b. Statistical modeling
    c. Synchronization with current or similar datasets
    d. Collaborator analysis needs

Filename conventions
13_M09_Audit_JGO

13_M09_Arbitration_JGO

In the examples above, "13" represents the year in which the survey was flown, "M09" represents the month in which the survey was flown. "Audit" or "Arbitration" is the task performed. "JGO" represents the initials of the auditor or arbitrator.

Data collection QA/QC
To ensure consistency during data collection and the accuracy of data entry, spreadsheet formatting is locked and drop-down menus are used in fields with analyzable data. In addition, drop-down menus are extracted from a master code database, which is updated with definitions and codes on a regular basis (Appendix 4D). Ancillary data within the reviewer spreadsheet, such as measurements or comments, are recorded as text. To ensure repeatability and consistency, all reviewers refer to the same reference

documents, such as measurement charts, seasonal distribution maps, and a "Confidence and Identification Criteria" document (Appendix 4E), which is based on a hierarchal matrix (Appendix 4F) that was developed from biota previously encountered on aerial and boat-based surveys conducted in the study area, as well as taxonomic pairings or groupings developed during HiDef's previous projects in Europe. In order for an object to be called a 'definite Dovekie', then all of the criteria for 'definite' and 'Dovekie' need to be met. Otherwise, it is either downgraded to a lower confidence level or a higher taxonomic grouping, such as 'Unidentified Alcid'.

Data completion QA/QC

Reviewers check for common data errors using a checklist (Appendix 4G). After target identification is complete, the QA/QC manager compiles the data by month and double-checks for errors, such as those listed in Appendix 4G. Errors are corrected by the original identifier, if available, and any corrections to the data by the team leader or QA/QC manager are noted in the comments field in the original spreadsheet.

Blind audit re-identifications

Following completion of the above steps for each survey's data, the compiled data are filtered for objects originally characterized by Hi-Def reviewers as biota. Buoys, boats, and reel locations do not qualify for audit. Twenty percent of the remaining objects are eligible for audit and this number is noted. In order to maximize the audit effort, and to reduce audit technical error, other objects are exempt from the audit, such as duplicate objects, outside zone objects, and objects that could not be identified due to reel or marker number errors. Next, a formula is used to assign a random number to all eligible objects. Once those numbers are generated, the spreadsheet is sorted in numerical order by the random-generated number. The top 20% are chosen and pasted into a new tab. The original compiled spreadsheet is sorted for threatened and endangered (T&E) species and any T&E objects that did not get chosen for the random-generated audit are also added to the random audit. The objects are assigned a second random number and sorted in ascending order by the random-generated number. The spreadsheet is filtered by each original reviewer and those objects are evenly distributed to other BRI reviewers. All original answers are removed, new fields for audit identification are added, and a new "blind" spreadsheet is generated for each auditor. Auditors follow the same identification protocol as for the target ID process above, and their identifications are compared to the original identifications to determine how often the first and second reviewers agree. A "pass" grade occurs when auditors agree with ≥90% of original reviewers' data in the random audit, and 100% for the T&E audit.

Audit analysis: randomly chosen objects

Assessment of audit agreement rates is conducted via MS Access using pre-determined answer agreements (Appendix 4H; these are based on the 'Confidence and Identification Criteria' document and rules that apply to all biotic objects). The rules are (see Table 4-3 for examples):

1. Specific species identifications are considered to equal the next available higher taxonomic grouping as long as the next available grouping is not "UNBI; Unidentified Bird", "ID Impossible; ID Impossible", or "CESS; Cetacean/Seal/Shark". In those instances, the species can only equal itself. For example, some species such as "NOGA; Northern Gannet" and "REBA; Red Bat" are

singly defined in the audit answer status (see Appendix 4H) because they have no known similar species in the study area at this time. Fully defined species such as "BODO; Bottlenose Dolphin" can pass as an "SBCE; Small beaked Cetacean to 3m" in an audit.

2. Higher taxonomic grouping identifications are considered equal to the next lowest taxonomic level as well as next highest taxonomic grouping. For example, SBCE; Small beaked Cetacean to 3m can equal CODO; Common Dolphin or BODO; Bottlenose Dolphin, and it can also be considered to equal UNDO; Unidentified Dolphin. However, it would not be a match to an even broader taxonomic category such as UNCE; Unidentified Cetacean.

3. Biota will not equal abiota.

4. For higher flying birds, such as gulls and terns, measurements may have overlapping measurement error values, which can further be exacerbated by unknown flight height of the bird at the time of identification. Therefore, groupings with size designations can cross sizes in the audit agreement rules and also equal the next available higher taxonomic grouping. For example, UNMT; Unidentified Medium Tern: 32-45 cm can equal UNLT; Unidentified large Tern as well as UNTE; Unidentified Tern.

5. Except for sea turtles, which all have a T&E status, T&E species can only equal themselves.

Some ID Categories are not yet fully defined and, therefore, are more likely to change in audit answer composition or be more flexible with the audit answers. This mostly occurs with non-avian biota, such as sharks and cetaceans, where reviewers may be less certain of what species to expect, or whether there are enough ID criteria available in video footage to discern between higher and lower taxonomic groupings (see Appendix 4H).

If there is at least 90% agreement, then the audit is passed for that survey and no further analysis is needed. If the overall audit is in <90% agreement (meaning that for 100 objects, there was disagreement between the first and second reviewer on >10 objects), then biotic taxonomic groups that represent ≥20% overall object composition within the survey but have <90% agreement are discussed by the team to determine better methods for identification (see Table 4-4 for an example). After clarifying ID criteria and revising the 'Confidence and Identification Criteria' document, all objects from those taxonomic groups are re-reviewed in the original data. After repeating a review of those target taxa, 20% of the target taxa that were not in the original audit are audited. If 90% agreement is achieved in this second audit, no further analysis is needed. If audit disagreement continues, the taxonomic grouping goes into arbitration, whereby the object(s) in question are independently reviewed again by the entire team and a final answer is determined based on those results. Mismatches from taxa that do not represent ≥20% overall object composition within the survey are team-reviewed in order to improve identification methods and criteria.

Audit analysis: T&E species

All objects that are identified as state- and federally-listed species are included in the audit alongside randomly chosen objects[4]. Audit agreement must be 100% for T&E species and in most cases, the T&E

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[4] The T&E audit was conducted separately from the random audit for the first five surveys, but became integrated with rest of the audit beginning with December 2012.

species must match exactly. Since all sea turtles are federally listed, audit agreement allows for a specific species of turtle to match SMTU; small turtle and vice versa. However, a specific species cannot match another species in the turtle grouping. All mismatches of T&E species automatically go to arbitration.

Arbitration

Arbitration occurs when there is less than 20% agreement on biotic objects during the randomly chosen object audit and <100% agreement on T&E objects. Essentially, the objects in question are independently reviewed again by the entire team and final answers are determined based on those results.

Each arbitrator receives a new spreadsheet with all audit mismatches and each object is reviewed on the video footage again. Each object mismatch is reviewed by the original reviewer, original auditor, a new informed reviewer, and a new uninformed reviewer. For those objects where the arbitrator role is original reviewer, original auditor or informed reviewer, the arbitrator can view the original reviewer's identification category and comments, as well as the original auditor's identification category and comments. The arbitrators review the video footage, assess the original reviewer and auditor answers, and either choose one of those answers or an entirely new answer. For the uninformed arbitrator, the original reviewer's identification category and comments as well as the original auditor's identification category and comments are omitted.

Once the arbitration spreadsheets are complete, the final answers are determined by the level of Identification Category agreement. If the majority of the arbitrators chose the same Identification Category, then this is the final answer. If there is no majority agreement, then the Identification Category with the highest taxonomic value is chosen. If needed, corrections are then made to the original reviewer spreadsheet.

Literature cited

Hatch, S.K., Connelly, E.E., Divoll, T.J., Stenhouse, I.J., Williams, K.A., 2013. Offshore observations of eastern red bats (Lasiurus borealis) in the mid-Atlantic United States using multiple survey methods. PLoS One 8, 1–8. doi:10.1371/journal.pone.0083803

Figures and tables
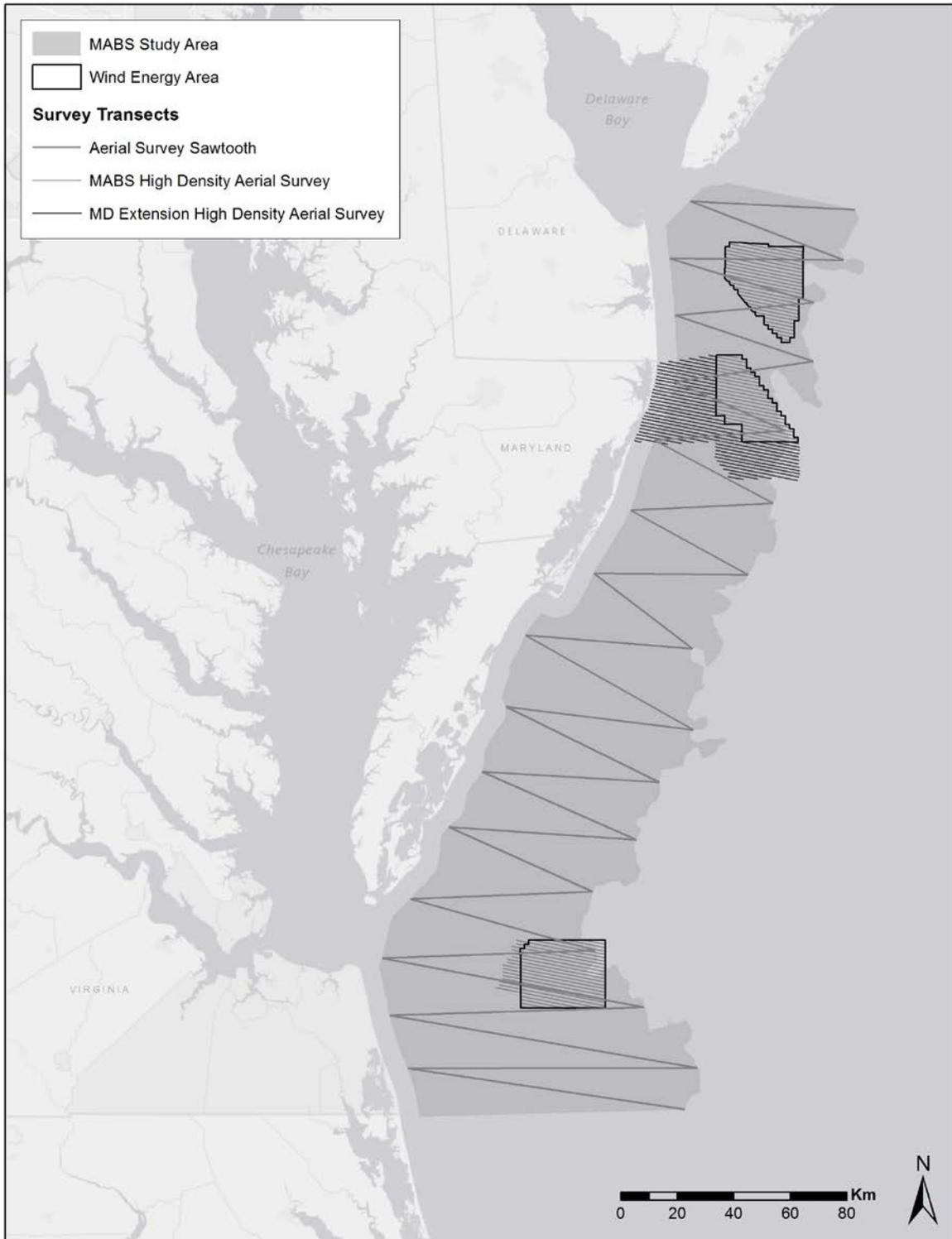
Figure 4-1. Map of digital video aerial survey transects for the Mid-Atlantic Baseline Studies and Maryland Projects. Mid-Atlantic Baseline Studies transects are shown in light gray. High-density Maryland extension transects are shown in dark gray.

Table 4-1. Species identification confidence levels.

Option	Definition
Possible	less than 50% certain
Probable	greater than 50%, but less than 95% certain
Definite	greater than 95% certain

Table 4-2. Measurement definitions for various taxonomic groups.

Taxon Group	Measurement Format	Example
Birds in flight	Length (bill tip to tail tip) x Wingspan (wing tip to wing tip)	60 x 114
Bats in flight	Length (tip of head to tail tip) x Wingspan (wing tip to wing tip)	15 x 40
Sharks, Fish	Length (snout tip to caudal fin tip)	157
Cetaceans	Length (upper jaw tip to fluke notch)	225
Seals	Length (nose tip to tail tip)	190
Rays	Disc Width (pectoral fin tip to pectoral fin tip at the widest part)	90
Turtles	Straight Carapace Length (carapace top to carapace bottom at the midline)	84

Table 4-3. Excerpt from an audit showing examples of audit agreement and disagreement. The complete rules are contained in Audit analysis: randomly chosen objects.

Reviewer ID Category	Auditor ID Category	Audit Match?
CATE;Caspian Tern	UNTE;Unidentified Tern	Yes, rule 1
GRSH;Greater Shearwater	UNBI;Unidentified Bird	No, rule 1
TSMG;Tern/Small or Medium Gull	UNTE;Unidentified Tern	Yes, rule 2
UNBI;Unidentified Bird	UNKN;unknown	No, rule 3
UNMT;Medium Tern: 32-45 cm	UNLT; Unidentified large Tern	Yes, rule 4
UNMT;Medium Tern: 32-45 cm	UNBI;Unidentified Bird	No, rule 2
BODO;Bottlenose Dolphin	SBCE;Small beaked Cetacean to 3 m	Yes, rule 1
BODO;Bottlenose Dolphin	CESS;Cetacean/Seal/Shark	No, rule 1
COWR;Cownose Ray	UNRA;Unidentified ray	Yes, rule 1
COWR;Cownose Ray	CESS;Cetacean/Seal/Shark	No, rule 1
KRST;Kemp's Ridley Sea Turtle	SMTU;Small turtle	Yes, rule 5
SMTU;Small turtle	LOTU;Loggerhead Turtle	Yes, rule 5
SMTU;Small turtle	UNKN;unknown	No, rule 3&5
SCHA;Scalloped Hammerhead	HASH;Hammerhead shark	Yes, rule 1

Table 4-4. Example of disagreement in audit results. Overall agreement from the example audit below is 80%. Loons represent ≥20% overall object composition and received <90% agreement, resulting in re-review of all loon objects (n=548) and subsequent 20% re-audit of loons not in the original audit.

Taxonomic Grouping	n	Overall Object Composition	# Mismatches	# Matches	Total	% Agreement	Consequences
Egrets and Herons	2	0%	0	1	1	100%	None
Fish and Sharks	209	11%	5	42	47	89%	Team review of mismatches
Gannets (Sulidae)	71	4%	3	8	11	73%	Team review of mismatches
Gulls and Terns (Laridae)	341	18%	17	54	71	76%	Team review of mismatches
Jaegers and Skuas (Stercorariidae)	4	0%	0	0	0	NA	Not applicable
Jellyfish (Cnidaria)	1	0%	0	0	0	NA	Not applicable
Loons (Gaviidae)	**548**	**29%**	**31**	**76**	**107**	**71%**	**Re-review and re-audit**
Other Biota	26	1%	0	0	0	NA	Not applicable
Pelicans (Pelicanidae)	3	0%	1	0	1	0%	Team review of mismatches
Rays (Batoidea)	1	0%	0	0	0	NA	Not applicable
Scoters, Ducks, Geese (Anatidae)	1	0%	0	0	0	NA	Not applicable
Toothed Whales (Odontoceti)	200	11%	5	34	39	87%	Team review of mismatches
Turtles (Testudines)	**293**	**16%**	**3**	**56**	**59**	**95%**	**Arbitration**
Unidentified Birds (Aves spp.)	152	8%	10	20	30	67%	Team review of mismatches
Unidentified Marine Mammal or	20	1%	1	2	3	67%	Team review of mismatches
Unidentified Whale (Cetacea)	2	0%	1	0	1	0%	Team review of mismatches
Grand Total	**1874**	100%	**77**	**299**	**376**	**80%**	

Supplementary material

Appendix 4A. Glossary

Audit – Inspection of data conducted by reviewers after each major step of the data analysis process. A minimum of 20% of the data from each survey month is audited by a second observer, and objects on which the reviewers disagree may be re-reviewed in an arbitration process (the exact process varies between the marking audit and identification audit; for details on the identification audit process, see the Target Identification Protocol). The selection of data for regular audits is random. Threatened and Endangered Species audits (in which all species initially identified as a listed species of concern at the state or federal level are reviewed by a second observer) are comprehensive, and include 100% of these identified species for each audit.

BRI – Biodiversity Research Institute, the nonprofit research organization based in Maine that is overseeing the Mid-Atlantic Baseline Studies Project (www.briloon.org).

Frame – individual image within a video reel. There are roughly 20,000 frames per reel. Frames are recorded at a rate of approximately one every 0.06 seconds of survey under normal circumstances.

GSD – ground sample distance, affects image resolution.

HiDef – HiDef Aerial Surveying Ltd., the organization based in the United Kingdom that developed the high resolution video camera system and captures and processes high resolution digital aerial video.

Marker number – number assigned by HiDef reviewers as a unique identifier for individual objects. This is recorded in the spreadsheet automatically during HiDef processing.

Maryland Project – Extension to the Mid-Atlantic Baseline Studies Project funded by the Maryland Department of Natural Resources. Expanded high density survey coverage south and west of the Maryland WEA, including into Maryland state waters. These surveys were flown March 2013-May 2014 in conjunction with the MABS surveys. One additional survey of the Maryland Project study area and the Maryland WEA occurred in August 2013 as a part of the extension project.

Mid-Atlantic Baseline Studies Project (MABS) – three-year (2012-2015) project funded by the Department of Energy. The project includes boat and digital video aerial surveys of animals in the mid-Atlantic outer continental shelf, among other studies (www.briloon.org/mabs).

Parallax – the apparent motion of an elevated object against a distant background due to the movement of the observer (used to estimate flight height).

QA/QC – quality assurance and quality control.

Red line – midline of the video footage, and over which an object must cross to be included within the survey area - this red line represents 50 meters wide for 2 cm GSD, 75 meters wide for 3 cm GSD.

Reel – continuous stream of video footage. ID# for a reel is the exact (GPS) start time. One camera records one reel along one transect.

SOP – standard operating procedure.

T&E – threatened and endangered species.

Transect – line flown by aircraft during surveys. There are 152 individually numbered transects under the current survey design for the Mid-Atlantic Baseline Studies Project and Maryland Project (as of March 2013).

Video sequence – sequence of video collected by HiDef, split into individual reels.

WEA – federally designated Wind Energy Area, or geographic region that the Bureau of Ocean Energy Management has identified as an area for potentially expedited permitting of offshore wind facilities.

Appendix 4B. Quick Guide to Video Identification Spreadsheet Fields

Table 4B-1. The fields completed by HiDef Review Team for every object identified. *Required information for all records.

Field	Description	Example
██████	Zone surveyed.	*Zone 19*
████████	Date of survey – mm/dd/yyyy.	*03/26/2012*
█████	Number assigned to each camera in an array.	*1*
███████	Ground sample distance in cm	*2cm*
███████	Local time at start of reel. Noted as hours-minutes-decimal seconds in 24 hour time.	*11-36-07.796*
██████	Initials of the HiDef reviewer.	*DC*
███ ████████████	██████████	██████
█████	Frame number in which an object is marked. Frames are numbered sequentially at the beginning of each reel.	*159*
██████	General category describing observation. Start and end of reels are also noted in this field.	*bird*
█████	Number of the marker on the object to be identified.	*23*

Table 4B-2. The fields completed by BRI Review Team for relevant objects identified. Unused fields (for non-required information) are left blank. *Required information for all records.

Field	Description	Field Type	Drop-down Options or Text examples
ID Category	Code for ID of object.	Drop-down	See Appendix D
Confidence	Degree of certainty.	Drop-down	Definite, Probable, Possible
Behaviour	General behavior of identified animals. Include direction of animal's movement in relation to camera applicable.	Drop-down	Sitting, Sitting on object, Loafing, Taking Off, Feeding, Following Vessel, Flying (Direction Unknown), Flying up (etc.), Stationary, Moving left (etc.), Haul-out (pinnipeds)
Flying at Sea Level	Splashing or shadow at ocean surface.	Drop-down	Yes, No
Submerged	Under or at water's surface.	Drop-down	Submerged, Surfacing

Field	Description	Field Type	Drop-down Options or Text examples
Approximate Age	Adult= animals with adult plumage or mature body size; Immature= animals >1 year old that have not achieved adult plumage or full body size; Juvenile= young of the year, Hatch Year (HY) birds or any animal with known age <1 year.	Drop-down	Adult, Immature, Juvenile
Plumage	Gannet or Northern Fulmar plumages.	Drop-down	Light Phase, Dark Phase, Intermediate Phase, Gannet Plumage 1 – 6, Unknown
Molt	Bird molt stage.	Drop-down	Summer, Winter, Transitional, Primary Molt, No Primary Molt, Unknown
Probable Sex	Select appropriate option from list.	Drop-down	Male, Female
Measurements	Estimated length or wingspan, in cm.	Number	105
Outside Zone	Mark if object does not cross line.	Drop-down	Yes or blank
Flag	Entry marked for later examination.	Drop-down	Yes or blank
Added Frame Number	Frame number where missed object was marked.	Number	485
Comments	Other notable features, description of what you have seen, clarity of camera/frames.	Text	Too blurry to ID to species
Identification Date	Date of review – mm/dd/yyyy.	Number	5/29/2013
Identifier	Initials of the BRI reviewer.	Text	EC

Table 4B-3. Spreadsheet compiled by HiDef analysts in the parallax and georeferencing process.

Field	Description	*Example*
Behaviour	General behavior of identified animals. Direction of animal's movement is translated from the movement in relation to viewing screen (up, down, left, right) to cardinal direction when applicable.	Flying SE
Flight Height	Range of possible flight heights in meters for eligible objects.	0 - 20
Flight Height Confidence	Confidence of the flight height calculation.	100%
Latitude	Latitude of the frame number or "play pos" in decimal degrees.	36.93328
Longitude	Longitude of the frame number or "play pos" in decimal degrees.	-75.56408

Appendix 4C. Data Analysis Methods: example images from the proprietary video processing software.

Figure 4C-1. Footage of a Northern Gannet (*Morus bassanus)* in flight. The yellow circle with "65" inside (not visible) is the marker with a marker number. Animals are marked when they are close to the red midline, as in this picture.

Figure 4C-2. Gain can be adjusted to help pick up different features on the object for identification. Here, gain was increased from the base image in **Figure 4C-1**, causing the white on this bird to stand out.

Figure 4C-3. Adjusting the Gain and Gamma can give greater overall contrast especially when viewing flying objects vs. submerged objects. The Gain adjusts the brightness of highlights or whites, while gamma can be adjusted to deal with the brightness of mid-tones. In this image the Gain has been lowered compared to **Figure 4C-2** and the Gamma has been decreased. The adjustments allow for the yellow coloration on the head and the black wing tips to stand out.
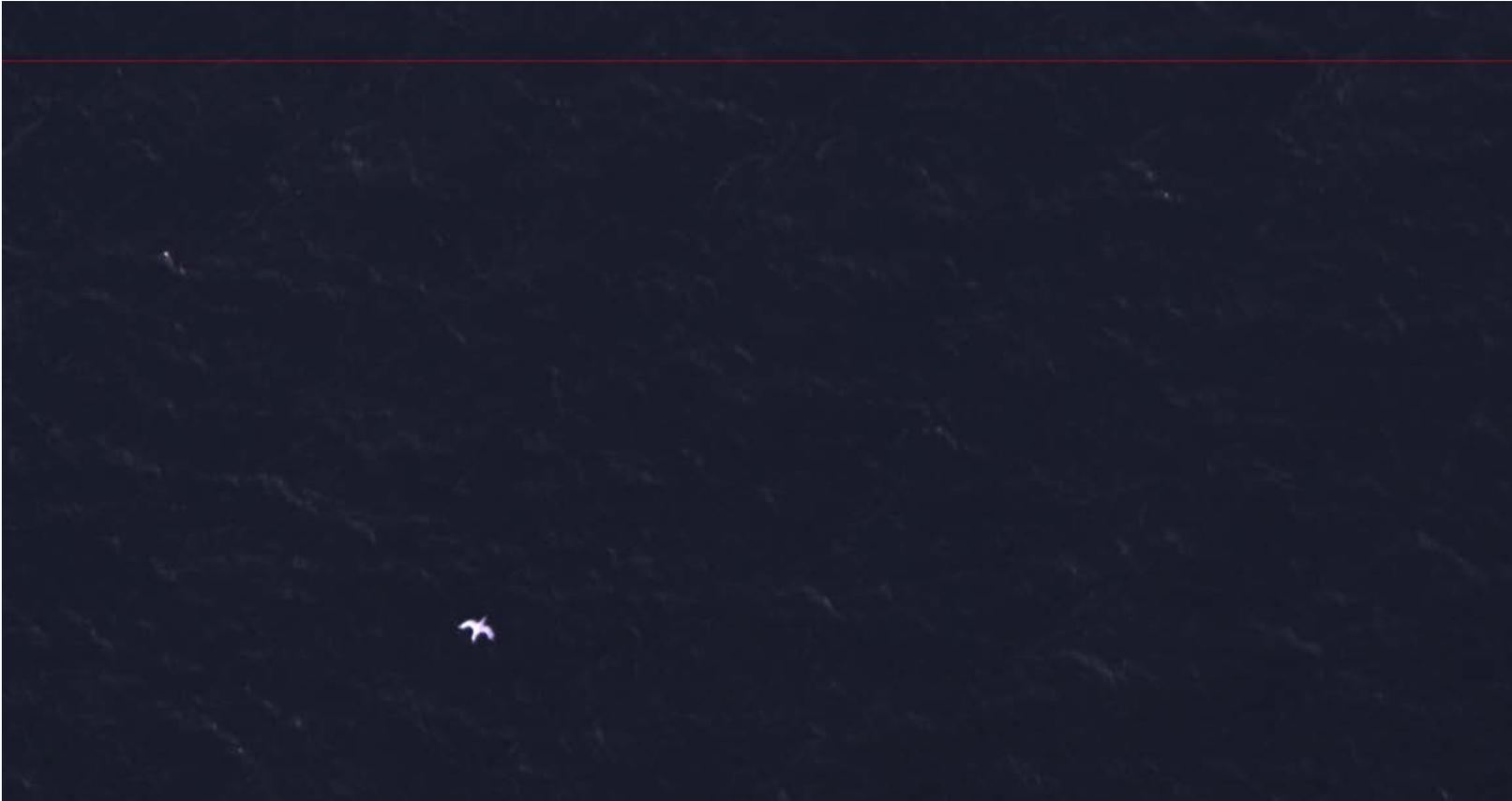
Figure 4C-4. Moving the footage backward and forward from the frame in which the object is marked can allow reviewers to examine animal movements such as wing flapping, diving, or turning a head. In this image the reviewer has reversed to an earlier frame from the one shown in **Figure 4C-1**.

Figure 4C-5. It is important for reviewers to move through each frame when making identifications as some portions of the screen can be blurry. These images of a Cownose Ray (*Rhinoptera bonasus*) can show how one image (left) can be clear, while the subsequent frame (right) can be blurry.

Figure 4C-6. Black Scoters flying with shadows visible. Each scoter in this image would be counted as flying at sea level.
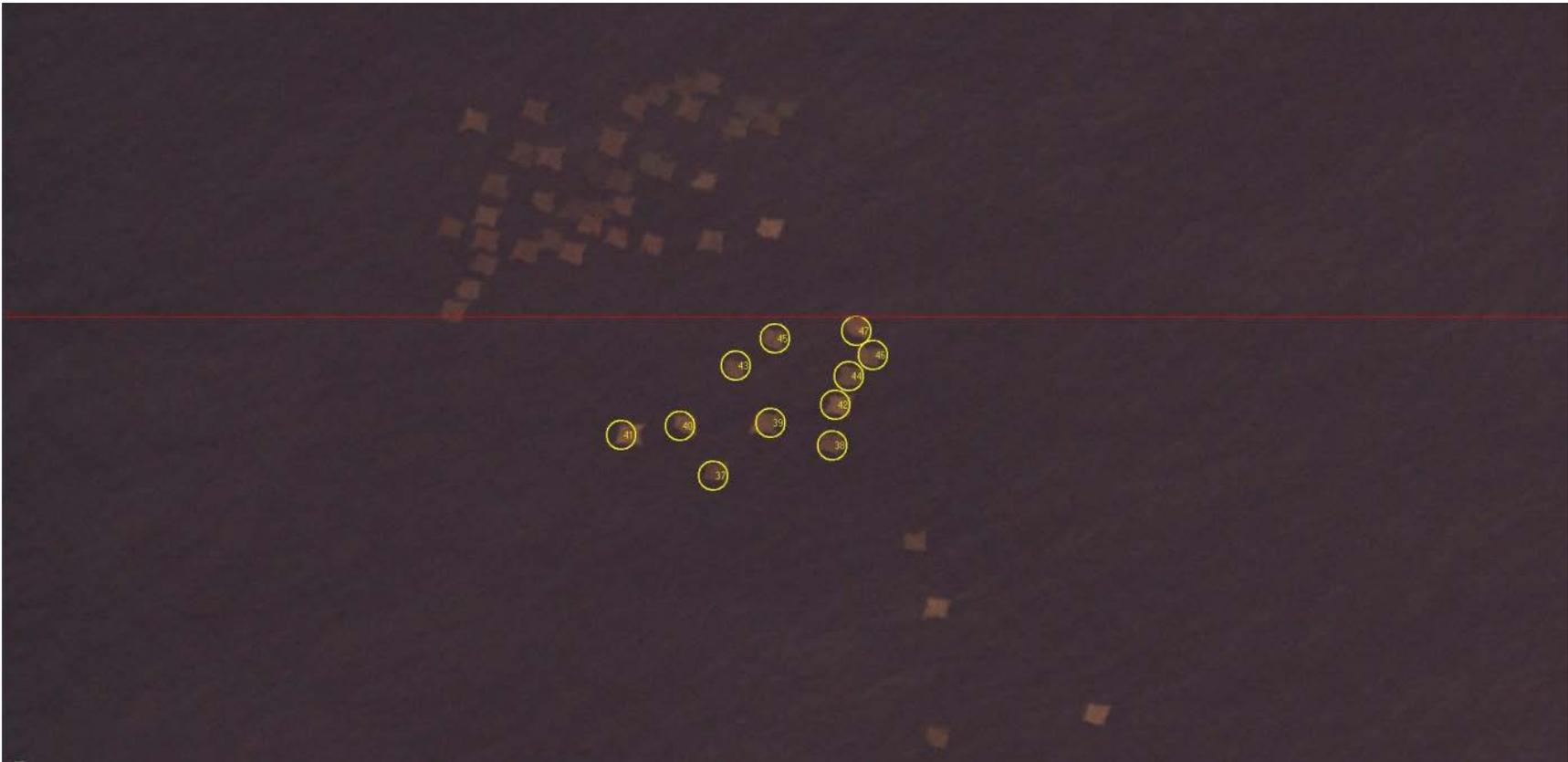
Figure 4C-7. Cownose Rays in a large school. Individuals that are close to the red midline are marked while those that have passed or are approaching are marked in a different frame. This helps with data processing and identifying individual animals.

Figure 4C-8. Measurement of a Cownose Ray. Cownose Rays are measured from their widest point fin-to-fin, so it is important to choose a frame where you can see both fin tips. Note that this is a screen capture of the same rays as **Figure 4C-7,** but a few frames before it, so a different group of rays is marked by the marker numbers.

Appendix 4D. Identification Categories Used in Data Analysis

Table 4D-1. Identification (ID) categories used for aerial analysis. New categories or species are added as the need arises. All species codes used in the species included column can be found in the ID Category column. Bird species codes largely adhere to AOU (American Ornithologists' Union) four-letter alpha codes.

ID Category	Explanation or Species Included	Occurred in Project?
AKSH;Auk or Shearwater	Includes ATPU,AUSH,BLGU,COMU,DOVE,MASH,RAZO,TBMU	Yes
AMBI;American Bittern		Yes
ARTE;Arctic Tern		No
ASDO;Atlantic Spotted Dolphin		No
ATPU;Atlantic Puffin		Yes
AUSH;Audubon's Shearwater		No
BAEA;Bald Eagle		Yes
BAIT;bait ball		Yes
BALN;balloon		Yes
BAOR;Baltimore Oriole		Yes
BARS;Barn Swallow		Yes
BASH;Basking Shark		Yes
BBWH;Blainville's Beaked Whale		No
BCPE;Black-capped Petrel		No
BEKI;Belted Kingfisher		Yes
BLGU;Black Guillemot		No
BLKI;Black-legged Kittiwake		No
BLSC;Black Scoter		Yes
BLSH;Blue Shark		No
BLTE;Black Tern		Yes
BLVU;Black Vulture		Yes
BLWH;Blue Whale		No
BOAT;Boat--unidentified		Yes
BOBA;boat--barge/barge and tug		No
BOCA;Boat--cargo		Yes
BOCF;Boat--commercial fishing		Yes
BOCG;Boat--Coast Guard		Yes
BOCR;boat--cruise		Yes
BOCS;boat--container ship		Yes
BODO;Bottlenose Dolphin		Yes
BOFE;boat--ferry		No
BOFI;boat--fishing		Yes

ID Category	Explanation or Species Included	Occurred in Project?
BOGU;Bonaparte's Gull		Yes
BOLO;boat--lobster		No
BOME;boat--merchant		No
BOPL;boat--pleasure		Yes
BOPS;boat--purseiner		No
BORF;boat--recreational fishing		Yes
BORV;boat--research vessel		Yes
BOSA;boat--sail		Yes
BOTA;boat--tanker		Yes
BOTD;boat--trawler/dragger		No
BOTU;boat--tug		Yes
BOWW;boat--whale watch		No
BOYA;boat--yacht		Yes
BRAN;Brant		Yes
BRBO;Brown Booby		No
BRDO;Bridled Dolphin?	Members of genus Stenella. Includes ASDO,CLDO,LSSD,PSDO,STDO	No
BRPE;Brown Pelican		Yes
BRTE;Bridled Tern		No
BRWH;Bryde's Whale		No
BUFF;Bufflehead		No
BUOY;Buoy		Yes
CANG;Canada Goose		No
CASW;Cave Swallow		No
CATE;Caspian Tern		Yes
CBWH;Cuvier's Beaked Whale		No
CEDW;Cedar Waxwing		Yes
CESS;Cetacean/Seal/Shark	Includes all cetaceans/seals/sharks and fish.	Yes
CLDO;Clymene Dolphin		No
CODO;Common Dolphin	Short-beaked or Long-beaked Common Dolphin. Short-beaked is the more likely common dolphin in the Mid-Atlantic target area.	Yes
COLO;Common Loon		Yes
COME;Common Merganser		No
COMU;Common Murre		No
CONI;Common Nighthawk		Yes
COSH;Cory's Shearwater		Yes
COTE;Common Tern		Yes
COWR;Cownose Ray		Yes
DBSH;Dark-backed Shearwater	Includes AUSH,MASH,SOSH	No

ID Category	Explanation or Species Included	Occurred in Project?
DCCO;Double-crested Cormorant		Yes
DOVE;Dovekie		Yes
DOWI;Dowitcher spp.	Short-billed or Long-billed Dowitcher	Yes
DUPL;Duplicate	The same object marked in two different frames	Yes
ERRO;error		Yes
FIGE;fishing gear		Yes
FISH;Unidentified fish	All "Fish"	Yes
FISS;Unidentified fish school	All "Fish" schools	Yes
FIWH;Fin Whale		Yes
FKWH;False Killer Whale		No
FLJE;flotsam and jetsam		Yes
FOTE;Forster's Tern		No
FUMG;Fulmar or Medium Gull	Includes BLKI,LAGU,NOFU,RBGU,SAGU	Yes
GBBG;Great Black-backed Gull		Yes
GBHE;Great Blue Heron		Yes
GBWH;Gervais' Beaked Whale		No
GLGU;Glaucous Gull		No
GMRA;Giant Manta Ray		Yes
GRBC;Great Shearwater or Black-capped Petrel (flying)	Includes BCPE,GRSH	Yes
GRCO;Great Cormorant		No
GRCS;Great or Cory's Shearwater (on water)	Includes COSH,GRSH	No
GRSE;Gray Seal		No
GRSH;Greater Shearwater		Yes
GRSK;Great Skua		No
GRTU;Green Turtle		Yes
GSGO;Greater Snow Goose		Yes
HAPO;Harbor Porpoise		Yes
HASE;Harbor Seal		No
HASH;Hammerhead shark		Yes
HATU;Hawksbill Turtle		Yes
HELI;Helicopter		No
HERG;Herring Gull		Yes
HOGR;Horned Grebe		Yes
HOSE;Hooded Seal		No
HUWH;Humpback Whale		Yes
ICGU;Iceland Gull		No

ID Category	Explanation or Species Included	Occurred in Project?
ID Impossible;ID Impossible	Biotic object lacking enough detail to place in a broad taxonomic grouping	Yes
JASK;Jaeger or Skua	Includes GRSK,LTJA,PAJA,POJA,SPSK	No
KIWH;Killer Whale		No
KRST;Kemp's Ridley Sea Turtle		Yes
LABA;balloon--Latex		Yes
LAGU;Laughing Gull		Yes
LASH;Large Shorebird sp.		Yes
LBBG;Lesser Black-backed Gull		Yes
LESP;Leach's Storm-petrel		No
LETE;Least Tern		No
LETU;Leatherback Turtle		Yes
LFPW;Long-finned Pilot Whale		No
LIGU;Little Gull		No
LOTU;Loggerhead Turtle		Yes
LSSD;Long-snouted Spinner Dolphin		No
LTDU;Long-tailed Duck		Yes
LTJA;Long-tailed Jaeger		No
MACR;macroalgae		Yes
MARA;Unidentified Manta Ray		Yes
MASH;Manx Shearwater		Yes
MBCE;Medium beaked Cetacean 3-10 m	Medium sized cetaceans with beaks.	No
MIWH;Minke Whale		Yes
MNBC;Medium non beaked Cetacean 3-10 m	Medium sized Cetaceans with small or no beaks.	No
MOLA;Ocean Sunfish (Mola)		Yes
MYBA;balloon--Mylar		Yes
NA;Not Applicable	Used for the first and last frame of the reel, and any other descriptive tags (e.g., start and end of clouds).	Yes
NABW;North Atlantic Bottle-nosed whale		No
NOFU;Northern Fulmar		Yes
NOGA;Northern Gannet		Yes
Nothing;Nothing	Use for objects that are waves or bird feces	Yes
OSPR;Osprey		Yes
PAJA;Parasitic Jaeger		Yes
PEFA;Peregrine Falcon		No

ID Category	Explanation or Species Included	Occurred in Project?
PKWH;Pygmy Killer Whale		No
POJA;Pomarine Jaeger		Yes
PSDO;Pantropical Spotted Dolphin		No
RAZO;Razorbill		Yes
RBGU;Ring-billed Gull		Yes
RBME;Red-breasted Merganser		Yes
REBA;Red Bat		Yes
REPH;Red Phalarope		No
RIDO;Risso's dolphin		Yes
RIWH;Right Whale	North Atlantic Right Whale	Yes
RNGR;Red-necked Grebe		Yes
RNPH;Red-necked Phalarope		No
ROST;Roseate Tern		No
ROYT;Royal Tern		Yes
RSST;Roughtail or Southern Stingray		Yes
RTDO;Rough-toothed Dolphin		No
RTLO;Red-throated Loon		Yes
SAGU;Sabine's Gull		Yes
SATE;Sandwich Tern		Yes
SBCE;Small beaked Cetacean to 3 m	Smaller sized cetaceans with beaks. Includes ASDO,BODO,CLDO,CODO,LSSD,PSDO,RTDO,STDO	Yes
SBWH;Sowerby's Beaked Whale		No
SCHA;Scalloped Hammerhead		Yes
SEDO;Seal/Dolphin	True Seals and small cetaceans	Yes
SEWH;Sei Whale		No
SFWH;Short-finned Pilot Whale		No
SHAR;Unidentified shark	Members of Chondrichthyes	Yes
SMSH;Small Shorebird sp.	Includes REPH,RNPH	Yes
SMTU;Small turtle	Includes GRTU,HATU,KRST,LOTU	Yes
SNBC;Small non beaked Cetacean to 3 m	Smaller sized Cetaceans with small or no beaks	No
SNEG;Snowy Egret		Yes
SOSH;Sooty Shearwater		Yes
SOTE;Sooty Tern		No
SPDO;Spinner Dolphins	Either Clymene, Short-snouted dolphin or long-snouted dolphin	No

ID Category	Explanation or Species Included	Occurred in Project?
SPSK;South Polar Skua		No
SPWH;Sperm Whale		No
STDO;Striped Dolphin		No
SUSC;Surf Scoter		Yes
SWAL;Unidentified Swallow	Includes BARS,CASW	Yes
TBMU;Thick-billed Murre		No
TBWH;True's Beaked Whale		No
THSH;Thresher Shark	Thresher Shark or Bigeye Thresher	Yes
TSMG;Tern/Small or Medium Gull	Includes ARTE,BLKI,BLTE,BOGU,BRTE,CATE,COTE,FOTE,LAGU,LETE,LIGU,RBGU,ROST,ROYT,SAGU,SATE,SOTE	Yes
UNAL;Unidentified Alcid	Includes ATPU,BLGU,COMU,DOVE,RAZO,TBMU	Yes
UNBI;Unidentified Bird	Includes all bird species	Yes
UNBW;Unidentified Baleen Whale	Members of Suborder Mysticeti	No
UNCE;Unidentified Cetacean	All whales and dolphins	Yes
UNCO;Unidentified Cormorant	Includes DCCO,GRCO	No
UNDO;Unidentified Dolphin	Members of Family Delphinidae	Yes
UNDT;Dark Tern	Includes BRTE,SOTE	No
UNDU;Unidentified Duck	Includes BLSC,BUFF,COME,LTDU,RBME,SUSC,UNME,UNSC,WWSC	Yes
UNFS;Unidentified Fin/Sei	Fin or Sei Whale	Yes
UNGR;Unidentified Grebe	Includes HOGR,RNGR	Yes
UNGU;Unidentified Gull	Includes BLKI,BOGU,GBBG,GLGU,HERG,ICGU,LBBG,LAGU,LIGU,RBGU,SAGU	Yes
UNJA;Unidentified Jaeger	Includes LTJA,PAJA,POJA	Yes
UNJE;Unidentified jellyfish	Members of Cnidaria	Yes
UNKN;unknown	Biotic or Abiotic objects	Yes
UNLA;Unidentified large alcid (Razorbill or Murre)	Includes COMU,RAZO,TBMU	Yes
UNLG;Unidentified Large Gull	Includes GBBG,GLGU,HERG,ICGU,LBBG,SAGU	Yes
UNLO;Unidentified Loon	Includes COLO,RTLO	Yes
UNLT;Unidentified large Tern	Includes CATE,ROYT	Yes
UNLW;Unidentified large whale	Large Cetacean > 10m	No
UNME;Unidentified Merganser	Includes COME,RBME	No

ID Category	Explanation or Species Included	Occurred in Project?
UNMG;Medium Gull: 38-53 cm	Includes BLKI,LAGU,RBGU,SAGU	Yes
UNMT;Medium Tern: 32-45 cm	Includes ARTE,BRTE,COTE,FOTE,ROST,SATE,SOTE	Yes
UNMW;Unidentified Medium Whale	Medium-sized Cetacea. Could include species BBWH,CBWH,FKWH,GBWH,KIWH,LFPW,MIWH,NABW,SFWH,SBWH,TBWH	Yes
UNPA;Unidentified Passerine		Yes
UNPH;Unidentified Phalarope	Includes REPH,RNPH	Yes
UNRA;Unidentified ray	Includes members of superorder Batoidea	Yes
UNRO;Unidentified Rorqual	Members of Family Balaenopteridae	No
UNRS;Unidentified ray school	School of unidentified rays are marked (instead of individual animals within the schools) in situations where individuals are too small, deeply submerged, or otherwise poorly visible to be able to reliably distinguish individuals.	Yes
UNSA;Unidentified small alcid (Puffin/Dovekie)	Includes ATPU,BLGU,DOVE	Yes
UNSC;Unidentified Scoter	Includes BLSC,SUSC,WWSC	Yes
UNSG;Unidentified small gull	Includes BOGU,LIGU,SAGU	Yes
UNSH;Unidentified Shearwater	Includes AUSH,COSH,GRSH,MASH,SOSH	Yes
UNSK;Unidentified Skua	Includes GRSK,SPSK	No
UNSP;Unidentified Storm-petrel	Includes BRSP,LESP,WFSP,WISP	Yes
UNST;Unidentified small Tern	Includes BLTE,LETE	Yes
UNSW;Unidentified small whale	Small-sized Cetacea	No
UNTE;Unidentified Tern	Includes ARTE,BLTE,BRTE,CATE,COTE,FOTE,LETE,ROST,ROYT,SATE,SOTE	Yes
UNTW;Unidentified Toothed Whales	Odontoceti	Yes
UTSE;Unidentified True Seal	Members of Family Phocidae	No
WFSP;White-faced Storm-Petrel		No
WHSH;Whale Shark		No
WISP;Wilson's Storm-Petrel		Yes

ID Category	Explanation or Species Included	Occurred in Project?
WSDO;Atlantic White-sided Dolphin		No
WTTR;White-tailed Tropicbird		No
WWSC;White-winged Scoter		Yes

Appendix 4E. Excerpt from the "Confidence and Identification Criteria" document

Examples of criteria used for identifying avian and non-avian biotic targets at different confidence and taxonomic levels. If an object does not meet the "Definite" criteria for a particular ID category, then it goes to the next lower confidence level. If the object does not meet even the "Possible" level criteria, then it goes to a higher taxonomic grouping (e.g., from "Possible Black Scoter" to "Definite Unidentified Scoter").

Table 4E-1. Excerpt from the Avian Confidence and Identification Criteria.

AVIAN			
ID Category	**Definite (Sitting)**	**Probable (Sitting)**	**Possible (Sitting)**	**Next Higher Taxonomic Group**
AKSH; Auk or Shearwater	To be determined as the need arises	Not used	Not used	UNBI; Unidentified Bird
DOVE; Dovekie	Dark bird < 21 cm (approximate sitting size[5]) with some white in front. Reddish bill can be ruled out.	Dark bird < 21 cm (approximate sitting size) with some white in front. Bill is not seen.	To be determined	UNSA; Unidentified small alcid (Puffin/Dovekie)
NOGA; Northern Gannet	Adult: Large white, gannet-shaped bird with dark-tipped primaries and yellow to yellow-brown wash on head.	Adult: If the bird is obscured due to position, orientation, or blurriness and the definite features are hard to discern.	Adult: General size and shape are present and you can rule out buoy.	UNBI; Unidentified Bird or UNKN;unknown
SUSC; Surf Scoter	Can see white patches on head. Can see yellow orange to red bill pixel. Shape, size, and color is like a scoter. Female in close proximity to a definite male.	Shape, size, and color is like a scoter. Female or undetermined sex is in close proximity to a definite male or in all SUSC flock. Inconclusive bill color.	Shape, size, and color. Not enough frames to determine sex and species, but is in a SUSC flock.	UNSC; Unidentified Scoter

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[5] Sitting size is the measurement of a resting bird (not stretched out).

	AVIAN			
ID Category	**Definite (Sitting)**	**Probable (Sitting)**	**Possible (Sitting)**	**Next Higher Taxonomic Group**
UNAL; Unidentified Alcid	An auk of indeterminate size with general auk shape, dark plumage, white on the sides and head, visible bill and face characteristics, but unable to distinguish between species.	An auk of indeterminate size with general auk shape, dark plumage and white on the sides and head.	An auk of indeterminate size with general auk shape and color, but there are fewer frames or image obscurities that won't allow for higher identification confidence.	AKSH; Auk or Shearwater or UNBI;Unidentified Bird
UNBI; Unidentified Bird	Object has shape, color, head, bill, and bird-like movement. Image quality or other factors won't allow placement into a lower taxonomic grouping.	Shape, color, head, and bill with possible bird-like movement or posture.	Bird shape (body and head) and coloring.	ID Impossible;ID Impossible
UNSA; Unidentified small alcid (Puffin/Dovekie)	An auk between 15-30 cm (approximate sitting size) with general auk shape, dark plumage, white on the sides and head, but no bill or face details to distinguish between species.	An auk between 15-30cm (approximate sitting size) with general auk shape and color, but there are fewer frames or image obscurities that won't allow for higher identification confidence.	To be determined	UNAL; Unidentified Alcid
UNSC; Unidentified Scoter	Female or unknown sex in a mixed flock. Color and shape similar to scoters. No conclusive bill or head identifying features.	Single bird with color and shape similar to scoters. No conclusive bill identifying features.	To be determined	UNDU;Unidentified Duck or UNBI;Unidentified Bird

Table 4E-2. Non-Avian Confidence and Identification Criteria.

	NON-AVIAN			
ID Category	**Definite**	**Probable**	**Possible**	**Next Higher Taxonomic Group**
BAIT; bait ball	Small fish-shaped objects in a group. There is definite movement.	A more submerged or blurry bait ball.	Hard to determine definite movement. There is speckling in the water but it is harder to determine if this is a bait ball. Reviewer are most likely assessing whether this is a bait ball, ocean spray or debris in the water.	ID Impossible; ID Impossible
BASH; Basking Shark	Large, odd shaped shark with a pointed snout. If feeding, can see the shape of the gills extended out.	Large, odd shaped shark that is more submerged or seen in less frames.	Not used.	SHAR; Unidentified shark
BODO; Bottlenose Dolphin	No distinct color patterns and dolphin >300 cm.	Unsure if size >300, but is associating with a definite BODO.	Large(>300, unless it is a juvenile) cetacean that is submerged or blurry cetacean and is non-descript.	SBCE; Small beaked Cetacean to 3 m
CODO; Common Dolphin	Can clearly see hourglass pattern on the side.	Can see hourglass pattern in a few frames. There is no identification by association with this species.	A submerged common dolphin with a probable CODO patterning on the side. Can rule out BODO and Striped Dolphin patterning. There is no identification by association with this species. Associated species without a hint of patterning should go to a SBCE identification.	SBCE; Small beaked Cetacean to 3 m
COWR; Cownose Ray	Cownose is visible and therefore direction of movement is known. Can be single or in a group.	An individual that cannot be identified to species, but is associating with a school member that is a definite cownose ray.	A deep or blurry individual that is associating with a cownose ray.	UNRA; Unidentified Ray
FIWH; Fin Whale	Slender whale with white under the lower right jaw.	Not used	Not used	UNFS; Unidentified Fin/Sei

NON-AVIAN				
ID Category	**Definite**	**Probable**	**Possible**	**Next Higher Taxonomic Group**
GMRA; Giant Manta Ray	Dark ray with a disc width >122 cm.	Dark ray with a disc width >122 cm. Reviewer unfamiliarity with this species would cause a lower confidence.	Not used	MARA; Unidentified Manta Ray
GRTU; Green Turtle	Head width is consistently small through frames. SCL>90cm. Carapace shape is elliptical.	SCL >90 cm, head width smaller (up to 15 cm) and not broad	>90 cm, head width not consistent or unclear across some frames	SMTU; Small turtle
HAPO; Harbor Porpoise	Not used	Between 137-183 cm with no distinct markings and no beak. Also has a chunky appearance compared.	The "no beak" appearance is seen in fewer frames. Since it is harder to definitively determine that a cetacean is non-beaked, reviewers would most likely use the broader category, Unidentified Toothed Whale.	SNBC; Small non beaked Cetacean to 3 m
HASH; Hammerhead shark	Shark with a distinct hammer-shaped head consistent across frames	Submerged or blurry shark with a hammer-shaped head.	Deeply submerged shark with a hint of a hammer-shaped head.	SHAR; Unidentified shark
HATU; Hawksbill Turtle	Overlapping scutes, color is like a Hawksbill. SCL>65 and <90 cm, head width smaller and not broad, jagged edges of scutes.	SCL>65 and <90 cm, head width smaller and not broad, jagged edges of scutes.	SCL>65 and <90 cm, head width smaller and not broad. Large tail indicating a mature male is present.	SMTU; Small turtle
HUWH; Humpback Whale	Stocky body with relatively long white pectoral fins.	Not used	Not used	UNBW; Unidentified Baleen Whale
ID Impossible; ID Impossible	Biotic object that cannot be put into a species grouping.	ID Impossible Probable was used in the first month of data, but then was not used after that. This should be the same as ID Impossible Definite.	Not used	UNKN; unknown
KRST; Kemp's Ridley Sea Turtle	>56 cm, round shell (width is almost equal to length), broad head compared to SCL (up to 13cm head width),	Carapace looks round, but measurements indicate a more elliptical shape.	Turtle is more submerged or in fewer frames, but can still see shape and size.	SMTU; Small turtle

		NON-AVIAN		
ID Category	**Definite**	**Probable**	**Possible**	**Next Higher Taxonomic Group**
LETU; Leatherback Turtle	A turtle with a broad upper body with relatively long front flippers.	A more submerged individual or an individual in fewer frames. Dark coloring and overall shape is still present.	Large, dark-colored object that is mostly leatherback-shaped. Can rule out Molas and manta rays. Leatherback turtles that cannot be identified to Possible would most likely go to ID Impossible if there is movement and UNKN (Unknown) if there is no discernible movement.	ID Impossible; ID Impossible
LOTU; Loggerhead Turtle	SCL >90 cm, head width large (up to 28 cm) and broad, overall carapace is heart-shaped	SCL > 65 and <90, head is broad	Loggerhead features (broad head, carapace shape and etc.) are in fewer frames. Other species of sea turtles can be ruled out.	SMTU; Small turtle
MARA; Unidentified Manta Ray	Not used	A dark ray that is too submerged to get an accurate size. Overall shape and color of a Mylobatidae spp. Reviewer unfamiliarity with this grouping would cause a lower confidence.	Not used	CESS; Cetacean/Seal/Shark
MIWH; Minke Whale	Not used.	Slender, comparatively small whale with a pointed rostrum. Can see white band on flippers.	A more submerged cetacean with the shape and size of a Minke Whale.	UNRO; Unidentified Rorqual

	NON-AVIAN			
ID Category	Definite	Probable	Possible	Next Higher Taxonomic Group
MOLA; Ocean Sunfish (Mola)	Large, irregular shaped fish with fins near the posterior end. A definite MOLA would consistently and definitively be a MOLA in almost all frames.	MOLA that is angled a bit in the water column where it is hard to see the shape. A probable MOLA might be more submerged or blurry in some of the frames.	Either deeply submerged or seen in fewer frames. Must rule out small turtle and rays. Due to the irregular shape, MOLA not identified to the Possible confidence may to go to a broader category such as ID Impossible. If the fins are not seen and there is no discernible movement, it is possible for a MOLA to go to the UNKN (Unknown) identification category.	FISH; Unidentified fish
REBA; Red Bat	Tone or color is reddish or rusty brown. Body shape is oblong to oval giving it a chunky appearance. Wing coloration is grayish, white or blurry. Wing is angled proximally to the body giving it a triangular appearance. All aforementioned characteristics are consistent across frames or you can see the arm.	Tail shape is wedged or "V" shaped like a bat and there is a triangular appearance to the wings. Red color is present.	To distinguish from an UNBI or ID Impossible, tail shape is wedged or "V" shaped like a bat and there is a triangular appearance to the wings.	ID Impossible; ID Impossible
RIDO; Risso's dolphin	Not used	Not used	Used only once, the reviewer cited that the cetacean was at least 387cm with a comparatively large back fin, and light-colored belly and side. If cetacean was approximately 300 cm, then this would go to the broader group, SBCE (Small beaked Cetacean to 3m). If cetacean was >300cm, then this would go to the broader group, UNDO(Unidentified Dolphin).	SBCE; Small beaked Cetacean to 3 m

NON-AVIAN				
ID Category	**Definite**	**Probable**	**Possible**	**Next Higher Taxonomic Group**
RIWH; Right Whale	A robust whale with callosities on the rostrum.	Not used	Not used	UNBW; Unidentified Baleen Whale
RSST; Roughtail or Southern Stingray	Rule out skate by size (disc width>107 cm) and shape (pointed wings). Disc width overlaps between species. There are not enough features such as tail length to identify the stingray to species.	Not used	Not used	UNRA; Unidentified Ray
SBCE; Small beaked Cetacean to 3 m	Beak present. Cetacean less than 3m.	Unknown if beak is present or unknown size, but is associating with a definite SBCE.	Beak may not be seen consistently across frames or single animal is deeply submerged.	UNDO; Unidentified Dolphin
SCHA; Scalloped Hammerhead	Not used	Hammerhead shark with a central notch on the head as well as smaller notches on either side of the central notch giving it a "scalloped" appearance.	"Scalloped" appearance may be harder to ascertain due to submergence, blurriness or number of frames.	HASH; Hammerhead shark
SHAR; Unidentified shark	Caudal fin is vertical and animal is greater than 198 cm. Or, if a smaller animal, there is consistent sinusoidal movement.	Shark is more submerged but size, shape or movement is shark-like.	Shark shape, size or movement is seen in fewer frames.	CESS; Cetacean/ Seal/Shark
SMTU; Small turtle	SCL>65 and <90 cm, head width smaller and not broad, lack of jagged edges. Or, definitely turtle-shaped (carapace shape with at least two alternate flippers or head is seen with the carapace shape), but other criteria are not met in order to classify to species. Or, SCL <50 cm, then immature SMTU. Mola and ray can be ruled out.	Turtle shape is not consistently seen in all frames, but in most frames. Mola and ray can be ruled out.	Mola and ray can be ruled out. There is often turtle-like movement. If it is a juvenile turtle, macroalgae can be ruled out.	ID Impossible; ID Impossible

		NON-AVIAN		
ID Category	Definite	Probable	Possible	Next Higher Taxonomic Group
SNBC; Small non beaked Cetacean to 3 m	Not used	Not used	Not used	UNTW; Unidentified Toothed Whales
THSH; Thresher Shark	Elongated upper caudal fin lobe that is almost longer than the entire body is consistently seen across many frames.	Shark is more submerged and caudal fin is not seen consistently across frames.	Elongated upper caudal fin lobe is seen in fewer frames, is more submerged or blurry.	SHAR; Unidentified shark
UNBW; Unidentified Baleen Whale	Not used	Not used	Not used	UNLW; Unidentified large whale or UNMW; Unidentified Medium Whale
UNCE; Unidentified Cetacean	Has cetacean tail. Unknown size or beak status.	A blurry or more submerged cetacean associating with a known cetacean.	Not used	SEDO; Seal/Dolphin or CESS; Cetacean/Seal/Shark
UNDO; Unidentified Dolphin	Unknown if a beak is present. Harbor Porpoise can be ruled out.	Associating with a definite UNDO.	Blurry or submerged cetacean that is associating with a group of unidentified dolphins.	UNTW; Unidentified Toothed Whales
UNFS; Unidentified Fin/Sei	Sizes overlap between Fin and Sei Whale. Rostrum and tail obscured. Overall slender whale.	Not used	Not used	UNRO; Unidentified Rorqual
UNKN; unknown	Shape is similar to flotsam/jetsam and animal.	NA	NA	NA
UNRA; Unidentified Ray	Single or group of ray-shaped objects where the nose shape or direction of movement is unknown.	A blurry or obscured individual with a ray shape or movement that is associating with definite rays.	A single ray or small group that consistently has a ray shape or ray movement. Turtle, Mola and trash can be ruled out.	CESS; Cetacean/Seal/Shark
UNRO; Unidentified Rorqual	Not used	Not used	Not used	MNBC; Medium non beaked Cetacean 3-10 m or UNBW; Unidentified Baleen Whale

NON-AVIAN				
ID Category	**Definite**	**Probable**	**Possible**	**Next Higher Taxonomic Group**
UNTW; Unidentified Toothed Whales	Unknown if a beak is present. Unknown size. Harbor Porpoise cannot be ruled out.	A blurry or more submerged toothed whale with unknown size or beak, but is small enough to be a Harbor Porpoise.	Not used	UNSW; Unidentified small whale

Appendix 4F. Hierarchical Matrix of Target Taxonomic Groups

Prior to the start of video analysis, a list of anticipated biota was compiled from past boat surveys and bird and mammal surveys conducted in the project area. Groupings were either developed based on anticipated similarity in video or from boat survey codes and experience. Other codes were added as they were discovered (e.g AMBI;American Bittern and BEKI;Belted Kingfisher). This table guides the "Confidence and Identification Criteria" and development of audit rules. Starting with the ID Category, it shows how the animal or animal group moves from a lower taxonomic group (Group 1) to a higher taxonomic group (Group 6 or 8), depending on the quality of the image, certainty criteria, and other factors.

Group 1 consists of mixed species from the same genera. It has a lesser amount of species associated with the grouping than Group 2 and in general, the grouping contains <4 associated species. It is also the lowest taxonomic grouping. Group 2 consists of mixed species and mixed genus groupings. This group may have a size or color designation that further splits the family down into fewer species' associations. Group 3 consists of mixed genus groupings. It will have a lower number of associated species than Broad Group 4 and in general may contain a subset to all members of the family. Group 4 consists of mixed genus groupings. In addition, it may have a high number of species associated with this group. This may contain a subset to all members of the family. Group 5 consists of mixed order and mixed family groupings. Group 6 is the highest taxonomic bird grouping. It consists of all bird orders.

Table 4F-1. Excerpt from Hierarchal Matrix of Avian Taxonomic Groups. Birds that cannot be identified to Group 6 (Unidentified Bird) will either be identified to ID Impossible if there is movement or UNKN;Unknown if there is no discernible movement.

AVIAN						
ID Category	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
AKSH; Auk or Shearwater						UNBI
DOVE;Dovekie		UNSA	UNAL			UNBI
NOGA; Northern Gannet						UNBI
SUSC; Surf Scoter	UNSC			UNDU or UNBI		UNBI
UNAL; Unidentified Alcid					AKSH	UNBI
UNSA; Unidentified small alcid (Puffin/Dovekie)			UNAL		AKSH	UNBI
UNSC; Unidentified Scoter				UNDU or UNBI		UNBI

Table 4F-2. Hierarchal Matrix of Non-Avian Taxonomic Groups. Non-avian biota that cannot be identified to Group 8 (CESS;Cetacean/Seal/Shark) will either be identified to ID Impossible if there is movement or UNKN;Unknown if there is no discernible movement. Group definitions: Group 1 consists of mixed species and mixed genus groupings. Group 2 consists of mixed genus groupings. Group 3 consists of mixed genus and mixed family groupings. It will have a lower number of associated species than Broad Group 4 and in general may contain a subset to all members of the family. Group 4 consists of sub-order groupings. Group 5 consists of mixed sub-order groupings based on size class. Group 6 consists of order groupings. Group 7 consists of mixed order and some mixed class groupings. Group 8 consists of mixed classes and contains the most number of species.

NON-AVIAN								
ID Category	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
BAIT;bait ball								
BASH;Basking Shark							SHAR or FISH	CESS
BODO;Bottlenose Dolphin		SBCE	UNDO	UNTW	UNSW	UNCE	SEDO	CESS
CESS;Cetacean/Seal/Shark								
CODO;Common Dolphin		SBCE	UNDO	UNTW	UNSW	UNCE	SEDO	CESS
COWR;Cownose Ray	UNRA							
FISH;Unidentified fish								CESS
FISS;Unidentified fish school								CESS
FIWH;Fin Whale	UNFS	UNRO		UNBW	UNLW	UNCE		CESS
GMRA;Giant Manta Ray	MARA							CESS
GRTU;Green Turtle	SMTU							
HAPO;Harbor Porpoise			SNBC	UNTW	UNSW	UNCE	SEDO	CESS
HASH;Hammerhead Shark							SHAR or FISH	CESS
HATU;Hawksbill Turtle	SMTU							
KRST;Kemp's Ridley Sea Turtle	SMTU							
LETU;Leatherback Turtle								
LOTU;Loggerhead Turtle	SMTU							
MARA;Unidentified Manta Ray								CESS
MIWH;Minke Whale		UNRO	MNBC	UNBW	UNMW or UNLW	UNCE		CESS
MNBC;Medium non beaked Cetacean 3-10 m	NOT USED IN THE AERIAL SURVEY							
MOLA;Ocean Sunfish (Mola)							FISH	CESS
REBA;Red Bat								
RIDO;Risso's Dolphin		SBCE	UNDO	UNTW	UNSW	UNCE	SEDO	CESS
RIWH;Right Whale				UNBW	UNLW	UNCE		CESS
RSST;Roughtail or Southern Stingray	UNRA							CESS

NON-AVIAN								
ID Category	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**	**Group 7**	**Group 8**
SBCE;Small beaked Cetacean to 3 m			UNDO	UNTW	UNSW	UNCE	SEDO or CESS	CESS
SCHA;Scalloped Hammerhead	HASH						SHAR or FISH	CESS
SEDO;Seal/Dolphin								CESS
SHAR;Unidentified shark								CESS
SMTU;Small turtle								
SNBC;Small non beaked Cetacean to 3 m	NOT USED IN THE AERIAL SURVEY							
THSH;Thresher Shark							SHAR or FISH	CESS
UNBW;Unidentified Baleen Whale	NOT USED IN THE AERIAL SURVEY							
UNCE;Unidentified Cetacean							SEDO or CESS	CESS
UNDO;Unidentified Dolphin								CESS
UNFS;Unidentified Fin/Sei		UNRO		UNBW	UNLW	UNCE		CESS
UNJE;Unidentified jellyfish								
UNLW;Unidentified large whale	NOT USED IN THE AERIAL SURVEY							
UNMW;Unidentified Medium Whale						UNCE		CESS
UNRA;Unidentified ray								CESS
UNRO;Unidentified Rorqual	NOT USED IN THE AERIAL SURVEY							
UNRS;Unidentified ray school								CESS
UNSW;Unidentified small whale	NOT USED IN THE AERIAL SURVEY							
UNTW;Unidentified Toothed Whales								CESS

Appendix 4G. QA/QC checklist for reviewed data

Table 4G-1. QA/QC checklist for reviewed data – updated as of September 16, 2013.

Missed objects are highlighted in yellow.
Missed objects have a frame number in the "Added Frame Number" column
All confidences should be filled out.
Birds and bats should be associated with appropriate behavior (flying, sitting, taking off, loafing, following vessel)
All objects in flight or taking off should have a yes or no filled in the "Flying at sea level" field.
Birds should not have the submerged field filled out.
Non-avian biota are associated with appropriate behavior (stationary, moving, haul out)
All seals, sharks, turtles, cetaceans, and fish should have the "Submerged" field filled out.
Make sure there are behaviors filled out for all animals.
Objects identified as Not Applicable, ID Impossible, UNKN, boats, balloons, FIGE, FLJE, MACR and buoys should not have behavior, flying at sea level, submerged, age, plumage, molt or sex filled out. Behaviors associated with UNKN, boats and ID Impossible can be put in comments.
ID Impossible should have a comment.
Make sure dates and initials are filled out for all lines in the spreadsheet.
In the "Category" column, all reel characterizations or bad condition comments such as Start of reel, end of reel, reached here, resumed here and end of cloud are classified as "NA; Not Applicable" in the "ID Category" column.
Make sure age and plumage match each other if both have been filled out.
Do a quick check in comments for misspellings.
Check for formatting in ID Category (lowercase vs uppercase).

Appendix 4H. Excerpt of allowed audit answers for a particular ID Category.

Table 4 H-1. Excerpt of allowed audit answers for a particular ID Category. Some ID categories such as "UNRA; Unidentified Ray" were not "Fully Defined" in the event that other species of rays were discovered during the project.

ID Category	Allowed Audit Answers	Audit Answer Status
AKSH; Auk or Shearwater	AKSH,UNAL,UNBI,UNSH,UNLA,DBSH	Fully defined
BODO;Bottlenose Dolphin	BODO,SBCE	Fully defined
COWR; Cownose Ray	COWR,UNRA	Fully defined
DOVE;Dovekie	DOVE,UNSA,UNAL	Fully defined
LOTU; Loggerhead Turtle	LOTU,SMTU	Fully defined
NOGA; Northern Gannet	NOGA	Single Defined-No similar spp
REBA;Red Bat	REBA	Single Defined-No similar spp
SBCE;Small beaked Cetacean to 3 m	BODO,CODO,SBCE,UNDO	Partial Defined-More Information is needed
SMTU; Small turtle	GRTU,HATU,KRST,LOTU,SMTU	Fully defined
SUSC; Surf Scoter	SUSC,UNSC	Fully defined
UNAL; Unidentified Alcid	AKSH,ATPU,BLGU,COMU,DOVE,RAZO,TBMU,UNAL, UNBI,UNLA,UNSA	Fully defined
Unidentified Bird	AKSH,DBSH,FUMG,GRBC,GRCS,JASK,LASH,SMSH,TSMG,UNAL,UNCO,UNDU,UNDT,UNGR,UNGU,UNJA,UNLA,UNLG,UNLO,UNLT,UNME,UNMG,UNMT,UNPH,UNSA,UNSC,UNSG,UNSH,UNSK,UNSP,UNST,UNTE,UNBI	Fully defined
UNDO; Unidentified Dolphin	SBCE,UNDO,UNTW	Partial Defined-More Information is needed
UNMT;Medium Tern: 32-45 cm	ARTE,BLTE,BRTE,CATE,COTE,FOTE,LETE,ROST,ROYT, SATE,SOTE,TSMG,UNDT,UNLT,UNMT,UNST,UNTE	
UNRA; Unidentified Ray	COWR,MARA,RSST,UNRA,UNRS	Partial Defined-More Information is needed
UNSA; Unidentified small alcid (Puffin/Dovekie)	ATPU,BLGU,DOVE,UNAL,UNSA	Fully defined
UNSC; Unidentified Scoter	WWSC,BLSC,SUSC,UNDU,UNBI,UNSC	Fully defined
UNTW; Unidentified Toothed Whales	UNDO,UNTW	Partial Defined-More Information is needed